HALEY ALDRICH

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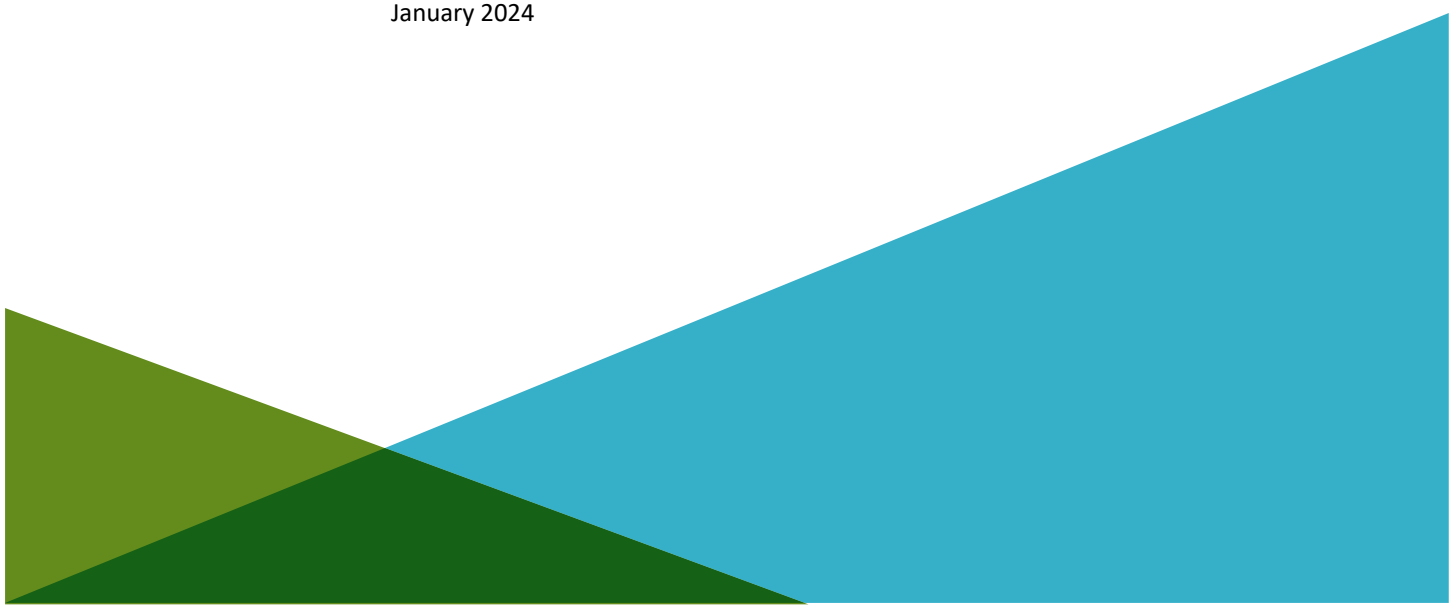
GEOTECHNICAL DATA REPORT
WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

by
Haley & Aldrich, Inc.
Portland, Maine

for
Vermont Agency of Transportation
Berlin, Vermont

File No. 0207068-000
January 2024



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26 January 2024
File No. 0207068-000

State of Vermont Agency of Transportation
Geotechnical Engineering Services
2178 Airport Road, Unit B
Berlin, Vermont 05641

Attention: Callie Ewald, P.E.
Geotechnical Engineering Manager

Subject: Geotechnical Data Report
Wolcott BO 1446(38)
Town Highway 3, Bridge 6 over Lamoille River
Wolcott, Vermont

Ladies and Gentlemen:

This geotechnical data report presents the results of the preliminary design phase (Phase I) geotechnical field investigation and laboratory testing programs as well as the design phase (Phase II) seismic refraction survey for the proposed replacement of the existing Bridge 6 in Wolcott, Vermont (see Figure 1). This geotechnical data report has been prepared for Vermont Agency of Transportation (VTrans) in accordance with our proposal dated 18 January 2023 and amendment dated 28 August 2023 and VTrans' notice to proceed received by email on 6 September 2023.

As discussed with you on 24 January 2024 and depending on the foundation approach selected by the team for the south abutment, an additional boring may be required to obtain additional bedrock information. This additional boring was part of the scope of our amendment dated 28 August 2023. If an additional boring is conducted, this data report will be revised to include the additional data.

Project Background

HORIZONTAL COORDINATE SYSTEM AND ELEVATION DATUM

Plan locations of test borings (borings) are reported as northing and easting coordinates relative to the Vermont State Plane Coordinate System, North American Datum of 1983 (NAD 83). The project

elevation datum and elevations referenced herein are in feet and reference the North American Vertical Datum of 1988 (NAVD 88).

EXISTING BRIDGE STRUCTURE

The existing 105-ft-long, single-span bridge carries School Street (Town Highway 3) over Lamoille River (river) in Wolcott, Vermont. We reviewed the historic plan sheets for the existing bridge (dated January 1928, included in Appendix C) and the Bridge Inspection Report (dated 2 July 2019) provided by VTrans. Based on our review of the historic bridge drawings and inspection report, it is our understanding that the existing abutments bear on spread footings directly on bedrock.

PROPOSED BRIDGE STRUCTURE

The proposed bridge will be a single-span, off-alignment replacement of the existing bridge. Based on conceptual plans prepared by McFarland Johnson (MJ; bridge design lead), the proposed northern abutment of the bridge will be located approximately 40 ft to the east of the existing abutment, and the proposed southern abutment will be located approximately 20 ft south of (behind) the existing abutment. It is our understanding that up to approximately 12 ft of fill will be placed for the northern approach and there will be little to no change in the vertical profile of the southern approach.

Geologic Setting

According to Vermont Geological Survey publications, bedrock geology at the site is Ordovician age and is mapped as the Moretown Formation. This formation consists of “pinstriped” granofels (Moretown Facies). Site surficial deposits are mapped as Recent Alluvium.

Geotechnical Field Investigation

PRELIMINARY DESIGN PHASE BORINGS

Haley & Aldrich, Inc. (Haley & Aldrich) conducted a preliminary design phase geotechnical field investigation at the site between 8 and 10 March 2023. The investigation consisted of drilling five borings (i.e., B-101 through B-105) to identify general subsurface conditions near the proposed bridge abutments.

Boring locations were laid out in the field by VTrans and adjusted as needed by Haley & Aldrich based on site conditions prior to drilling. The as-drilled boring locations were surveyed again by VTrans upon completion of drilling. The as-drilled boring locations are shown graphically on Figure 2, Site and Subsurface Exploration Location Plan.

The borings were drilled by Terracon Consultants, Inc. (Terracon) of Manchester, New Hampshire under the direction of Haley & Aldrich using a Mobile B57 track-mounted drill rig. The borings were drilled to depths ranging from 25 ft to 57 ft below ground surface (BGS). The borings were generally advanced using hollow stem augers through the in-situ fill where continuous sampling was conducted, then were

advanced using cased-washed drilling methods with 4-in. (HW-size) outside diameter (OD) steel casing. Soil samples were generally collected continuously through the in-situ fill (embankment) soils and then typically at 5-ft intervals thereafter.

Soil samples were collected by driving a 1-3/8-in. ID split-spoon sampler with a 140-lb hammer dropped from a height of 30 in., as indicated on the boring logs. The number of hammer blows required to advance the sampler through each 6-in. interval was recorded. The uncorrected SPT N-value is defined as the total number of blows required to advance the sampler through the middle 12 in. of the 24-in. sampling interval. The drill rig was equipped with a calibrated automatic hammer. Based on the calibration information provided by Terracon, a theoretical hammer efficiency factor of 0.83 was used for the automatic hammer. The energy-corrected SPT N-value (N_{60}) is equal to the uncorrected N-value multiplied by the hammer efficiency factor (0.83) divided by 0.6 (i.e., 60 percent theoretical hammer efficiency). The raw blow count data and the uncorrected SPT N-values are shown on the boring logs (see Appendix A). Energy-corrected SPT N-values were used in our simplified liquefaction calculations (see Appendix D).

Soil samples collected above encountered groundwater levels during drilling of boring B-101 were screened with a photoionization detector (PID) to determine the presence of volatile organic compounds (VOCs; i.e., from 0 to 37 ft BGS). No elevated readings of VOCs were measured with the PID and no visual or olfactory signs of contamination were observed during drilling (PID values were 0.0 to 0.2 parts per million).

The borings were advanced approximately 10 ft to 15 ft into bedrock using a 2-in. (NQ-size) ID diamond-tipped core barrel.

All soil and bedrock samples were preserved in glass sample jars and wooden core boxes. The samples that were not submitted for laboratory testing are available for review upon request. Soil and bedrock samples are being stored at the Haley & Aldrich laboratory facility in Manchester, New Hampshire.

DESIGN PHASE SEISMIC REFRACTION SURVEY

A seismic refraction survey (SRS) was conducted by Hager-Richter Geoscience, Inc. at/near the locations of both of the proposed abutments. The survey was completed under the direction of Haley & Aldrich on 20 September 2023 and included four seismic refraction lines. Seismic Line 1 was completed near the proposed north abutment, and Seismic Lines 2, 3, and 4 were completed near the proposed south abutment. The purpose of the SRS was to determine the depth to the top of bedrock in areas where borings were not completed. The locations of the seismic lines are shown on Figure 2.

The SRS was completed using 24-channel seismograph coupled to 24 4.5-Hz geophones, which were typically spaced 5 to 6 ft apart, along each transect. An 8-lb sledgehammer was used as the energy source for seven “shot points” completed for each transect. In general, two “shot points” were located at the transect ends, three were located between the transect ends, and two were located along the transect and beyond the end points.

Hager Richter interpreted the SRS data using the Generalized Reciprocal Method (GRM) and the IXRefraX software program developed by Interpex Limited. The SRS report prepared by Hager Richter was reviewed by Haley & Aldrich and is provided for reference in Appendix D.

Generalized Subsurface Conditions

The subsurface conditions encountered consisted of the following geologic units presented in order of increasing depth below ground surface: fill, alluvial deposits, fluvial deposits, glacial till, and bedrock. The alluvial and fluvial deposits were interbedded in borings B-103 through B-105 (i.e., south of the river). Fluvial deposits were not encountered in borings B-101 and B-102 (i.e., north of the river). Refer to Tables II and III for summaries of encountered soil and bedrock conditions. A general description of each soil/bedrock unit is provided below. Detailed soil and bedrock descriptions are provided on the boring logs included in Appendix A. Refer to Figure 3, Preliminary Interpretative Subsurface Profile for a graphical representation of the subsurface conditions present along the proposed bridge alignment. Please note that the soil descriptions provided on the boring logs and summarized below do not represent actual field conditions other than at the specific boring locations. The actual conditions will likely vary from those described and shown herein.

SOIL UNIT DESCRIPTIONS

Soil Unit	Approximate Range in Encountered Thickness (ft)	Generalized Visual Description
Fill	2.0 to 13.5	Loose to very dense Silty SAND with varying amounts of gravel. Embankment fill. *(Encountered in borings B-101 through B-104.)*
Alluvial Deposits	13.3 to 35.2	Very loose to medium dense Silty SAND. Very loose to medium dense SAND with varying amounts of silt, poorly graded. (*Encountered in borings B-101, B-103, B-104, and B-105.*)
Fluvial Deposits	3.2 to 8.2	Medium dense to very dense GRAVEL with Sand, poorly graded. Medium dense Silty SAND with Gravel. (*Encountered in borings B-103 through B-105, located near the southern abutment.*)
Glacial Till	3.8	Very dense Sand with Silt and Gravel, poorly graded. *(Encountered in boring B-101, located at the northeastern wingwall.)*

BEDROCK CONDITIONS

Bedrock was cored in all borings. The top of the bedrock surface ranged from approximately 13.5 ft to 41 ft BGS (El. 664.1 to El. 684.2). Bedrock encountered at the site consisted of hard to very hard

HORNFELS. Refer to Table III and the boring logs in Appendix A for more detailed rock descriptions. A 0.6-ft thick layer of weathered rock was encountered in boring B-105.

The seismic refraction survey concluded that the top of the bedrock surface varies between 12 ft and 32 ft BGS (El. 665 to El. 681) along the four seismic lines. The results were generally consistent with the top of rock data collected in the borings. Refer to Figures 3 through 6 for interpretive soil profile and cross sections.

Rock quality designation (RQD) is a common parameter that is used to help assess the competency of sampled bedrock. RQD is defined as the sum of pieces of recovered bedrock greater than 4 in. in length divided by the total length of the core run. RQD values for bedrock encountered at the site ranged between 0 and 100 percent (average of 83 percent), and Rock Mass Rating (RMR) values ranged between 18 and 74 (average of 50), which correlates to very poor to good rock (average of fair). Refer to Table III for a summary of recovery, RQD and RMR data for the collected rock cores.

GROUNDWATER

Groundwater levels were recorded between approximately El. 678 and El. 682 based on measurements made during drilling, as shown on the boring logs in Appendix A. Please note that these readings were taken immediately after drilling and may fluctuate. Please also note that observation wells were not installed in any of the borings so variation in static water levels at the site have not been determined.

It is our understanding based on discussion with you that design water levels in the river have not been determined at this time.

Laboratory Testing Program

A geotechnical laboratory testing program was undertaken on representative soil and bedrock samples collected during the preliminary field investigation. The program was designed to assist in soil classification/identification and help determine soil/rock physical and strength properties needed to complete preliminary geotechnical engineering evaluations. The bedrock testing was performed to understand the compressive strength of the bedrock which is needed to evaluate bearing resistances for spread footings on bedrock. In general, grain size testing was performed on disturbed soil samples collected during SPT sampling and on cored bedrock samples. Laboratory testing on soil samples was performed by the VTrans laboratory in Berlin, Vermont. Laboratory testing on bedrock core samples was performed by GeoTesting Express of Acton, Massachusetts. Geotechnical laboratory testing was performed in accordance with applicable ASTM International testing procedures.

The preliminary design phase testing program included performing 12 grain size analyses and four compressive strength rock tests with elastic moduli measurements. The laboratory test results are provided in Appendix B. A summary of laboratory test results is provided below.

Grain Size Analyses (ASTM D6913)

Boring/ Exploration No.	Soil Sample No.	Sample Depth (ft)	Percent Finer than No. 200 Sieve (%)	USCS Classification	Strata
B-101	S3	5.0 to 7.0	23.2	SM	Alluvial Deposits
B-101	S7	25.0 to 27.0	14.3	SM	Alluvial Deposits
B-102	S2	5.0 to 7.0	10.0	SP-SM	Fill
B-102	S4	10.0 to 12.0	17.7	SM	Fill
B-103	S4	7.0 to 9.0	25.2	SM	Fill
B-103	S6	15.0 to 17.0	33.0	SM	Alluvial Deposits
B-103	S7	20.0 to 22.0	12.9	GM	Fluvial Deposits
B-104	S3	5.0 to 7.0	16.8	GM	Fill
B-104	S6	15.0 to 17.0	19.6	SM	Alluvial Deposits
B-105	S3	5.0 to 7.0	11.9	SW-SM	Alluvial Deposits
B-105	S4	10.0 to 12.0	12.1	GM	Fluvial Deposits
B-105	S5	15.0 to 17.0	7.4	SP-SM	Alluvial Deposits

Bedrock Core Testing (ASTM D7012 – Method D)

Boring No.	Bedrock Core No.	Sample Depth (ft)	Bedrock Type	Peak Compressive Stress (psi)	Young's Modulus (psi)
B-102	C1	18.0 to 19.0	Hornfels	14,395	2,340,000 to 4,470,000
B-102	C2	24.60 to 24.97	Hornfels	16,463	2,130,000 to 3,680,000
B-103	C1	37.96 to 38.44	Hornfels	3,460*	2,030,000 to 2,800,000
B-104	C2	30.02 to 30.41	Hornfels	27,602	7,460,000 to 9.870,000

* The laboratory noted that the failure occurred both along a discontinuity and through intact material for the test on B-103, C1. The remaining three tests were all intact material failures.

Closure

We appreciate the opportunity to provide engineering services on this project. Please do not hesitate to contact us if you have any questions or comments.

Sincerely yours,
HALEY & ALDRICH, INC.

Eric Hunstein, E.I.
Staff Geotechnical Engineer

Erin A. Force, P.E. (ME)
Project Manager

Wayne A. Chadbourne, P.E.
Principal

Enclosures:

- Table I – Subsurface Exploration Location Data
- Table II – Subsurface Exploration Soil Data
- Table III – Subsurface Exploration Bedrock Core Data
- Figure 1 – Project Locus
- Figure 2 – Site and Subsurface Exploration Location Plan
- Figure 3 –Interpretive Subsurface Profile
- Figure 4 – North Abutment Section A-A
- Figure 5 – South Abutment Section B-B
- Figure 6 – South Approach Section C-C
- Appendix A – Boring Logs and Bedrock Core Photographs
- Appendix B – Laboratory Test Results
- Appendix C – Historic Drawings
- Appendix D – Seismic Refraction Survey

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References

Konig, R. H. and J. G. Dennis, *Geologic Map of the Hardwick Quadrangle, Vermont*, Vermont Geological Survey, 1964.

Stewart, David P. and Paul MacClintock, *Surficial Geologic Map of Vermont*, Vermont Geological Survey, 1970.

TABLE I
Subsurface Exploration Location Data
Wolcott BO 1446(38)
Town Highway 3, Bridge 6 over Lamoille River
Wolcott, Vermont

Haley & Aldrich, Inc. File No.: 0207068-000

Test Boring No.[1]	Ground Surface Elevation (ft)[3]	Station[4]	Offset Distance (ft) & Direction[4,5]	Horizontal Coordinates[2]	
				Northing (Y)	Easting (X)
B-101	705.1	9+47	23 LT	745,975	1,651,434
B-102	697.7	9+93	15 RT	745,946	1,651,384
B-103	697.0	11+62	4 LT	745,770	1,651,400
B-104	697.6	11+61	12 RT	745,776	1,651,383
B-105	687.8	11+47	44 RT	745,789	1,651,350

Notes:
[1] Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
[2] As-drilled coordinates of test borings were determined in the field by VTrans using GPS survey equipment, are measured in feet (ft), and reference NAD83, Vermont State Plane coordinate system.
[3] Ground surface elevations at test boring locations were determined in the field by VTrans using GPS survey equipment, are measured in ft, and reference the North American Vertical Datum of 1988 (NAVD 88).
[4] Station and offset information shown are approximate and are relative to the Town Highway 3 baseline and were determined by Haley & Aldrich based on information provided by VTrans and rounded to the nearest ft.
[5] LT = offset distance toward left direction; RT = offset distance toward right direction.

	Individual	Date
Prepared By:	EMH	3/21/2023
Checked By:	TPJ	4/26/2023
Reviewed By:	EAF	4/26/2023

TABLE II
Subsurface Exploration Soil Data
Wolcott BO 1446(38)
Town Highway 3, Bridge 6 over Lamoille River
Wolcott, Vermont

Haley & Aldrich, Inc. File No.: 0207068-000

Test Boring No.[1]	Ground Surface Elevation[2] (ft)	Stratigraphy Data[2,3]																Bottom of Exploration Depth (ft)	Elevation of Bottom of Exploration[2] (ft)
		Fill[4]			Alluvial Deposits[5]			Fluvial Deposits[5]			Glacial Till			Weathered Bedrock			Bedrock		
		Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)	Thickness (ft)	Depth to Top (ft)	Elev. of Top (ft)		
B-101	705.1	0.0	705.1	2.0	2.0	703.1	35.2	NE	NE	NE	37.2	667.9	3.8	NE	NE	NE	41.0	664.1	57.0	648.1
B-102	697.7	0.0	697.7	13.5	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	13.5	684.2	25.0	672.7
B-103	697.0	0.0	697.0	11.0	11.0 (upper) 23.5 (lower)	686.0 (upper) 673.5 (lower)	8.8 (upper) 4.5 (lower)	19.8 (upper) 28.0 (lower)	677.2 (upper) 669.0 (lower)	3.7 (upper) 4.5 (lower)	NE	NE	NE	NE	NE	NE	32.5	664.5	43.5	653.5
B-104	697.6	0.0	697.6	8.0	8.0 (upper) 23.5 (lower)	689.6 (upper) 674.1 (lower)	11.0 (upper) 5.5 (lower)	19.0	678.6	4.5	NE	NE	NE	NE	NE	NE	29.0	668.6	40.0	657.6
B-105	687.8	NE	NE	NE	0.0 (upper) 13.5 (lower)	687.8 (upper) 674.3 (lower)	10.3 (upper) 6.3 (lower)	10.3	677.5	3.2	NE	NE	NE	19.8	668.0	0.6	20.4	667.4	32.0	655.8

Notes:
[1] Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
[2] Ground surface elevations at test boring locations were determined in the field by VTrans using GPS survey equipment, are measured in feet (ft) and reference the North American Vertical Datum of 1988 (NAVD 88).
[3] "NE" indicates stratum was not encountered in test boring.
[4] Bituminous concrete was encountered in the upper 0.5 ft of test borings B-103 and B-104.
[5] Multiple layers of interbedded alluvial and fluvial deposits encountered in test borings B-103, B-104, and B-105.

	Individual	Date
Prepared By:	EMH	3/21/2023
Checked By:	TPJ	4/26/2023
Reviewed By:	EAF	4/26/2023

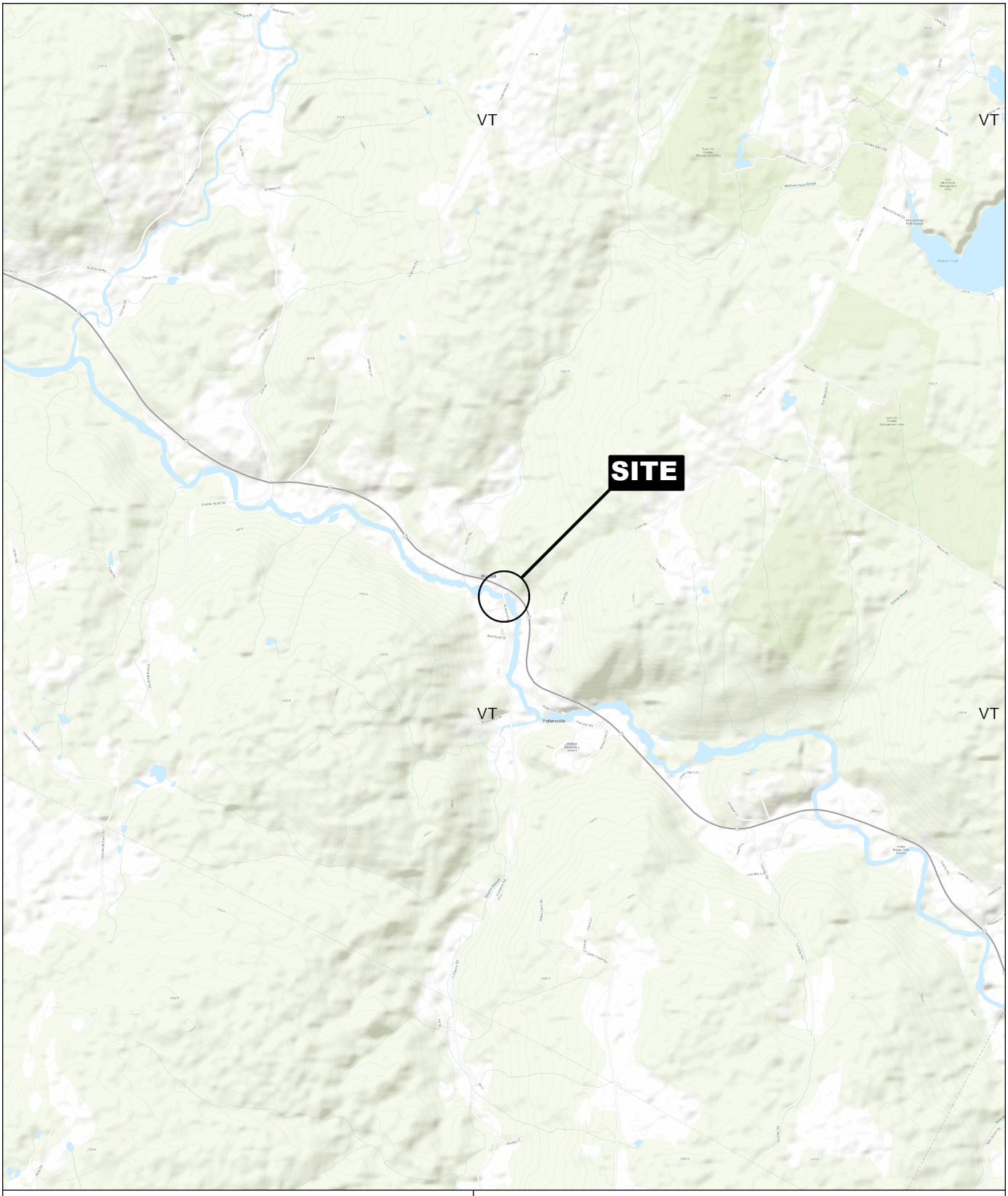
TABLE III
Subsurface Exploration Bedrock Core Data
Wolcott BO 1446(38)
Town Highway 3, Bridge 6 over Lamoille River
Wolcott, Vermont

Haley & Aldrich, Inc. File No.: 0207068-000

Test Boring No.[1]	Estimated Ground Surface Elevation[2] (ft)	Bedrock Core Diameter (in.)	Run					Total Core Recovery[3]		Rock Quality Designation[4]	Rock Mass Rating[5]		Physical Rock Parameters		Peak Compressive Strength[6] (psi)	Lithologic, Rock Mass, and Discontinuity Description
			No.	Depth Below Ground Surface (ft) Top	Bottom	Midpoint	Total Length (ft)	Recovered Length (ft)	%	%	Rating	Description	Weathering	Estimated Field Strength		
B-101	705.1	NQ (2")	C1	42.0	47.0	44.5	5.0	1.0	20%	0%	18	Very Poor	Highly Weathered	Hard	-	Gray, green, white, aphanitic HORNFELS. Likely multiple joint sets present, indescribable due to highly weathered core run.
			C2	47.0	52.0	49.5	5.0	5.0	100%	100%	56	Fair	Fresh	Very Hard	-	Olive-gray, green, aphanitic HORNFELS. Primary joint set dipping horizontal, aperatures smooth, disoclored, tight to open, no infilling.
			C3	52.0	57.0	54.5	5.0	3.6	72%	70%	49	Fair	Fresh	Very Hard	-	Gray, green, white, aphanitic HORNFELS. Primary joint set dipping horizontal, aperatures smooth, disoclored, open, no infilling. Secondary joint set dipping moderately, aperatures rough, disoclored, open, no infilling.
B-102	697.7	NQ (2")	C1	15.0	20.0	17.5	5.0	5.0	100%	100%	61	Good	Fresh	Very Hard	14,395	Gray, green, white, aphanitic, HORNFELS. Primary joint set dipping moderate to high angle, aperatures, rough, very close to wide, fresh to discolored, tight to open. Quartz stringers present throughout core run.
			C2	20.0	25.0	22.5	5.0	5.0	100%	98%	61	Good	Fresh	Very Hard	16,463	
B-103	697.0	NQ (2")	C1	33.5	38.5	36.0	5.0	5.0	100%	97%	50	Fair	Fresh	Very Hard	3,460	Gray, green, white, aphanitic HORNFELS. Primary joint set dipping high angle, aperatuers wide, smooth, fresh, open, no inflilling.
			C2	38.5	43.5	41.0	5.0	5.0	100%	100%	56	Fair	Fresh	Very Hard	-	Gray, green, white, aphanitic HORNFELS. Primary joint set dipping high angle, aperatuers smooth, fresh, tight, no inflilling.
B-104	697.6	NQ (2")	C1	30.0	35.0	32.5	5.0	4.8	95%	83%	31	Poor	Fresh	Very Hard	27,602	Gray, green, white, aphanitic HORNFELS. Primary joint set dipping horizontal to low angle, aperatuers close to wide, rough, fresh to discolored, open, no infilling.
			C2	35.0	40.0	37.5	5.0	4.8	95%	90%	50	Fair	Fresh	Very Hard	-	
B-105	687.8	NQ (2")	C1	22.0	27.0	24.5	5.0	4.8	95%	80%	43	Fair	Fresh	Very Hard	-	Gray, green, white, aphanitic to very coarse grained HORNFELS. Primary joint set dipping horizontal, aperatuers close to moderate, smooth to rough, fresh, open, no infilling. Core is nearly 100% quarts from 24.0 to 27.0 depth.
			C2	27.0	32.0	29.5	5.0	5.0	100%	100%	74	Good	Fresh	Very Hard	-	Gray, green, white, aphanitic to coarse grained HORNFELS. No joint sets present, Frequent quartz stringers throughout.

Notes:
[1] Test boring locations are shown on Figure 2, Site and Subsurface Exploration Location Plan.
[2] Ground surface elevations at test boring locations were determined in the field by VTrans using GPS survey equipment, are measured in feet (ft) and reference the North American Vertical Datum of 1988 (NAVD 88).
[3] TCR = total core recovery. TCR percent is the length of core recovered divided by the length of the run.
[4] RQD = rock quality designation. RQD is the total length of intact, full-diameter core pieces recovered with a length greater than or equal to twice the core diameter (i.e., length of at least 4 in.) measured along the core axis. The percent RQD is the total length of RQD measured divided by the run length. Note that vertical discontinuities are not included in determination of RQD.
[5] Rock Mass Rating based on AASHTO LRFD Bridge Design Specifications, 2012.
[6] Peak compressive strength was determined in accordance with ASTM D7012 - Method D.

	Individual	Date
Prepared By:	EMH	3/21/2023
Checked By:	TPJ	4/26/2023
Reviewed By:	EAF	4/26/2023



SITE COORDINATES: 44°32'46"N, 72°27'28"W

MAP SOURCE: USGS

HALEY ALDRICH

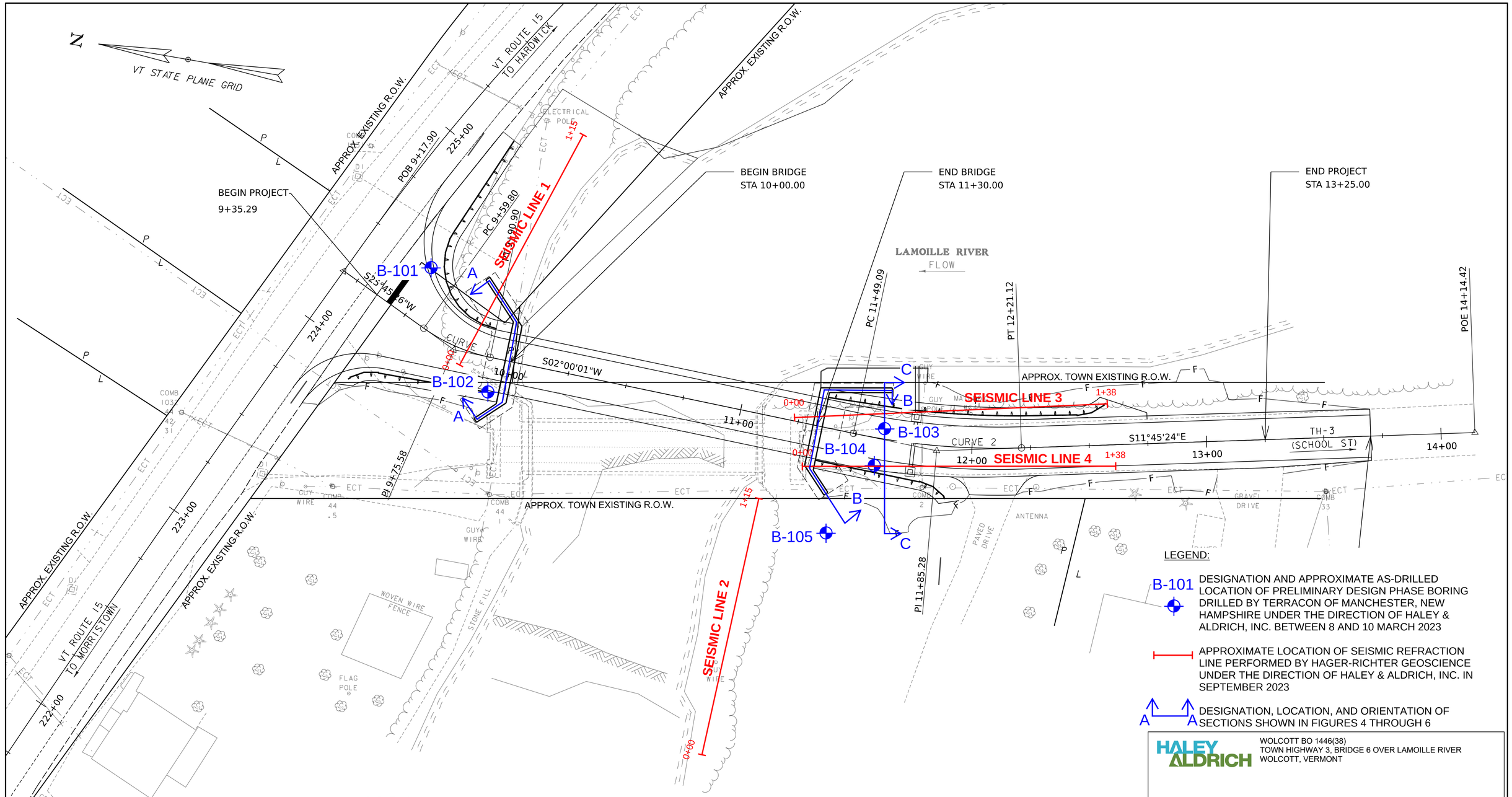
WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

PROJECT LOCUS

APPROXIMATE SCALE: 1 INCH = 3,000 FEET
JANUARY 2024

FIGURE 1

0207068_000_LOCUS HALEYALDRICH\EHUNSTEIN



EXISTING BRIDGE INFORMATION
BUILT 1928, REBUILT 2004
STEEL BEAM TRUSS
105' SINGLE SPAN
SINGLE LANE MAYBE BRIDGE
INSTALLED 2018

CURVE (1)
DELTA = 23^45'26"
D = 76^23'40"
R = 75.00'
T = 15.78'
L = 31.10'
e = 1.64'

LEGEND:

B-101 DESIGNATION AND APPROXIMATE AS-DRILLED LOCATION OF PRELIMINARY DESIGN PHASE BORING DRILLED BY TERRACON OF MANCHESTER, NEW HAMPSHIRE UNDER THE DIRECTION OF HALEY & ALDRICH, INC. BETWEEN 8 AND 10 MARCH 2023

APPROXIMATE LOCATION OF SEISMIC REFRACTION LINE PERFORMED BY HAGER-RICHTER GEOSCIENCE UNDER THE DIRECTION OF HALEY & ALDRICH, INC. IN SEPTEMBER 2023

A A DESIGNATION, LOCATION, AND ORIENTATION OF SECTIONS SHOWN IN FIGURES 4 THROUGH 6

NOTES:
1. BASE PLAN SHOWING EXISTING AND PROPOSED SITE CONDITIONS, THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE PROPOSED BRIDGE SUBSTRUCTURE LOCATIONS WAS PROVIDED BY THE VERMONT AGENCY OF TRANSPORTATION.
2. THE PLAN LOCATIONS OF AS-DRILLED TEST BORINGS SHOWN WERE DETERMINED IN THE FIELD BY HALEY & ALDRICH, INC. USING MEASUREMENTS FROM EXISTING FEATURES.
3. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. TEST BORINGS WERE MONITORED IN THE FIELD BY A HALEY & ALDRICH GEOLOGIST.
5. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS.

0 20 40
SCALE IN FEET

HALEY ALDRICH

WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

SITE AND SUBSURFACE EXPLORATION LOCATION PLAN

SCALE: AS SHOWN
JANUARY 2024

FIGURE 2

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eforce

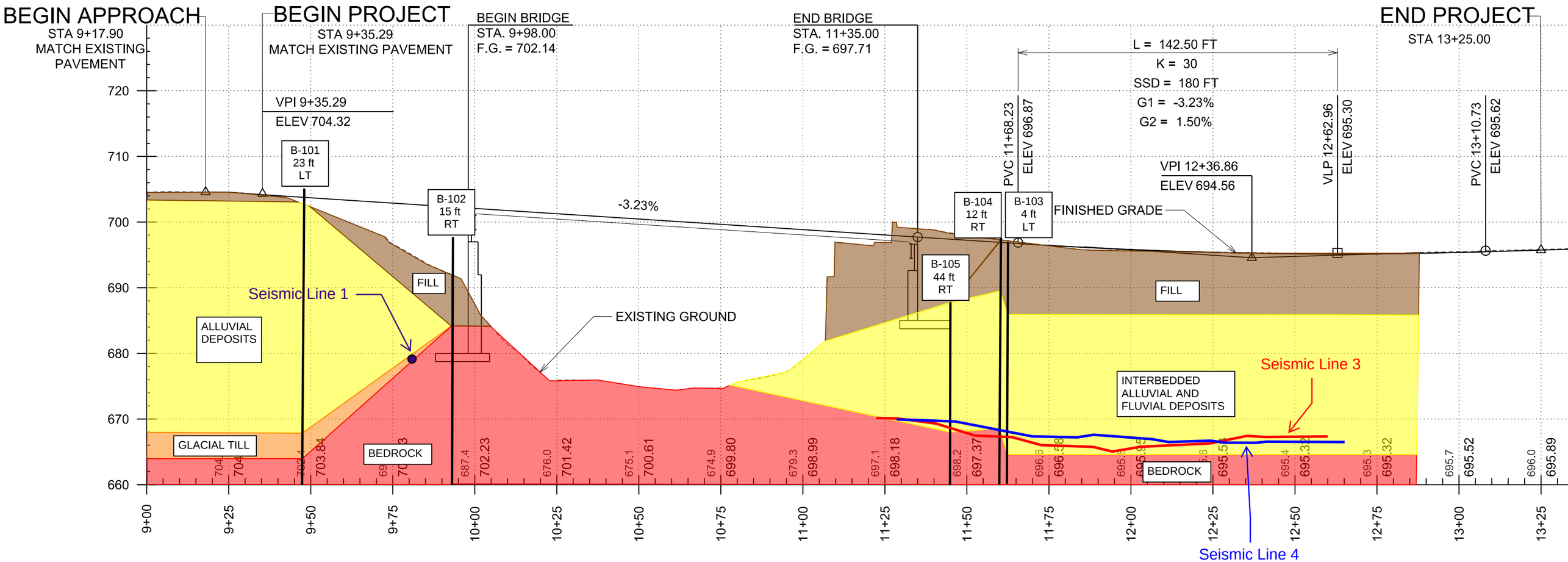
McFarland Johnson

MJ PROJECT #: 18502.04

PROJECT NAME: WOLCOTT
PROJECT NUMBER: BO 1446(38)

FILE NAME: z19v222nul
PROJECT LEADER: R. KLINEFELTER
DESIGNED BY: S. LISTER
MODEL: LAYOUT PLAN

PLOT DATE: 20-SEP-2022
DRAWN BY: S. LISTER
CHECKED BY: D. KULL
SHEET 6 OF 15



NOTES:
1. THIS GENERALIZED INTERPRETIVE SUBSURFACE PROFILE IS INTENDED TO CONVEY TRENDS IN SUBSURFACE CONDITIONS. THE BOUNDARIES BETWEEN STRATA ARE APPROXIMATE AND IDEALIZED, AND HAVE BEEN DEVELOPED BY INTERPRETATIONS OF WIDELY SPACED EXPLORATIONS AND SAMPLES. ACTUAL STRATA TRANSITIONS MAY VARY AND ARE PROBABLY MORE ERRATIC THAN ARE SHOWN ON THE PROFILE.
2. EXISTING AND PROPOSED SITE CONDITIONS, THE LOCATION AND ORIENTATION OF EXISTING SITE FEATURES, AND THE PROPOSED BRIDGE STRUCTURE ARE TAKEN FROM ELECTRONIC MICROSTATION FILES PROVIDED BY VERMONT AGENCY OF TRANSPORTATION.
3. ELEVATIONS ARE IN FEET AND REFERENCE THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88).
4. REFER TO APPENDIX A FOR TEST BORING LOGS AND ROCK CORE PHOTOGRAPHS.
5. ESTIMATED TOP OF ROCK AT SEISMIC LINES TAKEN FROM SEISMIC REFRACTION SURVEY PERFORMED BY HAGER-RICHTER GEOSCIENCE UNDER THE DIRECTION OF HALEY & ALDRICH, INC. IN SEPTEMBER 2023.

HALEY ALDRICH

WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

INTERPRETIVE SUBSURFACE PROFILE

SCALE: AS SHOWN
JANUARY 2024

FIGURE 3

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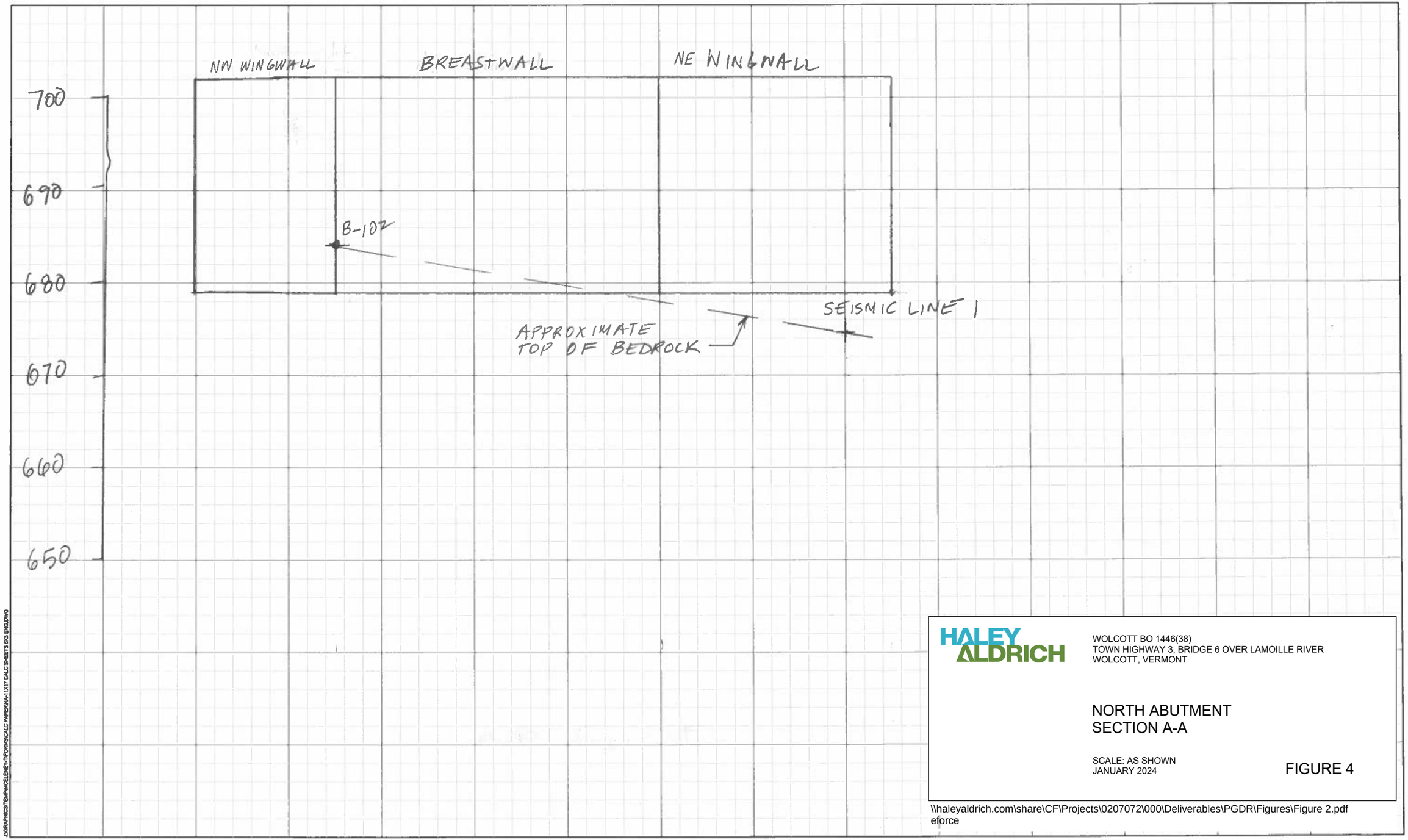

HALEY ALDRICH

WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

NORTH ABUTMENT
SECTION A-A

SCALE: AS SHOWN
JANUARY 2024

FIGURE 4

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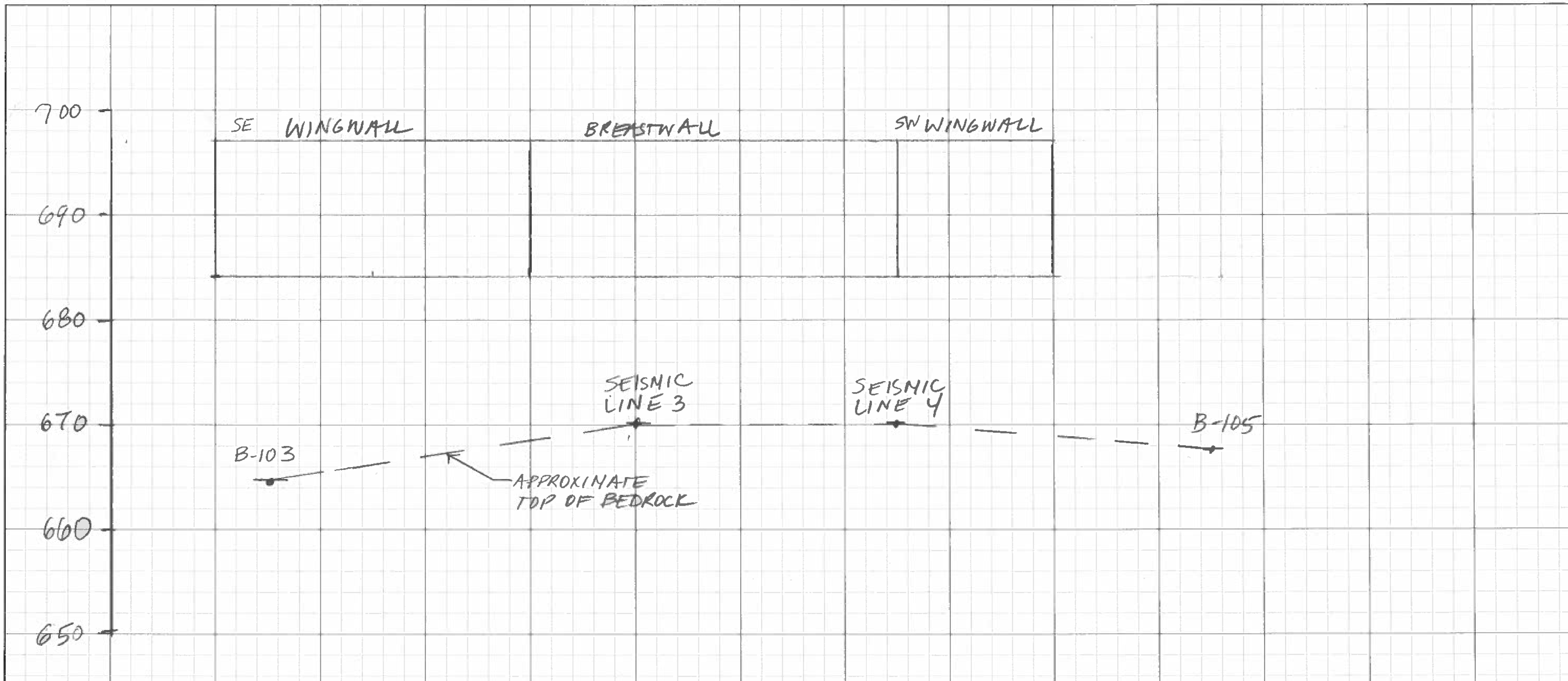
X:\GRAPHICS\TEMPMACELENG\1\FORMS\CALC PAPER\MA-11X17 CALC SHEETS (GS EXCL).DWG

NORTH

0 10 20
SCALE IN FEET

CLIENT: VTRANS
COMPUTED BY: EaF CHECKED BY: EMH
SHEET 1 of 1

HALEY ALDRICH
FILE NO: 0207068-000
DATE: 11/14/2023
PROJECT: WOLCOTT BO 1446(38)
SUBJECT: NORTH ABUTMENT ELEVATION



HALEY ALDRICH

WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

SOUTH ABUTMENT
SECTION B-B

SCALE: AS SHOWN
JANUARY 2024

FIGURE 5

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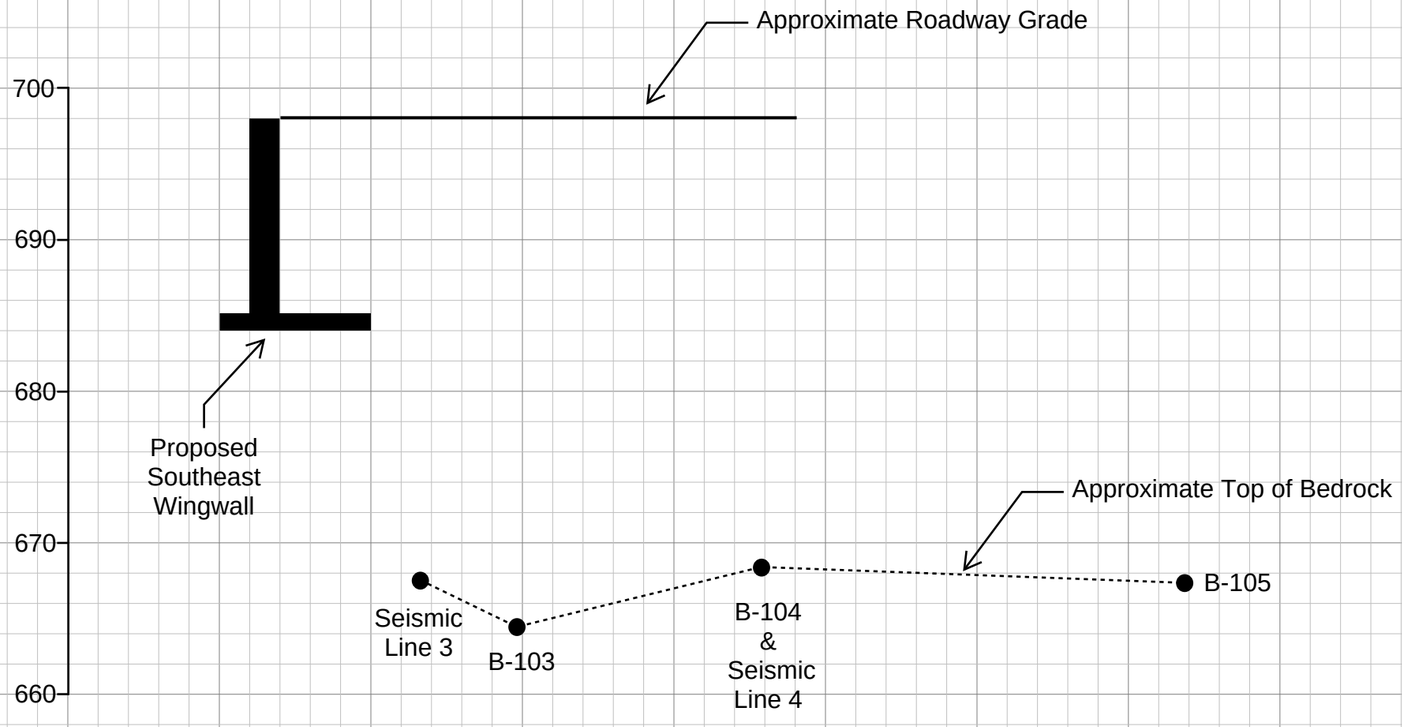
eforce

NORTH

0 10 20
SCALE IN FEET

CLIENT: VTRANS
COMPUTED BY: EQF CHECKED BY: EMH
SHEET 1 of 1

HALEY ALDRICH
FILE NO: 0207068-000
DATE: 11/14/2023
PROJECT: WOLCOTT BO 1446(38)
SUBJECT: SOUTH ABUTMENT ELEVATION



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HALEY ALDRICH

WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT

SOUTH APPROACH SECTION C-C

SCALE: AS SHOWN
JANUARY 2024

FIGURE 6

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NORTH

0 10 20
SCALE IN FEET

CLIENT: VTrans
COMPUTED BY: EMH CHECKED BY: EAF
SHEET 1 of 1

HALEY ALDRICH
FILE NO: 0207068-000
DATE: 11/14/2023
PROJECT: Wolcott BO 1446(38)
SUBJECT: SOUTH APPROACH SECTION C-C

APPENDIX A

Boring Logs and Bedrock Core Photographs

HALEY ALDRICH

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-101**
Page No.: 1 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/10/23 Date Finished: 3/10/23
VTSPG NAD83: N 745975 ft E 1651434 ft
Station: 9+47 Offset: 23L
Ground Elevation: 705.1 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	300 lb.	140 lb.
Hammer Fall:	24 in.	30 in.
Hammer/Rod Type:		Auto
Rig:	MOBILE Drill B-57	C_E = 1.38

Groundwater Observations

Date	Depth (ft)	Notes
03/10/23	24.0	

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 %
		Note: Frozen ground from 0.0 to 1.0 ft prevented sample collection, 0.0 ft - 1.0 ft								
		(Fill) Silty SAND (SM), loose, brown, moist, no structure, no odor, appears to be disturbed, PID=0.0 ppm, Rec. = 1.0 ft, 1.0 ft - 2.0 ft				3-3-3-3 (6)				
		A-2-4, Silty SAND (SM), loose, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), 2.0 ft - 3.0 ft				3-4-5-5 (9)				
5		A-2-4, Silty SAND (SM), loose, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.0 ppm, Rec. = 1.5 ft, 3.0 ft - 5.0 ft				4-6-7-8 (13)	11.8		76.8	23.2
		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.0 ppm, Rec. = 1.25 ft, 5.0 ft - 7.0 ft								
10		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.0 ppm, Rec. = 2.0 ft, 10.0 ft - 12.0 ft				5-7-7-8 (14)				
15		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.0 ppm, Rec. = 2.0 ft, 15.0 ft - 17.0 ft Note: Prominent mineral staining, 15.0 ft - 22.0 ft				6-7-10-10 (17)				
20		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.0 ppm, Rec. = 2.0 ft, 20.0 ft - 22.0 ft				8-10-14-15 (24)				
25		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.1 ppm, Rec. = 2.0 ft, 25.0 ft - 27.0 ft				5-6-8-10 (14)	22.8		85.7	14.3
30		A-2-4, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.1 ppm, Rec. = 0.75 ft, 30.0 ft - 32.0 ft				6-7-8-11 (15)				

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-101**
Page No.: 2 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/10/23 Date Finished: 3/10/23
VTSPG NAD83: N 745975 ft E 1651434 ft
Station: 9+47 Offset: 23L
Ground Elevation: 705.1 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	300 lb.	140 lb.
Hammer Fall:	24 in.	30 in.
Hammer/Rod Type:		Auto
Rig:	MOBILE Drill B-57	C_E = 1.38

Groundwater Observations

Date	Depth (ft)	Notes
03/10/23	24.0	

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, Silty SAND (SM), medium dense, olive-brown with red-brown, moist, stratified, no odor (Alluvial Deposits), PID=0.2 ppm, Rec. = 0.75 ft, 35.0 ft - 37.0 ft				9-13-17-17 (30)				
		37.2 ft - 37.2 ft								
40		A-3, Poorly-graded SAND with Silt and Gravel (SP-SM), very dense, brown, wet, no structure, no odor (Glacial Till), Rec. = 1.0 ft, 40.0 ft - 41.0 ft				26-62-100/5"				
		Top of Bedrock @ 41.0 ft								
		41.0 ft - 42.0 ft, Note: Drill action indicates rock from 41 to 42 ft. 42.0 ft - 47.0 ft, Gray, green, white, HORNFELS, aphanitic, hard, highly weathered. Likely multiple joint sets present, indescribable due to highly weathered core run. Very Poor Rock, NQ, RMR=18 (Moretown Formation)	C1	20 (0)	3 1 2 2.5 2.5					
45										
		47.0 ft - 52.0 ft, Olive-gray, green, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping horizontal, only present at 47.8 ft depth, smooth, discolored, tight to open, no infilling. Fair Rock, NQ, RMR=56 (Moretown Formation)	C2	100 (100)	2.5 2.5 1.5 1.5 1.5					
50										
		52.0 ft - 57.0 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping horizontal, ony present at 55.5 ft depth, smooth, discolored, open, no infilling. Secondary joint set dipping moderately, only present at 54.7 ft depth, rough, discolored. open, no infilling, Fair Rock, NQ, RMR=49 (Moretown Formation) 54.0 ft, Note: Recovered 43.0 in. Multiple unsuccessful attempts made to retrieve remaining 17 in.	C3	72 (70)	1.5 1.5 2.5 2.5 2.5					
55										
		Hole stopped @ 57.0 ft								
60										
65										

Remarks:
AASHTO classifications are based on visual description of sample recovery at depths where lab testing is not performed.

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/09/23 Date Finished: 3/09/23
VTSPG NAD83: N 745946 ft E 1651384 ft
Station: 9+93 Offset: 15R
Ground Elevation: 697.7 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:	Auto	
Rig: MOBILE Drill B-57	C_E = 1.38	

Groundwater Observations

Date	Depth (ft)	Notes
		Observations not taken

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 %
		Note: Frozen ground prevented sample collection, 0.0 ft - 1.0 ft								
		(Fill) Silty SAND (SM), very loose, dark brown, moist, no structure, no odor, appears to be disturbed, re-worked, Rec. = 0.5 ft, 1.0 ft - 3.0 ft				2-3-4-4 (7)				
		No Recovery, Rec. = 0.0 ft, 3.0 ft - 5.0 ft				4-3-3-3 (6)				
5		(Fill) Poorly-graded SAND with Silt and Gravel (SP-SM), very loose, dark brown, moist, no structure, no odor, disturbed, Rec. = 1.0 ft, 5.0 ft - 7.0 ft				2-2-2-2 (4)	7.0	41.5	48.5	10.0
		(Fill) Silty SAND (SM), very loose, dark brown, moist, no structure, no odor, disturbed, Rec. = 0.75 ft, 7.0 ft - 9.0 ft				2-2-2-2 (4)				
10		(Fill) Silty SAND with Gravel (SM), very loose, dark brown, moist, no structure, no odor, disturbed, Rec. = 0.83 ft, 10.0 ft - 12.0 ft				2-1-2-2 (3)	8.9	30.9	51.4	17.7
		(Fill) Silty SAND (SM), medium dense, dark brown, moist, no structure, no odor, disturbed, Rec. = 1.0 ft, 12.0 ft - 13.5 ft				1-1-11 (12)				
		13.5 ft - 15.0 ft, Note: Drill action indicates rock from 13.5 to 15 ft.				Top of Bedrock @ 13.5 ft				
15		15.0 ft - 20.0 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping moderate to high angle, close to wide, rough, fresh to discolored, tight to open. Quartz only from 15.0 to 15.8 ft depth. Quartz stringers present throughout core run.. Good Rock, NQ, RMR=61 (Moretown Formation)	C1	100 (100)	5.5 4.5 4.5 4.5 4					
20		20.0 ft - 25.0 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping moderate to high angle, very close to moderate, rough, mostly fresh, tight to open. Infrequent quartz stringers present throughout core run. Good Rock, NQ, RMR=61. (Moretown Formation)	C2	100 (98)	3.5 3.5 3.5 3 3.5					
25		Hole stopped @ 25.0 ft								
30										

Remarks:
AASHTO classifications are based on visual description of sample recovery at depths where lab testing is not performed.

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-103**
Page No.: 1 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/08/23 Date Finished: 3/08/23
VTSPG NAD83: N 745770 ft E 1651400 ft
Station: 11+62 Offset: 4L
Ground Elevation: 697.0 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:	Auto	
Rig: MOBILE Drill B-57	C_E = 1.38	

Groundwater Observations

Date	Depth (ft)	Notes
03/08/23	15.0	

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 %
		BITUMINOUS CONCRETE, 0.0 ft - 0.5 ft								
		(Fill) Silty SAND (SM), dense, dark brown, dry to moist, no structure, no odor, Rec. = 1.42 ft, 1.0 ft - 3.0 ft				40-16-15-15 (31)				
		(Fill) Silty SAND with Gravel (SM), medium dense, dark brown, moist, no structure, no odor, trace asphalt, Rec. = 1.08 ft, 3.0 ft - 5.0 ft				13-11-10-7 (21)				
5		(Fill) Silty SAND with Gravel (SM), loose, dark brown, moist, no structure, no odor, Rec. = 0.5 ft, 5.0 ft - 7.0 ft				4-4-3-3 (7)				
		(Fill) Silty SAND with Gravel (SM), loose, dark brown, moist, no structure, no odor, Rec. = 0.5 ft, 7.0 ft - 9.0 ft				3-3-2-3 (5)	5.9	23.7	51.1	25.2
10		(Fill) Silty SAND with Gravel (SM), very loose, dark brown, moist, no structure, no odor, Rec. = 1.0 ft, 10.0 ft - 11.0 ft				2-2-16-9 (18)				
		A-3, Poorly-graded SAND with Silt (SP-SM), medium dense, dark brown, moist to wet, stratified, no odor (Alluvial Deposits), 11.0 ft - 12.0 ft								
15		A-2-4, Silty SAND (SM), very loose, dark brown, wet, stratified, no odor (Alluvial Deposits), Rec. = 1.67 ft, 15.0 ft - 17.0 ft				1-1-1-1 (2)	23.1	0.2	66.8	33.0
20		19.8 ft - 19.8 ft A-1-a, Silty GRAVEL with Sand (GM), medium dense, olive-brown, wet, no structure, no odor, minor iron staining (Fluvial Deposits), Rec. = 1.5 ft, 20.0 ft - 22.0 ft				11-14-15-20 (29)	11.5	59.0	28.1	12.9
		23.5 ft - 23.5 ft								
25		A-3, Poorly-graded SAND (SP), medium dense, brown, wet, stratified, no odor (Alluvial Deposits), Rec. = 1.5 ft, 25.0 ft - 27.0 ft				10-10-11-12 (21)				
		28.0 ft - 28.0 ft								
30		A-3, Silty SAND with Gravel (SM), medium dense, gray and red-brown, wet, interbedded, no odor, mixed with weathered rock (Fluvial Deposits), Rec. = 1.17 ft, 30.0 ft - 32.0 ft				29-12-18-36 (30)				
		32.5 ft - 32.5 ft 32.5 ft - 33.5 ft, Note: Advanced borehole with rollerbit to 33.5 ft prior to coring. 33.5 ft - 38.5 ft, Gray, green, white, HORNFELS, aphanitic, very	C1	100 (97)	3 3	Top of Bedrock @ 32.5 ft				

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-103**
Page No.: 2 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/08/23 Date Finished: 3/08/23
VTSPG NAD83: N 745770 ft E 1651400 ft
Station: 11+62 Offset: 4L
Ground Elevation: 697.0 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:		Auto
Rig:	MOBILE Drill B-57	C_E = 1.38

Groundwater Observations

Date	Depth (ft)	Notes
03/08/23	15.0	

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 %
		hard, fresh. Primary joint set dipping high angle, wide, smooth, fresh, open, no infilling. Fair Rock, NQ, RMR=50 (Moretown Formation)			2.5 3 3					
40		38.5 ft - 43.5 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping high angle, only present at 42.5 ft depth, smooth, fresh, tight, no infilling. Fair Rock, NQ, RMR=56 (Moretown Formation)	C2	100 (100)	3 2.5 2.5 2.5 2.5					
		Hole stopped @ 43.5 ft								
45										
50										
55										
60										
65										

Remarks:
AASHTO classifications are based on visual description of sample recovery at depths where lab testing is not performed.

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-104**
Page No.: 1 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/08/23 Date Finished: 3/08/23
VTSPG NAD83: N 745776 ft E 1651383 ft
Station: 11+61 Offset: 12R
Ground Elevation: 697.6 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:		Auto
Rig: MOBILE Drill B-57		C_E = 1.38

Groundwater Observations

Date	Depth (ft)	Notes
03/08/23	16.0	*See note at 16.0 ft

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 %
		BITUMINOUS CONCRETE, 0.0 ft - 0.5 ft								
		(Fill) Silty SAND (SM), very dense, gray, dry, no structure, no odor, Rec. = 0.67 ft, 0.5 ft - 1.5 ft				17-55-60-10 (115)				
		(Fill) SECONDARY ASPHALT LAYER (degraded), very dense, black, 1.5 ft - 2.5 ft								
		(Fill) Silty SAND (SM), medium dense to loose, dark brown, wet, no structure, no odor, Rec. = 1.0 ft, 3.0 ft - 5.0 ft				13-14-11-9 (25)				
5		(Fill) Silty GRAVEL with Sand (GM), loose, dark brown, moist, no structure, no odor, Rec. = 0.25 ft, 5.0 ft - 7.0 ft				5-5-5-6 (10)	3.4	42.3	40.9	16.8
		(Fill) Silty SAND (SM), loose, dark brown, moist, no structure, no odor, 7.0 ft - 8.0 ft				5-3-3-2 (6)				
		A-3, Poorly-graded SAND with Silt (SP-SM), loose, red-brown, moist, stratified, no odor, weakly stratified (Alluvial Deposits), Rec. = 1.25 ft, 8.0 ft - 9.0 ft								
10		A-3, Silty SAND (SM), very loose, brown, moist, no structure, no odor, trace organic material throughout sample (Alluvial Deposits), Rec. = 1.5 ft, 10.0 ft - 12.0 ft				2-1-2-2 (3)				
15		A-2-4, Silty SAND (SM), very loose, dark brown, moist to wet, stratified, no odor (Alluvial Deposits), Rec. = 1.5 ft, 15.0 ft - 17.0 ft *Note: Water level was determined to be at a depth of 16.0 ft on 03/08/23 based upon saturation in S6., 16.0 ft				1-1-1-1 (2)	27.4		80.4	19.6
		19.0 ft - 19.0 ft								
20		A-1-b, Poorly-graded GRAVEL with Sand (GP), very dense, olive-brown, wet, no structure, no odor, minor staining (Fluvial Deposits), Rec. = 1.0 ft, 20.0 ft - 22.0 ft				11-31-36-24 (67)				
		23.5 ft - 23.5 ft								
25		A-3, Poorly-graded SAND (SP), medium dense, brown, wet, stratified, no odor (Alluvial Deposits), Rec. = 1.33 ft, 25.0 ft - 27.0 ft				12-9-9-9 (18)				
		29.0 ft - 29.0 ft								
30		29.0 ft - 30.0 ft, Note: Advanced borehole with rollerbit to 30.0 ft prior to coring. 30.0 ft - 35.0 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping horizontal to low angle, close to wide, rough, fresh to discolored, open, no infilling. Poor Rock, NQ, RMR=31 (Moretown Formation)	C1	95 (83)	2 2.5 2 2.5 2	Top of Bedrock @ 29.0 ft				

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

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

BORING LOG

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-104**
Page No.: 2 of 2
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/08/23 Date Finished: 3/08/23
VTSPG NAD83: N 745776 ft E 1651383 ft
Station: 11+61 Offset: 12R
Ground Elevation: 697.6 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:		Auto
Rig:	MOBILE Drill B-57	C_E = 1.38

Groundwater Observations

Date	Depth (ft)	Notes
03/08/23	16.0	*See note at 16.0 ft

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 %
40		35.0 ft - 40.0 ft, Gray, green, white, HORNFELS, aphanitic, very hard, fresh. Primary joint set dipping horizontal, only present at 37.2 ft depth, rough, fresh, open, no infilling. Fair Rock, NQ, RMR=50 (Moretown Formation)	C2	95 (90)	2.5 2.5 3 2.5 3					
		Hole stopped @ 40.0 ft								

Remarks:
AASHTO classifications are based on visual description of sample recovery at depths where lab testing is not performed.

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

Town Highway 3, Br. 6 Lamoille River
0207068
Wolcott BO 1446(38)

Boring No.: **B-105**
Page No.: 1 of 1
Pin No.: 19J222
Checked By: TJE

Boring Crew: P. Michaud, S. Shay
Date Started: 3/09/23 Date Finished: 3/09/23
VTSPG NAD83: N 745789 ft E 1651350 ft
Station: 11+47 Offset: 44R
Ground Elevation: 687.8 ft

	Casing	Sampler
Type:	HW	SS
I.D.:	4 in.	1.38 in.
Hammer Wt:	140 lb.	140 lb.
Hammer Fall:	30 in.	30 in.
Hammer/Rod Type:	Auto	
Rig: MOBILE Drill B-57	C_E = 1.38	

Groundwater Observations

Date	Depth (ft)	Notes
03/09/23	10.3	

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, Silty SAND (SM), very loose, dark brown, moist, stratified, no odor, trace to 5% organic material (Alluvial Deposits), Rec. = 1.5 ft, 0.0 ft - 2.0 ft				1-1-1-1 (2)				
		A-3, Silty SAND (SM), very loose, dark brown, moist, stratified, no odor, trace organics (Alluvial Deposits), Rec. = 1.5 ft, 2.0 ft - 4.0 ft				1-1-1-1 (2)				
5		A-2-4, Well-graded SAND with Silt (SW-SM), very loose, dark brown, moist, stratified, no odor, trace organics (Alluvial Deposits), Rec. = 2.0 ft, 5.0 ft - 7.0 ft				1-1-1-1 (2)	22.0		88.1	11.9
10		A-3, Silty SAND (SM), dense, dark brown, moist, stratified, no odor, trace organics (Alluvial Deposits), Rec. = 1.25 ft, 10.0 ft - 10.3 ft				14-22-19-20 (41)	10.6	56.5	31.4	12.1
		A-1-a, Silty GRAVEL with Sand (GM), dense, wet, no structure, no odor (Fluvial Deposits), 10.3 ft - 12.0 ft								
		13.5 ft - 13.5 ft								
15		A-3, Poorly-graded SAND with Silt (SP-SM), loose, brown to red-brown, wet, stratified, no odor (Alluvial Deposits), Rec. = 1.08 ft, 15.0 ft - 17.0 ft				3-3-3-12 (6)	22.5	1.4	91.2	7.4
20		Note: Abrupt change in effort to drive casing, 19.8 ft - 19.8 ft Weathered Bedrock returned in sample, Rec. = 0.42 ft, 20.0 ft - 20.4 ft				100/5" Top of Bedrock @ 20.4 ft				
		20.4 ft - 22.0 ft, Note: Drill action indicates rock from 20.4 to 22 ft. 22.0 ft - 27.0 ft, Gray, green, white, HORNFELS, aphanitic to very coarse grained, very hard, fresh. Primary joint set dipping horizontal, close to moderate, smooth to rough, fresh, open, no infilling. Core is nearly 100% quartz from 24.0-27.0 ft depth. Fair Rock, NQ, RMR=43 (Moretown Formation)	C1	95 (80)	3 3.5 3 3.5 3					
25										
		27.0 ft - 32.0 ft, Gray, green, white, HORNFELS, aphanitic to coarse-grained, very hard, fresh. No joint sets present. Frequent quartz stringers throughout. Good Rock, NQ, RMR=74 (Moretown Formation)	C2	100 (100)	3.5 4 3.5 3.5 3.5					
30		Hole stopped @ 32.0 ft								
35										

Remarks:
AASHTO classifications are based on visual description of sample recovery at depths where lab testing is not performed.

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.

BORING LOG 207068_VT_WOLCOTT.GPJ VERMONT AOT.GDT 19/5/23

BEDROCK CORE PHOTOGRAPHS
WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT
FILE NO. 0207068-000

Top Row: B-101, Run No. C1 42.0 ft (left) to 47.0 ft (middle); B-101, Run No. C2 47.0 (middle) to 51.0 (right)
Top Middle Row: B-101, Run No. C2 51.0 ft (left) to 52.0 ft (right)
Bottom Middle Row: B-101, Run No. C3 52.0 ft (left) to 57.0 ft (right)
Bottom Row: empty

BEDROCK CORE PHOTOGRAPHS
WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT
FILE NO. 0207068-000

Top Row: B-105, Run No. C1 22.0 ft (left) to 27.0 ft (right)
Top Middle Row: B-105, Run No. C2 27.0 ft (left) to 32.0 ft (right)
Bottom Middle Row: B-102, Run No. C1 15.0 ft (left) to 20.0 ft (right)
Bottom Row: B-102, Run No. C2 20.0 ft (left) to 25.0 ft (right)

BEDROCK CORE PHOTOGRAPHS
WOLCOTT BO 1446(38)
TOWN HIGHWAY 3, BRIDGE 6 OVER LAMOILLE RIVER
WOLCOTT, VERMONT
FILE NO. 0207068-000

Top Row: B-104, Run No. C1 30.0 ft (left) to 35.0 ft (right)
Top Middle Row: B-104, Run No. C2 35.0 ft (left) to 40.0 ft (right)
Bottom Middle Row: B-103, Run No. C1 33.5 ft (left) to 38.5 ft (right)
Bottom Row: B-103, Run No. C2 38.5 ft (left) to 43.5 ft (right)

APPENDIX B

Laboratory Test Results

HALEY ALDRICH

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 117 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 101 **Depth:** 5 ft **to:** 7 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		211.2		
75mm	**3in**	0.0	211.2	100.0
37.5mm	**1.5in**	0.0	211.2	100.0
19mm	**3/4in**	0.0	211.2	100.0
9.5mm	**3/8in**	0.0	211.2	100.0
4.75mm	**No.4**	0.0	211.2	100.0
Reduced	**4.75mm**	210.6		
2.00mm	**No.10**	0.0	210.6	100.0
850um	**No.20**	0.1	210.5	100.0
425um	**No.40**	4.1	206.4	98.0
250um	**No.60**	24.8	181.6	86.2
150um	**No.100**	46.3	135.3	64.2
75um	**No.200**	86.5	48.8	23.2
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 346.23 g
Mass of can and DRY SOIL: 321.31 g
Mass of can: 110.10 g
Moisture content: 11.8 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 0.0 %
Sa: 76.8 %
Si: 23.2 %
100.0 %

M145: AASHTO Class: A-2-4
D2487: Soil Description: SiSa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 118 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 101 **Depth:** 25 ft **to:** 27 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		210.0		
75mm	**3in**	0.0	210.0	100.0
37.5mm	**1.5in**	0.0	210.0	100.0
19mm	**3/4in**	0.0	210.0	100.0
9.5mm	**3/8in**	0.0	210.0	100.0
4.75mm	**No.4**	0.0	210.0	100.0
Reduced	**4.75mm**	209.0		
2.00mm	**No.10**	0.0	209.0	100.0
850um	**No.20**	0.2	208.8	99.9
425um	**No.40**	30.5	178.3	85.3
250um	**No.60**	59.4	118.9	56.9
150um	**No.100**	46.2	72.7	34.8
75um	**No.200**	42.9	29.8	14.3
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 530.21 g
Mass of can and DRY SOIL: 482.36 g
Mass of can: 272.41 g
Moisture content: 22.8 %

T-90 PL = **PI =** 0
T-89 LL =
Gr: 0.0 %
Sa: 85.7 %
Si: 14.3 %
100.0 %
M145: AASHTO Class: A-2-4
D2487: Soil Description: Sa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 119 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 102 **Depth:** 5 ft **to:** 7 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		249.3		
75mm	**3in**	0.0	249.3	100.0
37.5mm	**1.5in**	0.0	249.3	100.0
19mm	**3/4in**	22.6	226.7	90.9
9.5mm	**3/8in**	26.1	200.6	80.5
4.75mm	**No.4**	28.7	171.9	69.0
Reduced	**4.75mm**	171.7		
2.00mm	**No.10**	26.0	145.7	58.5
850um	**No.20**	26.8	118.9	47.8
425um	**No.40**	31.8	87.1	35.0
250um	**No.60**	24.2	62.9	25.3
150um	**No.100**	17.1	45.8	18.4
75um	**No.200**	20.8	25.0	10.0
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 538.75 g
Mass of can and DRY SOIL: 521.40 g
Mass of can: 272.07 g
Moisture content: 7 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 41.5 %
Sa: 48.5 %
Si: 10.0 %
100.0 %

M145: AASHTO Class: A-1-b
D2487: Soil Description: GrSa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 120 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 102 **Depth:** 10 ft **to:** 12 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained 248.4	Wt Passing	% Passing
75mm	3in	0.0	248.4	100.0
37.5mm	1.5in	0.0	248.4	100.0
19mm	3/4in	12.4	236.0	95.0
9.5mm	3/8in	24.2	211.8	85.3
4.75mm	No.4	21.2	190.6	76.7
Reduced	4.75mm	190.4		
2.00mm	No.10	18.9	171.5	69.1
850um	No.20	20.9	150.6	60.7
425um	No.40	23.7	126.9	51.1
250um	No.60	23.7	103.2	41.6
150um	No.100	23.7	79.5	32.0
75um	No.200	35.6	43.9	17.7
<75um	<No.200			

T-265 Moisture Content

Mass of can and WET SOIL:	379.34	g
Mass of can and DRY SOIL:	357.12	g
Mass of can:	108.76	g
Moisture content:	8.9	%

T-90 PL = **PI =** 0

T-89 LL =

Gr: 30.9 %

Sa: 51.4 %

Si: 17.7 %

100.0 %

M145: AASHTO Class: A-2-4

D2487: Soil Description: GrSa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 114 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 103 **Depth:** 7 ft **to:** 9 ft **Examined For:** Class

Field Description: 0 **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		177.1		
75mm	**3in**	0.0	177.1	100.0
37.5mm	**1.5in**	0.0	177.1	100.0
19mm	**3/4in**	14.2	162.9	92.0
9.5mm	**3/8in**	2.5	160.4	90.6
4.75mm	**No.4**	10.3	150.1	84.8
Reduced	**4.75mm**	149.8		
2.00mm	**No.10**	15.0	134.8	76.3
850um	**No.20**	14.4	120.4	68.1
425um	**No.40**	19.4	101.0	57.1
250um	**No.60**	14.3	86.7	49.1
150um	**No.100**	14.0	72.7	41.1
75um	**No.200**	28.2	44.5	25.2
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 457.52 g
Mass of can and DRY SOIL: 447.04 g
Mass of can: 269.94 g
Moisture content: 5.9 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 23.7 %
Sa: 51.1 %
Si: 25.2 %
100.0 %

M145: AASHTO Class: A-2-4
D2487: Soil Description: GrSiSa

Comments: Jar was not tight, possible loss of moisture in transit

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 115 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 103 **Depth:** 15 ft **to:** 17 ft **Examined For:** Class

Field Description: 0 **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		186.9		
75mm	**3in**	0.0	186.9	100.0
37.5mm	**1.5in**	0.0	186.9	100.0
19mm	**3/4in**	0.0	186.9	100.0
9.5mm	**3/8in**	0.0	186.9	100.0
4.75mm	**No.4**	0.0	186.9	100.0
Reduced	**4.75mm**	180.4		
2.00mm	**No.10**	0.3	180.1	99.8
850um	**No.20**	2.9	177.2	98.2
425um	**No.40**	5.0	172.2	95.5
250um	**No.60**	11.8	160.4	88.9
150um	**No.100**	31.1	129.3	71.7
75um	**No.200**	69.7	59.6	33.0
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 501.62 g
Mass of can and DRY SOIL: 458.39 g
Mass of can: 271.49 g
Moisture content: 23.1 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 0.2 %
Sa: 66.8 %
Si: 33.0 %
100.0 %

M145: AASHTO Class: A-2-4
D2487: Soil Description: SiSa

Comments: Jar was broken in transit, however sample could be salvaged for testing. Possible moisture loss due to broken jar.

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 116 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 103 **Depth:** 20 ft **to:** 22 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		372.2		
75mm	**3in**	0.0	372.2	100.0
37.5mm	**1.5in**	0.0	372.2	100.0
19mm	**3/4in**	47.5	324.7	87.2
9.5mm	**3/8in**	86.4	238.3	64.0
4.75mm	**No.4**	48.6	189.7	51.0
Reduced	**4.75mm**	187.1		
2.00mm	**No.10**	36.6	150.5	41.0
850um	**No.20**	31.1	119.4	32.5
425um	**No.40**	21.9	97.5	26.6
250um	**No.60**	16.0	81.5	22.2
150um	**No.100**	15.6	65.9	18.0
75um	**No.200**	18.5	47.4	12.9
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL:	685.90	g
Mass of can and DRY SOIL:	643.08	g
Mass of can:	270.89	g
Moisture content:	11.5	%

T-90 PL = **PI =** 0

T-89 LL =

Gr: 59.0 %

Sa: 28.1 %

Si: 12.9 %

100.0 %

M145: AASHTO Class: A-1-a

D2487: Soil Description: SaGr

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 121 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 104 **Depth:** 5 ft **to:** 7 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		84.6		
75mm	**3in**	0.0	84.6	100.0
37.5mm	**1.5in**	0.0	84.6	100.0
19mm	**3/4in**	9.6	75.0	88.7
9.5mm	**3/8in**	7.2	67.8	80.1
4.75mm	**No.4**	6.4	61.4	72.6
Reduced	**4.75mm**	61.6		
2.00mm	**No.10**	12.6	49.0	57.7
850um	**No.20**	10.6	38.4	45.2
425um	**No.40**	9.6	28.8	33.9
250um	**No.60**	4.8	24.0	28.3
150um	**No.100**	3.6	20.4	24.0
75um	**No.200**	6.1	14.3	16.8
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 198.38 g
Mass of can and DRY SOIL: 195.51 g
Mass of can: 110.89 g
Moisture content: 3.4 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 42.3 %
Sa: 40.9 %
Si: 16.8 %
100.0 %

M145: AASHTO Class: A-1-b
D2487: Soil Description: SaGr

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 122 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 104 **Depth:** 15 ft **to:** 17 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		296.4		
75mm	**3in**	0.0	296.4	100.0
37.5mm	**1.5in**	0.0	296.4	100.0
19mm	**3/4in**	0.0	296.4	100.0
9.5mm	**3/8in**	0.0	296.4	100.0
4.75mm	**No.4**	0.0	296.4	100.0
Reduced	**4.75mm**	294.5		
2.00mm	**No.10**	0.1	294.4	100.0
850um	**No.20**	0.4	294.0	99.8
425um	**No.40**	6.5	287.5	97.6
250um	**No.60**	56.1	231.4	78.6
150um	**No.100**	92.8	138.6	47.1
75um	**No.200**	80.9	57.7	19.6
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 487.69 g
Mass of can and DRY SOIL: 406.56 g
Mass of can: 110.12 g
Moisture content: 27.4 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 0.0 %
Sa: 80.4 %
Si: 19.6 %
100.0 %

M145: AASHTO Class: A-2-4
D2487: Soil Description: Sa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 111 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 105 **Depth:** 5 ft **to:** 7 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		260.3		
75mm	**3in**	0.0	260.3	100.0
37.5mm	**1.5in**	0.0	260.3	100.0
19mm	**3/4in**	0.0	260.3	100.0
9.5mm	**3/8in**	0.0	260.3	100.0
4.75mm	**No.4**	0.0	260.3	100.0
Reduced	**4.75mm**	260.1		
2.00mm	**No.10**	0.0	260.1	100.0
850um	**No.20**	3.2	256.9	98.8
425um	**No.40**	38.7	218.2	83.9
250um	**No.60**	94.5	123.7	47.6
150um	**No.100**	56.0	67.7	26.0
75um	**No.200**	36.8	30.9	11.9
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 590.06 g
Mass of can and DRY SOIL: 532.69 g
Mass of can: 272.40 g
Moisture content: 22 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 0.0 %
Sa: 88.1 %
Si: 11.9 %
100.0 %

M145: AASHTO Class: A-2-4
D2487: Soil Description: Sa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 112 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 105 **Depth:** 10 ft **to:** 12 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		328.2		
75mm	**3in**	0.0	328.2	100.0
37.5mm	**1.5in**	0.0	328.2	100.0
19mm	**3/4in**	16.8	311.4	94.9
9.5mm	**3/8in**	56.7	254.7	77.6
4.75mm	**No.4**	74.1	180.6	55.0
Reduced	**4.75mm**	178.8		
2.00mm	**No.10**	37.6	141.2	43.5
850um	**No.20**	29.6	111.6	34.3
425um	**No.40**	21.1	90.5	27.9
250um	**No.60**	19.0	71.5	22.0
150um	**No.100**	16.4	55.1	17.0
75um	**No.200**	15.9	39.2	12.1
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 632.51 g
Mass of can and DRY SOIL: 597.74 g
Mass of can: 269.54 g
Moisture content: 10.6 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 56.5 %
Sa: 31.4 %
Si: 12.1 %
100.0 %

M145: AASHTO Class: A-1-a
D2487: Soil Description: SaGr

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

State of Vermont
Agency of Transportation
Construction and Materials Bureau
Central Laboratory

Report on Soil Sample

Lab Number: E21 113 **Report Date:** 4/21/2023

Project: Wolcott BF 1446(38) **Site:** **Tested By:** B. Fletcher

Date Sampled: 4 / 5 / 23 **Date Received:** 4 / 11 / 2023 **Date Tested:** 4 / 13 / 2023

Station: 0 + 0 **Offset:** 0 **Hole:** B 105 **Depth:** 15 ft **to:** 17 ft **Examined For:** Class

Field Description: N/A **Submitted By:** E. Force **Sample Type:** SS

Test Results

T-88 Sieve Analysis

	TOTAL:	Wt Retained	Wt Passing	% Passing
		284.2		
75mm	**3in**	0.0	284.2	100.0
37.5mm	**1.5in**	0.0	284.2	100.0
19mm	**3/4in**	0.0	284.2	100.0
9.5mm	**3/8in**	0.0	284.2	100.0
4.75mm	**No.4**	0.8	283.4	99.7
Reduced	**4.75mm**	281.9		
2.00mm	**No.10**	3.3	278.6	98.6
850um	**No.20**	31.5	247.1	87.4
425um	**No.40**	69.6	177.5	62.8
250um	**No.60**	121.7	55.8	19.7
150um	**No.100**	24.1	31.7	11.2
75um	**No.200**	10.8	20.9	7.4
<75um	**<No.200**			

T-265 Moisture Content

Mass of can and WET SOIL: 620.53 g
Mass of can and DRY SOIL: 556.46 g
Mass of can: 272.30 g
Moisture content: 22.5 %

T-90 PL = **PI =** 0
T-89 LL =

Gr: 1.4 %
Sa: 91.2 %
Si: 7.4 %
100.0 %

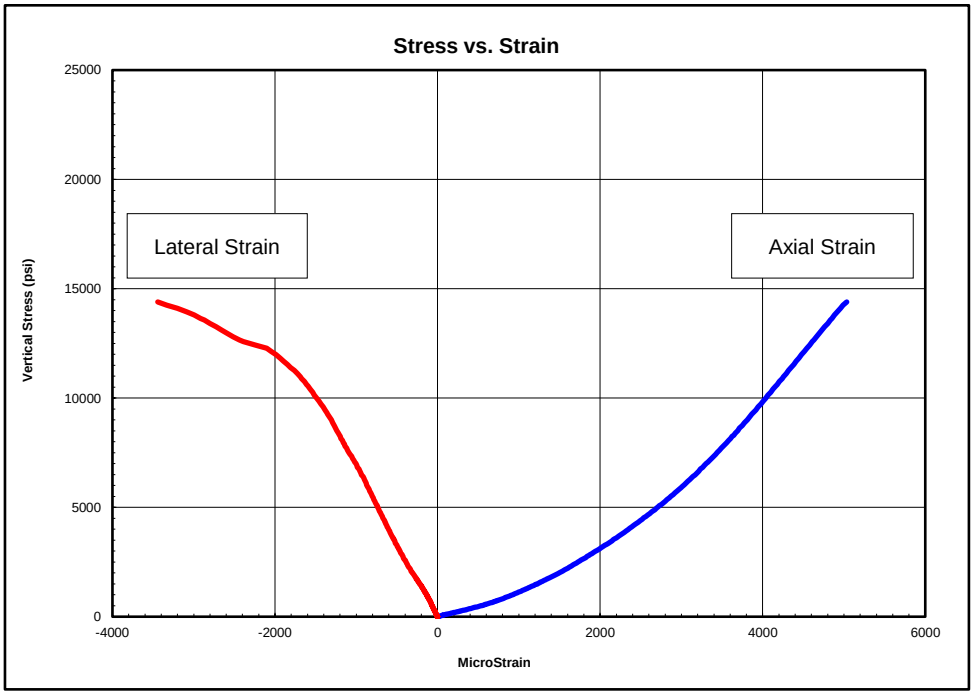
M145: AASHTO Class: A-3
D2487: Soil Description: Sa

Comments: 0

Reviewed By: Callie Ewald, P.E., Geotechnical Engineering Manager

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	jsc
Boring ID:	B-102
Sample ID:	C1
Depth, ft:	15.0-20.0
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 14,395 psi

The strain values recorded within the second and third stress ranges for this test produce values of Poisson's Ratio that exceed maximum values found in rocks.

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
1400-5300	2,340,000	0.35
5300-9100	3,690,000	---
9100-13000	4,470,000	---

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	4/26/2023
Project Name:	Wolcott School St Bridge	Tested By:	jab
Project Location:	Wolcott, VT	Checked By:	smd
GTX #:	317045		
Boring ID:	B-102		
Sample ID:	C1		
Depth:	15.0-20.0 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.48	4.47	4.48
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	615.22		
Bulk Density, lb/ft^3	168	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:

0° = 0.00020 90° = 0.00030

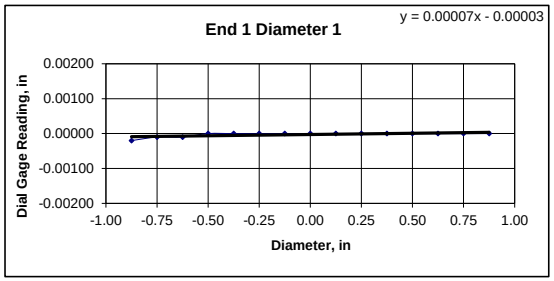
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00010	-0.00010	0.00000	0.00000	0.00010	0.00020	0.00000	0.00000	0.00000	0.00000	0.00020	0.00010	0.00000	0.00000	0.00000

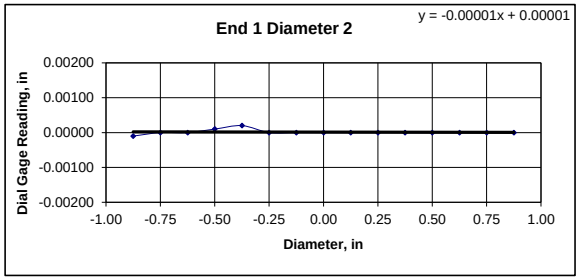
Difference between max and min readings, in:

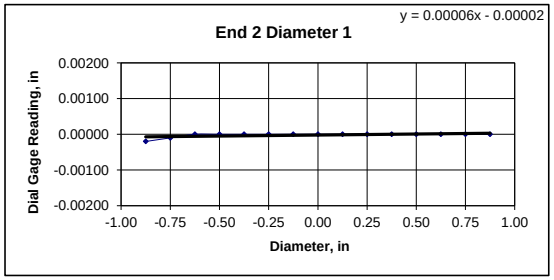
0° = 0.0002 90° = 0.0003

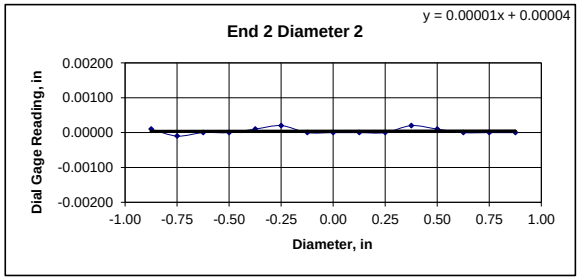
Maximum difference must be < 0.0020 in. Difference = ± 0.00015

Flatness Tolerance Met? YES









DIAMETER 1

End 1:
- Slope of Best Fit Line: 0.00007
- Angle of Best Fit Line: 0.00409

End 2:
- Slope of Best Fit Line: 0.00006
- Angle of Best Fit Line: 0.00327

Maximum Angular Difference: 0.00082

Parallelism Tolerance Met? YES

Spherically Seated

DIAMETER 2

End 1:
- Slope of Best Fit Line: 0.00001
- Angle of Best Fit Line: 0.00049

End 2:
- Slope of Best Fit Line: 0.00001
- Angle of Best Fit Line: 0.00033

Maximum Angular Difference: 0.00016

Parallelism Tolerance Met? YES

Spherically Seated

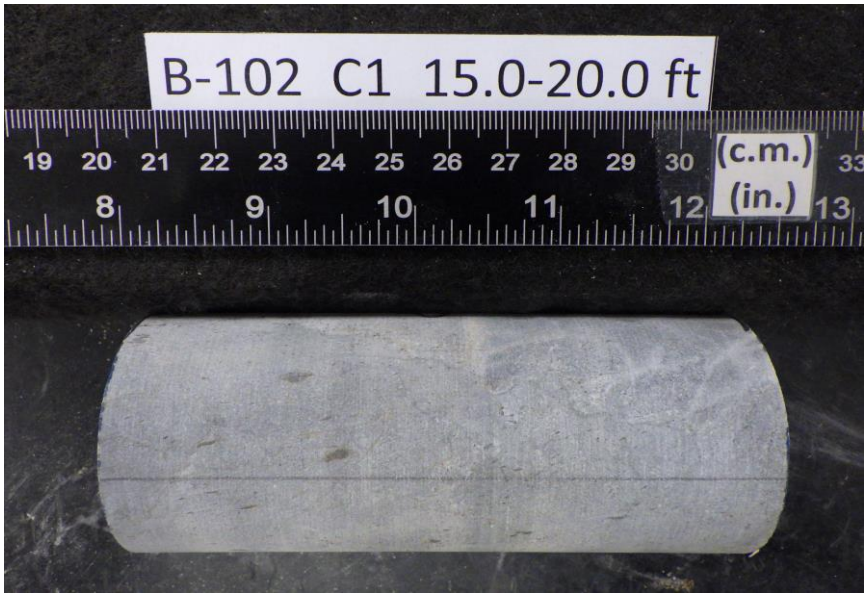
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES
END 2					
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES

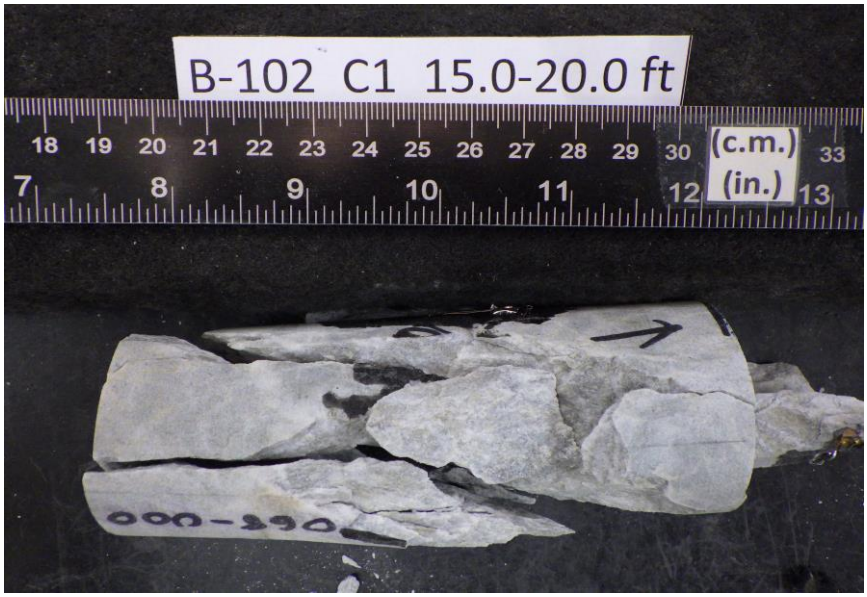
Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	smd
Boring ID:	B-102
Sample ID:	C1
Depth, ft:	15.0-20.0



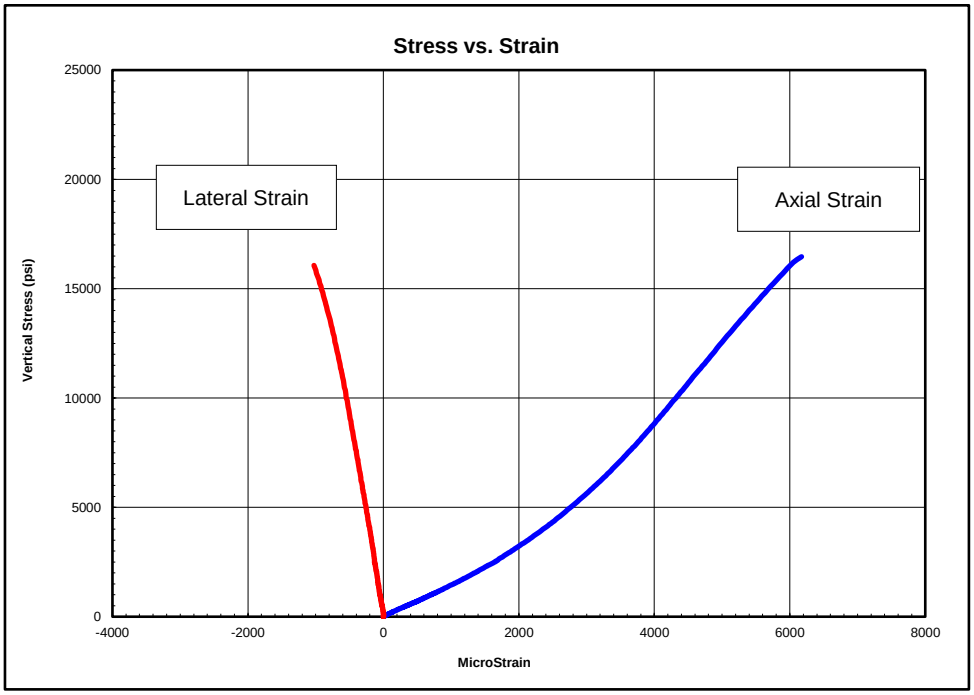
After cutting and grinding



After break

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	jsc
Boring ID:	B-102
Sample ID:	C2
Depth, ft:	24.60-24.97
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 16,463 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
1600-6000	2,130,000	0.11
6000-10400	3,420,000	0.20
10400-14800	3,680,000	0.27

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	4/26/2023
Project Name:	Wolcott School St Bridge	Tested By:	jab
Project Location:	Wolcott, VT	Checked By:	smd
GTX #:	317045		
Boring ID:	B-102		
Sample ID:	C2		
Depth:	24.60-24.97 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.41	4.41	4.41
Specimen Diameter, in:	1.99	1.99	1.99
Specimen Mass, g:	608.31		
Bulk Density, lb/ft^3	169	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

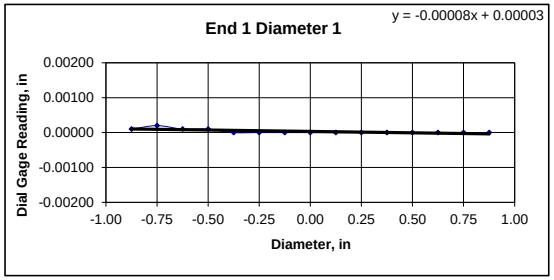
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010	0.00000

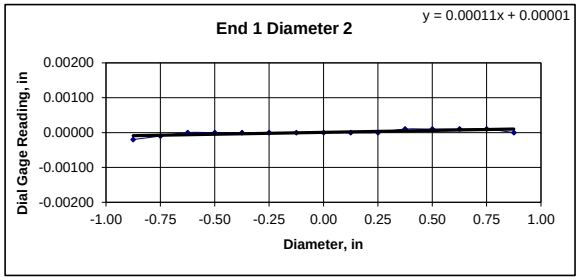
Difference between max and min readings, in:
0° = 0.00020 90° = 0.00030

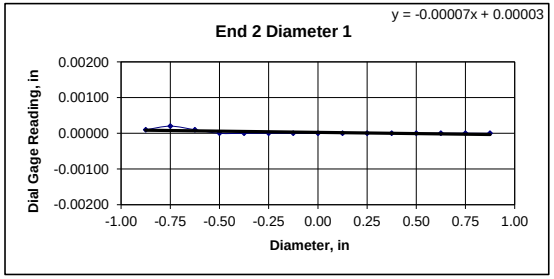
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00010	0.00020	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Diameter 2, in (rotated 90°)	0.00000	0.00010	0.00020	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00010

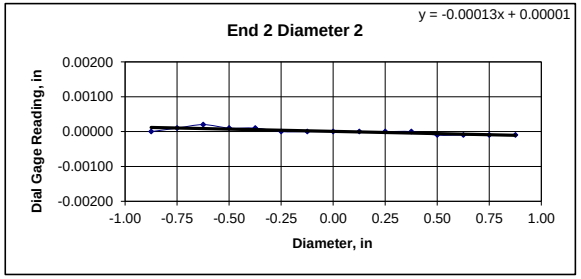
Difference between max and min readings, in:
0° = 0.0002 90° = 0.0003

Maximum difference must be < 0.0020 in. Difference = ± 0.00015
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00008
Angle of Best Fit Line: 0.00458

End 2:
Slope of Best Fit Line 0.00007
Angle of Best Fit Line: 0.00393

Maximum Angular Difference: 0.00065

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00011
Angle of Best Fit Line: 0.00622

End 2:
Slope of Best Fit Line 0.00013
Angle of Best Fit Line: 0.00737

Maximum Angular Difference: 0.00115

Parallelism Tolerance Met? YES
Spherically Seated

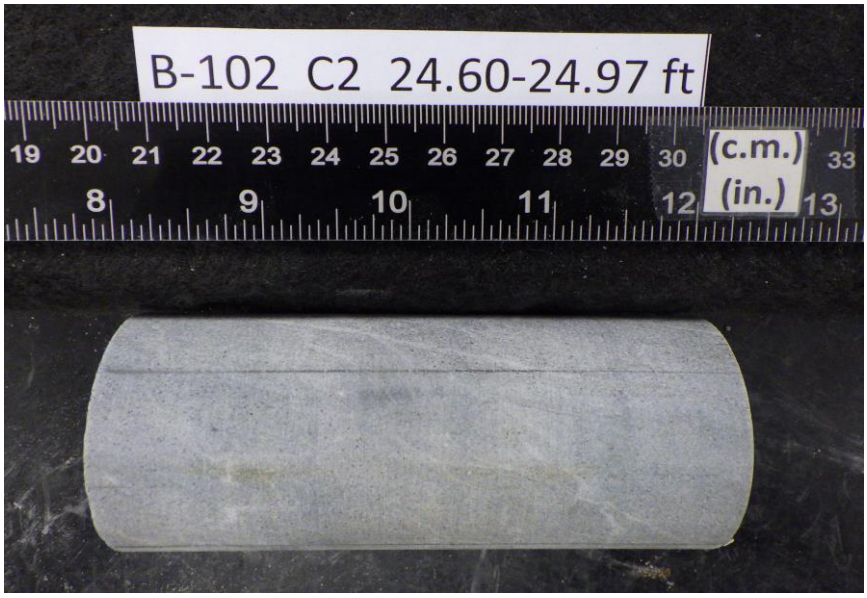
PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES

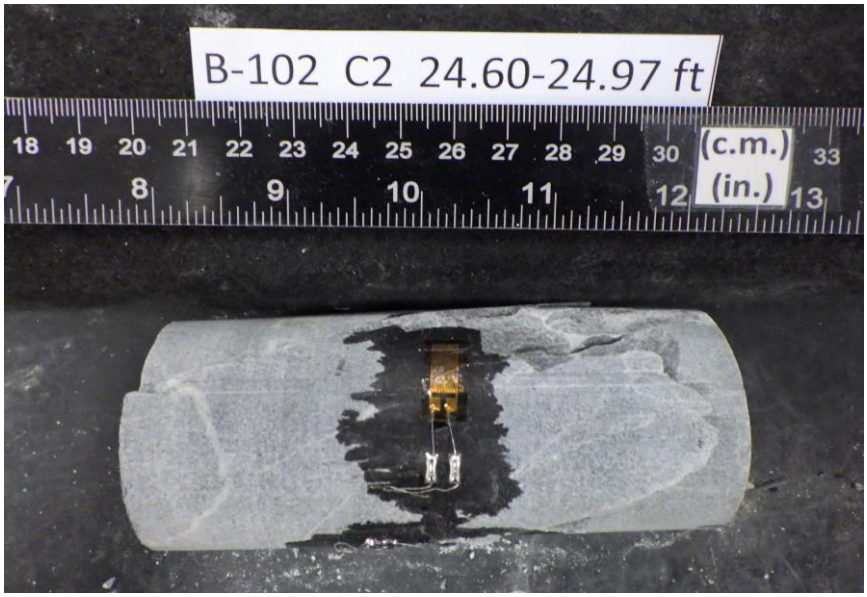
Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

END 2					
Diameter 1, in	0.00020	1.990	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00030	1.990	0.00015	0.009	YES

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	smd
Boring ID:	B-102
Sample ID:	C2
Depth, ft:	24.60-24.97



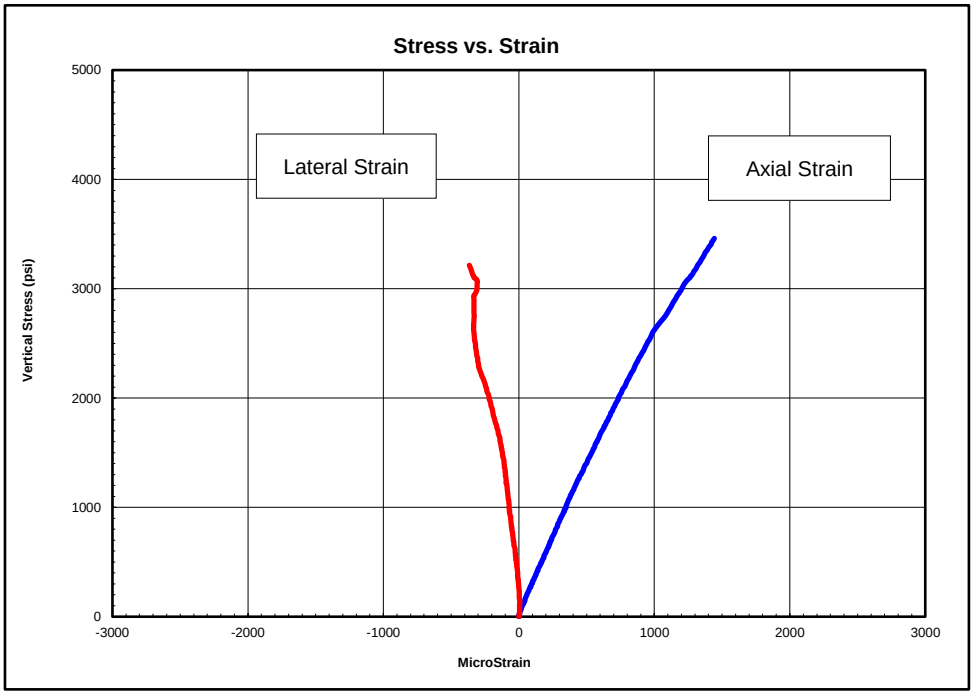
After cutting and grinding



After break

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	jsc
Boring ID:	B-103
Sample ID:	C1
Depth, ft:	37.96-38.44
Sample Type:	rock core
Sample Description:	See photographs Intact material and discontinuity failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 3,460 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
300-1300	2,800,000	0.28
1300-2200	2,500,000	0.49
2200-3100	2,030,000	0.24

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	4/26/2023
Project Name:	Wolcott School St Bridge	Tested By:	jab
Project Location:	Wolcott, VT	Checked By:	smd
GTX #:	317045		
Boring ID:	B-103		
Sample ID:	C1		
Depth:	37.96-38.44 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.58	4.58	4.58
Specimen Diameter, in:	2.00	1.99	2.00
Specimen Mass, g:	674.07		
Bulk Density, lb/ft^3	179	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.3	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00030	0.00050	0.00060	0.00070
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00050	0.00070	0.00070	0.00070

Difference between max and min readings, in:

0° = 0.00090 90° = 0.00070

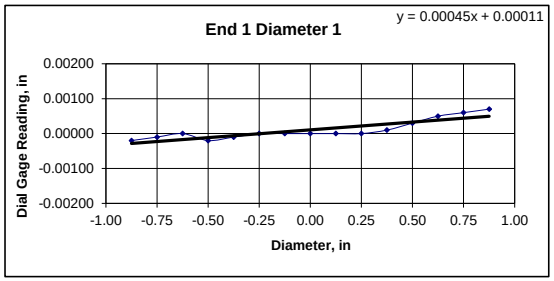
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00010	-0.00010	-0.00010	0.00000	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010
Diameter 2, in (rotated 90°)	0.00020	0.00030	0.00020	0.00030	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00010	0.00010	0.00010

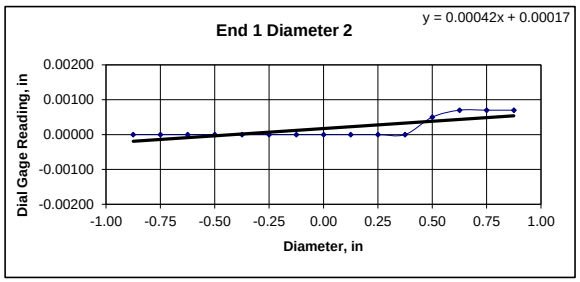
Difference between max and min readings, in:

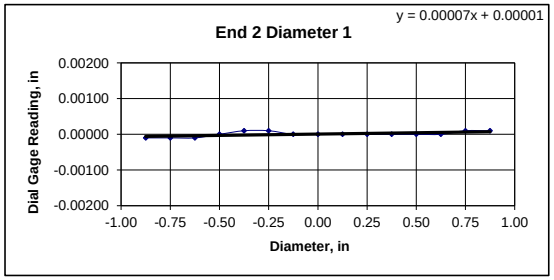
0° = 0.0002 90° = 0.0003

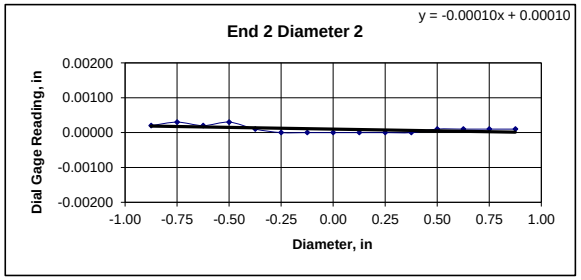
Maximum difference must be < 0.0020 in. Difference = ± 0.00045

Flatness Tolerance Met? YES









DIAMETER 1

End 1:
- Slope of Best Fit Line: 0.00045
- Angle of Best Fit Line: 0.02554

End 2:
- Slope of Best Fit Line: 0.00007
- Angle of Best Fit Line: 0.00426

Maximum Angular Difference: 0.02128

Parallelism Tolerance Met? NO

Spherically Seated

DIAMETER 2

End 1:
- Slope of Best Fit Line: 0.00042
- Angle of Best Fit Line: 0.02390

End 2:
- Slope of Best Fit Line: 0.00010
- Angle of Best Fit Line: 0.00573

Maximum Angular Difference: 0.01817

Parallelism Tolerance Met? NO

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00090	1.995	0.00045	0.026	YES
Diameter 2, in (rotated 90°)	0.00070	1.995	0.00035	0.020	YES
END 2					
Diameter 1, in	0.00020	1.995	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00030	1.995	0.00015	0.009	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

Client:	Haley & Aldrich, Inc.	Test Date:	4/26/2023
Project Name:	Wolcott School St Bridge	Tested By:	jab
Project Location:	Wolcott, VT	Checked By:	smd
GTX #:	317045		
Boring ID:	B-103	Reliable dial gauge measurements could not be performed on this rock type. Tolerance measurements were performed using a machinist straightedge and feeler gauges to ASTM specifications.	
Sample ID:	C1		
Depth (ft):	37.96-38.44		
Visual Description:	See photographs		

BEST EFFORT END FLATNESS TOLERANCES OF ROCK CORE SPECIMENS TO ASTM D4543

END FLATNESS		
END 1		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES
END 2		
Diameter 1	Is the maximum gap $\leq \pm 0.001$ in.?	YES
Diameter 2 (rotated 90°)	Is the maximum gap $\leq \pm 0.001$ in.?	YES

End Flatness Tolerance Met? YES

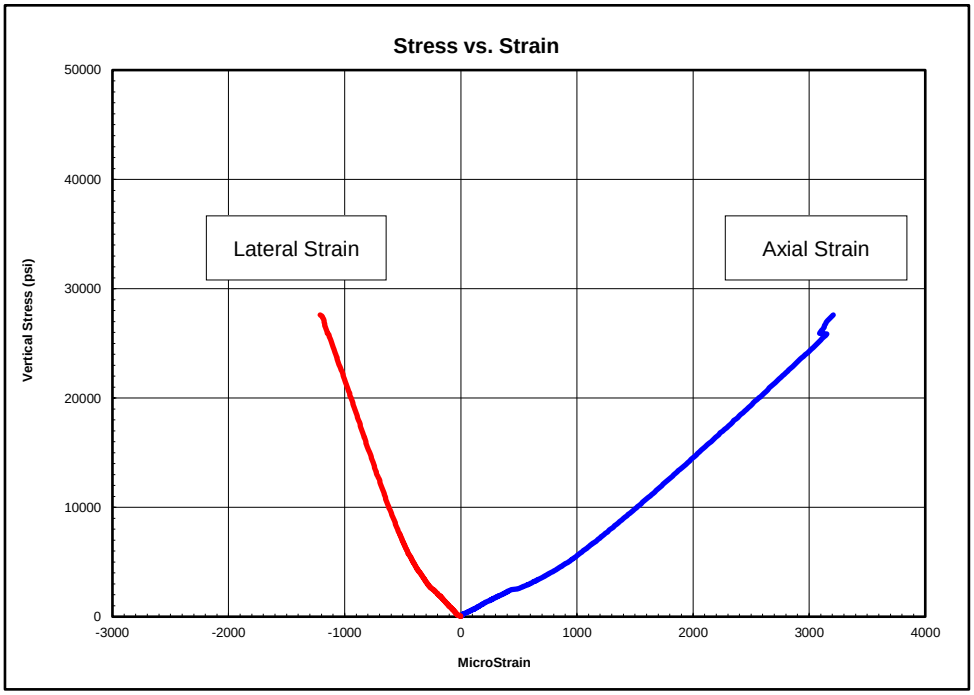
Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	smd
Boring ID:	B-103
Sample ID:	C1
Depth, ft:	37.96-38.44

After cutting and grinding

After break

Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	jsc
Boring ID:	B-104
Sample ID:	C1
Depth, ft:	30.02-30.41
Sample Type:	rock core
Sample Description:	See photographs Intact material failure

Compressive Strength and Elastic Moduli of Rock by ASTM D7012 - Method D



Peak Compressive Stress: 27,602 psi

Stress Range, psi	Young's Modulus, psi	Poisson's Ratio
2800-10100	7,460,000	0.37
10100-17500	9,460,000	0.31
17500-24800	9,870,000	0.32

Notes:
Test specimen tested at the approximate as-received moisture content and at standard laboratory temperature.
The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.
Young's Modulus and Poisson's Ratio calculated using the tangent to the line in the stress range listed.
Calculations assume samples are isotropic, which is not necessarily the case.

Client:	Haley & Aldrich, Inc.	Test Date:	4/26/2023
Project Name:	Wolcott School St Bridge	Tested By:	jab
Project Location:	Wolcott, VT	Checked By:	smd
GTX #:	317045		
Boring ID:	B-104		
Sample ID:	C1		
Depth:	30.02-30.41 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.46	4.46	4.46
Specimen Diameter, in:	1.98	1.99	1.99
Specimen Mass, g:	699.99		
Bulk Density, lb/ft^3	193	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:

Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.

Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	-0.00020	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Difference between max and min readings, in:

0° = 0.00020 90° = 0.00010

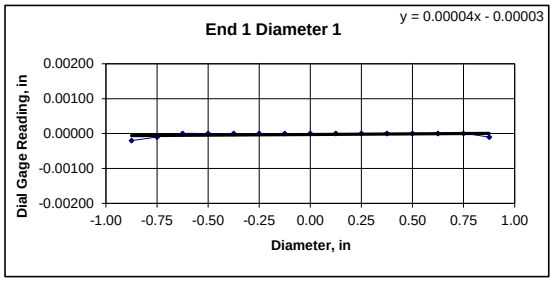
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020
Diameter 2, in (rotated 90°)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

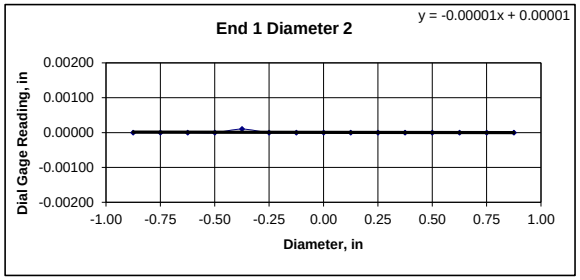
Difference between max and min readings, in:

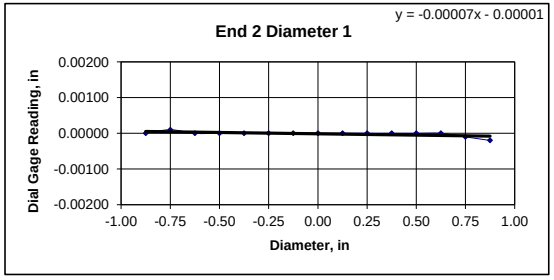
0° = 0.0003 90° = 0

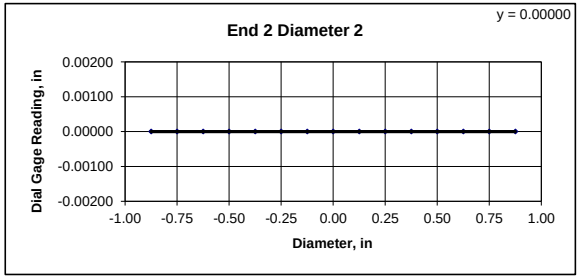
Maximum difference must be < 0.0020 in. Difference = ± 0.00015

Flatness Tolerance Met? YES









DIAMETER 1

End 1:
- Slope of Best Fit Line: 0.00004
- Angle of Best Fit Line: 0.00213

End 2:
- Slope of Best Fit Line: 0.00007
- Angle of Best Fit Line: 0.00426

Maximum Angular Difference: 0.00213

Parallelism Tolerance Met? YES

Spherically Seated

DIAMETER 2

End 1:
- Slope of Best Fit Line: 0.00001
- Angle of Best Fit Line: 0.00049

End 2:
- Slope of Best Fit Line: 0.00000
- Angle of Best Fit Line: 0.00000

Maximum Angular Difference: 0.00049

Parallelism Tolerance Met? YES

Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00020	1.985	0.00010	0.006	YES
Diameter 2, in (rotated 90°)	0.00010	1.985	0.00005	0.003	YES
END 2					
Diameter 1, in	0.00030	1.985	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00000	1.985	0.00000	0.000	YES

Maximum angle of departure must be ≤ 0.25°

Perpendicularity Tolerance Met? YES

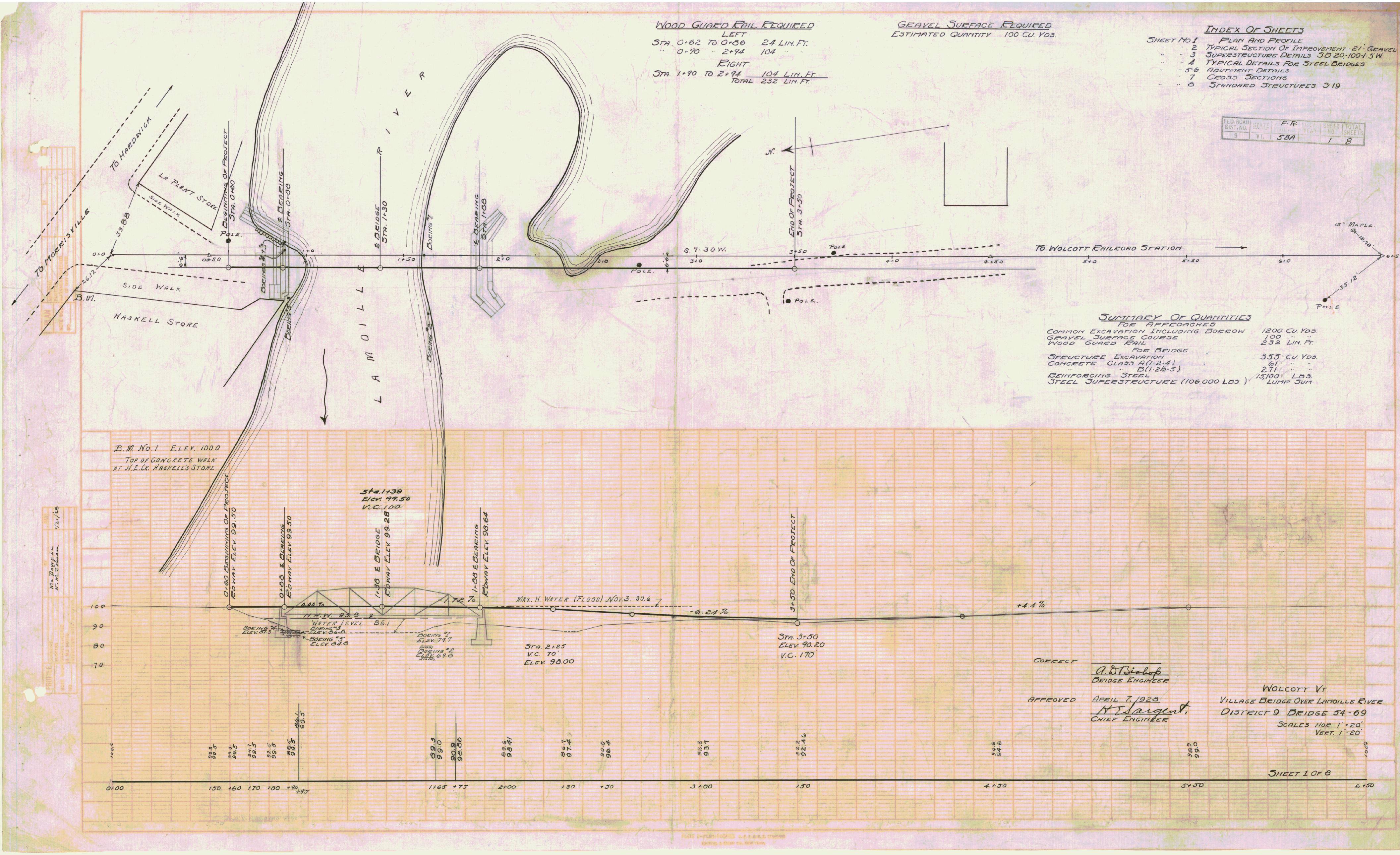
Client:	Haley & Aldrich, Inc.
Project Name:	Wolcott School St Bridge
Project Location:	Wolcott, VT
GTX #:	317045
Test Date:	4/27/2023
Tested By:	jab
Checked By:	smd
Boring ID:	B-104
Sample ID:	C1
Depth, ft:	30.02-30.41

After cutting and grinding

After break

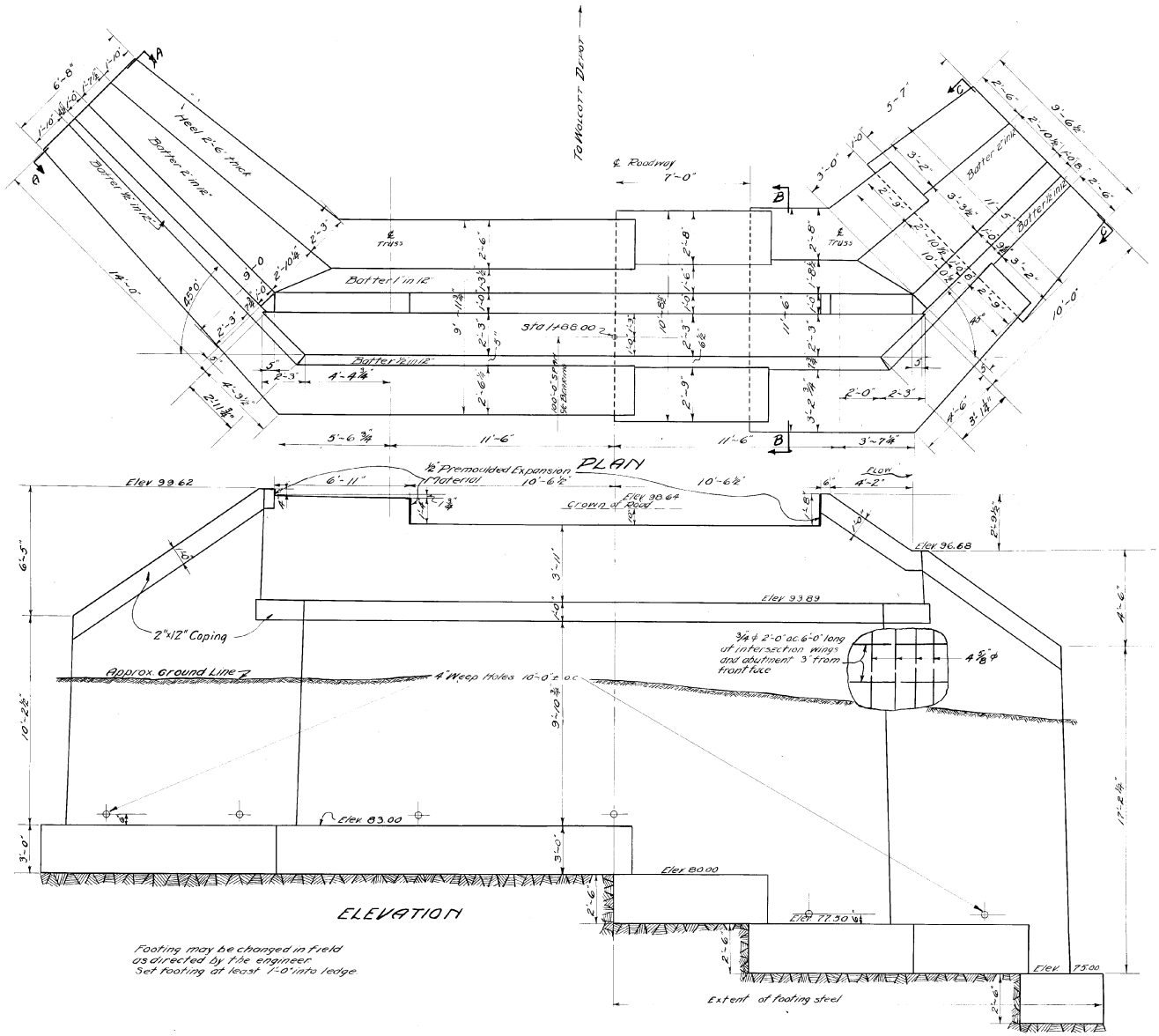
APPENDIX C

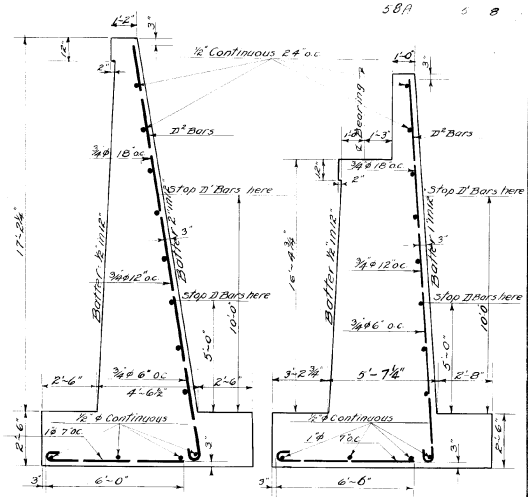
Historic Drawings

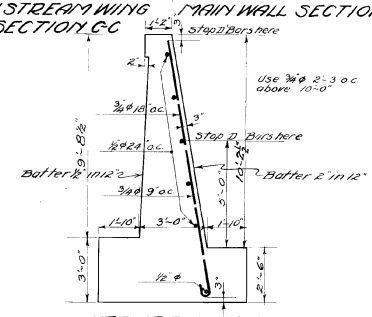


WOOD GUARD RAIL REQUIRED
LEFT
STA. 0+62 TO 0+86 24 LIN. FT.
" 0+90 " 2+94 104 " "
RIGHT
STA. 1+90 TO 2+94 104 LIN. FT.
TOTAL 232 LIN. FT.
GRAVEL SURFACE REQUIRED
ESTIMATED QUANTITY 100 CU. YDS.
INDEX OF SHEETS
SHEET NO 1 PLAN AND PROFILE
" " 2 TYPICAL SECTION OF IMPROVEMENT -21'- GRAVEL
" " 3 SUPERSTRUCTURE DETAILS SB 20,-100-1-5W.
" " 4 TYPICAL DETAILS FOR STEEL BRIDGES
" " 5-6 ABUTMENT DETAILS
" " 7 CROSS SECTIONS
" " 8 STANDARD STRUCTURES S 19
FED. ROAD DIST. NO. 9
STATE VT.
F. R. 58A
SHEET NO. 1
TOTAL SHEETS 8
N.
TO HARDWICK
TO MORRISVILLE
LA PLANT STORE
SIDE WALK
HASKELL STORE
B.M.
POLE
BEGINNING OF PROJECT STA. 0+60
℄ BEARING STA. 0+90
℄ BRIDGE STA. 1+30
℄ BEARING STA. 1+88
END OF PROJECT STA. 3+50
LAMOILLE RIVER
S. 7-30 W.
TO WOLCOTT RAILROAD STATION
15" MAPLE
35.12'
SUMMARY OF QUANTITIES
FOR APPROACHES
COMMON EXCAVATION INCLUDING BORROW 1200 CU. YDS.
GRAVEL SURFACE COURSE 100 " "
WOOD GUARD RAIL 232 LIN. FT.
FOR BRIDGE
STRUCTURE EXCAVATION 355 CU. YDS.
CONCRETE CLASS A(1-2-4) 61 " "
" " B(1-2½-5) 271 " "
REINFORCING STEEL 15,100 LBS.
STEEL SUPERSTRUCTURE (106,000 LBS.) LUMP SUM
B.M. NO. 1 ELEV. 100.0
TOP OF CONCRETE WALK AT N.E. CR. HASKELL'S STORE
STA. 1+38 ELEV. 99.50 V.C. 100
0+60 BEGINNING OF PROJECT R'DWAY ELEV. 99.50
0+90 ℄ BEARING R'DWAY ELEV. 99.50
1+30 ℄ BRIDGE R'DWAY ELEV. 99.28
1+88 ℄ BEARING R'DWAY ELEV. 98.64
3+50 END OF PROJECT
MAX. H. WATER (FLOOD) NOV. 3. 93.6
-1.12 %
-6.24 %
+4.4 %
WATER LEVEL 86.1
STA. 2+25 V.C. 70' ELEV. 98.00
STA. 3+50 ELEV. 90.20 V.C. 170
CORRECT
A. D. Bishop
BRIDGE ENGINEER
APPROVED APRIL 7, 1928
H. E. Sargent,
CHIEF ENGINEER
WOLCOTT VT.
VILLAGE BRIDGE OVER LAMOILLE RIVER
DISTRICT 9 BRIDGE 54-69
SCALES HOR. 1" = 20'
VERT. 1" = 20'
SHEET 1 OF 8

F.R.
58A 5 8







ALL CONCRETE CLASS B (1:2½:5)

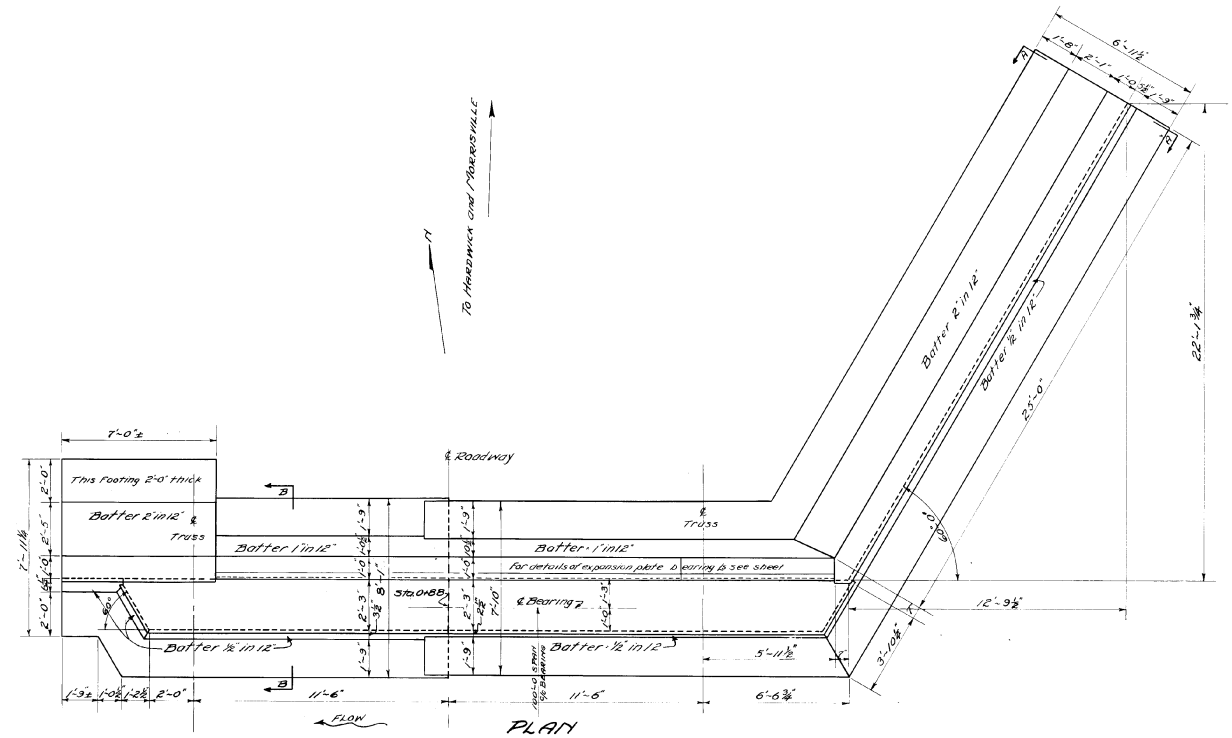
ABUTMENT
STA 1+88.0
WOLCOTT VILLAGE BRIDGE
WOLCOTT, VT.
BRIDGE 54-69 DIST. No 9
Scale 3/8" = 1'-0"

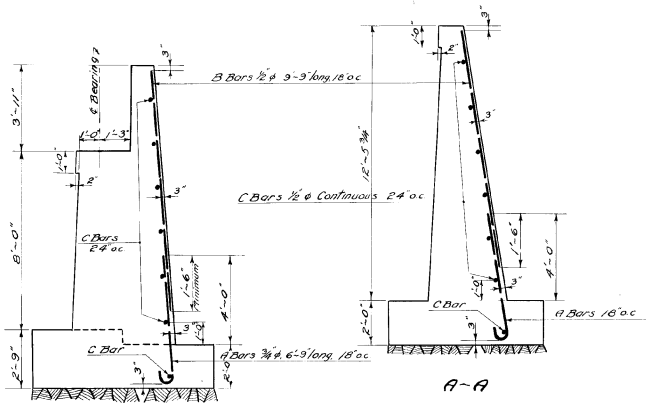
ESTIMATED QUANTITIES

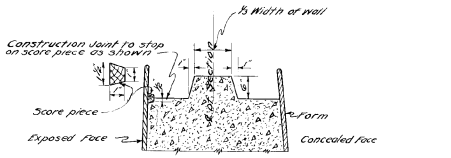
Structure Excavation	300 Cu Yds.
Class B Concrete 1:2½:5	160 Cu Yds.
Reinforcing Steel	38000 Lbs.

Surveyed by	M^c Donell
Designed by	W.G.H.
Drawn by	A.B.W.
Traced by	A.B.W.
Checked by	W.H.E. Day
Series 9 No. 34	Filed 69
Sheet 5 of 8 Sheets	

F. R.
581 6 8

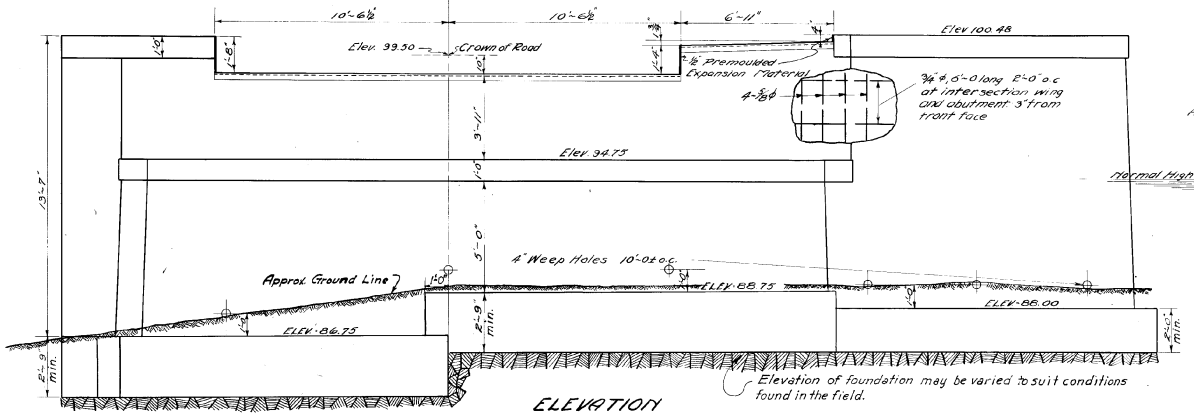






DETAILS FOR SCORE MARKS & CONSTRUCTION JOINTS BOTH ABUTMENTS

Unless otherwise directed by the Engineer, Score Pieces shall be equally spaced vertically at about 1'-6" o.c., shall stop at underside of copings and shall be carried around ends of walls where they may be exposed to view. Score marks shall line horizontally and shall be at same levels on both abutments. Construction joints may be made at any score mark.



ABUTMENT
STA. 0+88
WOLCOTT VILLAGE BRIDGE
WOLCOTT V.T.
Scale 3/8"=1'-0"

Estimated Quantities

Structure Excavation	55	cu Yds
Class B Concrete 1:2½:5	111	cu Yds
Reinforcing Steel	1000	Lbs

Surveyed by H. Darrell
Designed by W.H.G.
Drawn by K.B.W.
Traced by K.B.W.
Checked by W. H. G. Day
Series 9 No. 54 Filed 69
Sheet 6 of 8 Sheets

Printed by "Imperial" Blueprint Co. Inc. Utica, N.Y.

APPENDIX D

Seismic Refraction Survey

HALEY ALDRICH

HRGS

GEOPHYSICAL SURVEY
SCHOOL STREET BRIDGE
WOLCOTT, VERMONT

Prepared for:

Haley & Aldrich, Inc.
75 Washington Avenue | Suite 1A
Portland, Maine 04101

Prepared by:

Hager-Richter Geoscience, Inc.
2 Industrial Way – S/2
Atkinson, New Hampshire 03811

File 23VD36
October 2023

HRGS
HAGER-RICHTER GEOSCIENCE

GEOPHYSICS FOR THE ENGINEERING & ENVIRONMENTAL COMMUNITIES

2 Industrial Way S/2, Atkinson, NH (603.893.9944)
846 Main Street, Fords, NJ (732.661.0555)

www.hager-richter.com

October 20, 2023
File 23VD36

Erin A. Force, P.E.
Senior Project Manager
Senior Geotechnical Engineer
Haley & Aldrich, Inc.
75 Washington Avenue | Suite 1A
Portland, Maine 04101

Tel: 207.482.4626
Cell: 207.712.2704
Email: EForce@haleyaldrich.com

RE: Geophysical Survey
School Street Bridge
Wolcott, Vermont

Dear Ms. Force:

In this report, we summarize the results of a surface geophysical survey conducted in September 2023 by Hager-Richter Geoscience at the above referenced site located in Wolcott, Vermont for Haley & Aldrich, Inc. (H&A). The scope of the survey and area of interest were specified by H&A.

INTRODUCTION

The site is a bridge carrying School Street across Lamoille River. General location of the site is shown in Figure 1. The future plan is to replace the existing bridge with a new bridge designed with new abutment and wing wall locations. H&A requested costs for conducting geophysical survey, specifically seismic refraction to determine the overburden thickness and bedrock configuration at each new proposed abutment locations at School Street Bridge in Wolcott, Vermont. Figure 2 is a site plan showing the location of the seismic lines.

Subsurface information for the project site was provided by H&A, and it comprises of five soil borings. Bedrock was encountered at depths ranging from 13 to 41 feet below ground surface, overlain by alluvial and fluvial deposits and fill.

OBJECTIVES

The objective of the geophysical survey is to determine the thickness of overburden and bedrock configuration at the site.

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THE SURVEY

Vanja Dezelic, Ph.D., and Amber Carlson of HRGS conducted the geophysical survey on September 20, 2023. The project was coordinated with Ms. Erin A. Force, P.E. of H&A. Mr. Finn Tierney was present for the survey and assisted with safety logistics and site access. The seismic lines were positioned on both sides of the roadway towards the existing bridge abutments, and along the river banks. General location of the four (4) seismic lines is shown in Figure 2. Original data and field notes reside in the HRGS files and will be retained for a minimum of three years. Photographs 1 and 2 show typical conditions at the site.

i.

ii.

Photographs 1 and 2. Typical conditions along the seismic lines:

i.) Line 1 view to the east along the seismic line.; ii.) Line 4 view to the south along the seismic line

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The locations of the seismic lines were georeferenced using a Trimble Geo7X CM GPS system utilizing a Zephyr-2 external antenna.

EQUIPMENT AND PROCEDURES

Seismic Refraction. The seismic refraction survey was conducted using one 24-channel seismograph (Geometrics Geode) coupled to 24 4.5-Hz geophones. A geophone spacing of 5 feet was used for the seismic lines 1 and 2, and 6 feet for seismic lines 3 and 4. An 8-pound sledgehammer striking an aluminum plate placed on the ground was used as the energy source. Seven (7) shot points were acquired for the seismic spread – three (3) located internal to the spread, one (1) at each end of the spread, and offset shots located in-line but outside of each end of the geophone spread. This configuration provides reversed profiles. The seismograph is connected to and controlled by a laptop computer. The software provides for the acquisition, display, plotting, filtering, and storage of seismic data in the field.

The seismic refraction data were interpreted with the Generalized Reciprocal Method (GRM). For the GRM interpretation, we used IXRefraX, commercially licensed software from Interpex Limited. GRM allows the depth to bedrock to be determined for *each* geophone location, rather than only at the shot points as for most other methods, and it is less sensitive to the presence of dipping interfaces and hidden layers. The GRM method requires at least one (1) shot at each end of the cable.

LIMITATIONS OF THE METHOD

> IN GENERAL, THE ACCURACY (STANDARD DEVIATION) OF THE APPARENT DEPTHS OF RELATIVELY COMPETENT BEDROCK DETERMINED BY THE SEISMIC REFRACTION METHOD IS ABOUT ± 10% OF THE APPARENT DEPTH OF BEDROCK, OR ± 2 FEET, WHICHEVER IS GREATER. THE BEDROCK MODEL SHOWN AS A PROFILE OR LISTED AS TABULAR DATA SHOULD NOT BE USED SOLELY FOR CONTRACT BEDROCK REMOVAL QUANTITIES.

Seismic Refraction. As with all geophysical methods, the seismic refraction method assumes that the local geology is relatively uncomplicated. In particular, the seismic refraction method assumes that interfaces between geologic materials correlate with sharp increases in seismic velocity and that the interfaces between geologic units are relatively flat lying. The method is not very sensitive to lateral variations within layers, and relatively subtle features such as fracture zones within bedrock generally cannot be detected unless there is a topographic expression of the feature and/or a significant drop in bedrock velocity. The accuracy of the method is degraded in areas with strong topographic relief and/or where the interfaces have apparent dips greater than about 20^{o}. ***In general, the accuracy of depths determined is estimated to be about 10% or 2 feet, whichever is greater. The results of this survey should not be relied upon for contract bedrock removal quantities.***

Where two (2) materials do not exhibit contrasting velocities, or where velocities gradually increase with depth, a clear refracted signal is not generated, and the seismic refraction method cannot be used to distinguish the two materials. In some cases, the "geophysical contact" between materials with contrasting velocities does not correlate exactly with the "geologic contact." For example, where a

highly weathered bedrock is overlain by a dense material such as till, the velocity range of the weathered bedrock might overlap or approach the velocity range of the till, and the two materials cannot be distinguished seismically. In such cases, the depth determined by seismic refraction is the depth of *competent* bedrock, which might be located at some depth below the geologic contact.

The depth relations of the water table and bedrock may constitute a significant problem for the seismic refraction technique. This problem is that of a "blind layer." A blind layer occurs where the thickness of the saturated overburden is less than about half the depth of bedrock. In such cases, the water-saturated material immediately above bedrock is "blind" in the sense that no refracted seismic energy from it will be received as a first arrival of seismic energy, and all methods used to reduce the seismic data to determine the depth of bedrock, the objective of this survey, use *only* first arrivals. Thus, the saturated layer will not be detected where it is close to bedrock, and most methods of seismic data reduction will indicate that bedrock is considerably shallower than it is. Although GRM, the method used by HRGS to reduce the seismic refraction data, does not use first arrivals through the water saturated zone (because there is none to use) in such cases, GRM determines the depth of bedrock correctly by using the *average* velocity of the saturated and unsaturated zones.

A "hidden layer" occurs where a lower velocity material underlies a higher velocity material, a common situation in stratified sediments. An example is where sands are present under layers of clay or till. As in the case of a "blind layer," most methods of seismic refraction data reduction will indicate that bedrock is deeper than it is if a hidden layer is present but not detected. Internal tests in the seismic refraction data reduction software that we use (IXRefraX by Interpex) indicate that such layers might be present, and an average velocity of the two layers is used to determine the depth of bedrock.

RESULTS

General. The geophysical survey was conducted along four (4) seismic transects using seismic refraction to determine depth of bedrock. Figure 2 shows the locations of the seismic refraction lines. The results of the seismic refraction survey are shown in profile form in Figures 3 - 6 and listed in tabular form in Table 1. Figure 7 is a color contour plot showing the bedrock topography determined from the seismic and boring data.

Seismic Refraction. Seismic refraction was conducted along four (4) transects located at proposed new bridge abutments. A total of 506 linear feet of seismic refraction data was acquired.

The quality of the seismic refraction data ranges from very good to fair. A measure of the accuracy (standard deviation) of the data can be obtained by comparing the seismically determined depths with depths of bedrock recorded in nearby borings (Table 2). For the area of interest, three of the four borings were close enough to the seismic lines (i.e., closer than about 20 feet) for direct comparison. An examination of Table 2 shows that the average depths determined seismically differs by about 10% from the depth of bedrock encountered in nearby borings. The largest individual discrepancy between seismically determined bedrock elevation and the bedrock elevation encountered in a boring is between the 0+00 station of Line 1 and B-102, which differ by 3 feet or 23%; however we note that at this

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location, the bedrock appears to have a steep gradient, evidenced by the 20-foot difference in bedrock elevations encountered in B101 and B102, located about 60 feet apart.

Based on these results, and on similar seismic refraction surveys, we estimate the accuracy of depths determined from seismic refraction to be in general about 10% or 2 feet, whichever is greater.

Seismic Velocity. Based on the interpretation obtained with the GRM method, materials with two distinct velocity ranges were detected for the seismic lines. The uppermost material exhibits a compressional wave velocity range of approximately 1,100 to 1,550 feet per second (fps), inferred to represent mostly unsaturated soil. The lowermost material exhibits compressional wave velocities ranging from about 10,400 fps to about 13,200 fps and is inferred to represent competent bedrock.

Bedrock Depths and Configuration. The results of the seismic refraction survey are shown in profile form in Figures 3 - 6 and are listed in tabular form in Table 1. The depth of competent bedrock varies between about 12 and 32 feet below ground surface, and bedrock elevation varies between 665 and 681 feet, an apparent relief of about 16 feet.

Figure 7 is a bedrock topographic plan developed from the seismic refraction results and the bedrock information from borings provided by H&A. The contours shown represent interpolations based on the seismic data and reported bedrock elevations at borings installed for the project. The contours shown represent non-unique models for bedrock depth (i.e., different valid models can be developed to fit the data set), and the depth of competent bedrock at any location may differ significantly from that shown.

CONCLUSIONS

Based on the geophysical survey conducted by Hager-Richter Geoscience, Inc. (HRGS) for the School Street Bridge in Wolcott, Vermont in September 2023 for H&A, we conclude the following:

- The depth of competent bedrock varies between 12 and 32 feet below ground surface along the seismic lines at proposed new bridge structure.

- The elevation of competent bedrock varies between 665 and 681 feet with an apparent relief of about 16 feet along the seismic lines at proposed new bridge structure.

LIMITATIONS ON USE OF THIS REPORT

This letter report was prepared for the exclusive use of H&A (Client). No other party shall be entitled to rely on this Report, or any information, documents, records, data, interpretations, advice, or opinions given to Client by Hager-Richter Geoscience, Inc. (HRGS) in the performance of its work. The Report relates solely to the specific project for which HRGS has been retained and shall not be used or relied upon by Client or any third party for any variation or extension of this project, any other project, or any other purpose without the express written permission of HRGS. Any unpermitted use by Client or any third party shall be at Client's or such third party's own risk and without any liability to HRGS.

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HRGS has used reasonable care, skill, competence and judgment in the performance of' its services for this project consistent with professional standards for those providing similar services at the same time, in the same locale, and under like circumstances. Unless otherwise stated, the work performed by HRGS should be understood to be exploratory and interpretational in character and any results, findings or recommendations contained in this Report or resulting from the work proposed may include decisions which are judgmental in nature and not necessarily based solely on pure science or engineering. It should be noted that our conclusions might be modified if subsurface conditions were better delineated with additional subsurface exploration including, but not limited to, test pits, soil borings with collection of soil and water samples, and laboratory testing.

Except as expressly provided in this limitations section, HRGS makes no other representation or warranty of any kind whatsoever, oral or written, expressed or implied; and all implied warranties of merchantability and fitness for a particular purpose, are hereby disclaimed. If you have any questions or comments on this letter report, please contact us at your convenience. It has been a pleasure to work with H&A, on this project. We look forward to working with you again in the future.

Sincerely,
Hager-Richter Geoscience, Inc.,

Vanja Dezelic, Ph.D.
Geophysicist

Attachments: Tables 1 & 2
Figures 1 - 7

HRGS

TABLE 1
SEISMIC REFRACTION RESULTS
SCHOOL STREET BRIDGE
WOLCOTT, VERMOTT

Line	Station (ft)	Easting (ft)	Northing (ft)	Surface Elevation (ft)	Bedrock Depth (ft)	Bedrock Elevation (ft)
1	0+00	1651395.6	745959.7	697	16	681
1	0+05	1651400.4	745958.1	695	16	679
1	0+10	1651405.1	745956.4	693	14	679
1	0+15	1651409.8	745954.8	692	14	679
1	0+20	1651414.5	745953.1	691	13	678
1	0+25	1651419.2	745951.5	690	12	678
1	0+30	1651424.0	745949.9	690	13	676
1	0+35	1651428.8	745948.2	689	13	676
1	0+40	1651433.4	745946.6	689	14	675
1	0+45	1651438.1	745944.9	688	16	672
1	0+50	1651442.9	745943.3	688	17	672
1	0+55	1651447.6	745941.7	688	17	671
1	0+60	1651452.2	745940.0	688	18	670
1	0+65	1651457.0	745938.4	688	18	670
1	0+70	1651461.8	745936.8	688	19	669
1	0+75	1651466.5	745935.1	688	19	669

Line	Station (ft)	Easting (ft)	Northing (ft)	Surface Elevation (ft)	Bedrock Depth (ft)	Bedrock Elevation (ft)
1	0+80	1651471.2	745933.4	688	20	668
1	0+85	1651475.9	745931.8	688	19	669
1	0+90	1651480.6	745930.2	688	18	670
1	0+95	1651485.4	745928.6	688	17	671
1	1+00	1651490.1	745926.9	688	17	671
1	1+05	1651494.9	745925.2	688	17	671
1	1+10	1651499.5	745923.6	689	17	672
1	1+15	1651504.2	745922.0	689	17	673
2	0+00	1651243.6	745828.4	688	22	666
2	0+05	1651248.6	745828.1	688	22	666
2	0+10	1651253.6	745827.8	688	22	666
2	0+15	1651258.6	745827.4	688	22	666
2	0+20	1651263.6	745827.1	688	21	667
2	0+25	1651268.6	745826.8	688	20	668
2	0+30	1651273.5	745826.4	688	19	669
2	0+35	1651278.5	745826.1	688	18	670

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Vermont State Plane NAD83 in US survey feet. Elevations along the seismic lines were determined from plans provided by H&A and are relative to the NAVD 1988 datum.

Geophysical Survey
School Street Bridge
Wolcott, Vermont
File 23VD36 Table 1

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TABLE 1 (CONTINUED)
SEISMIC REFRACTION RESULTS

Line	Station (ft)	Easting (ft)	Northing (ft)	Surface Elevation (ft)	Bedrock Depth (ft)	Bedrock Elevation (ft)
2	0+40	1651283.5	745825.8	688	18	670
2	0+45	1651288.5	745825.4	688	18	670
2	0+50	1651293.5	745825.1	688	17	671
2	0+55	1651298.5	745824.8	688	17	671
2	0+60	1651303.5	745824.4	688	17	671
2	0+65	1651308.5	745824.1	688	17	671
2	0+70	1651313.5	745823.8	688	18	671
2	0+75	1651318.5	745823.5	688	18	670
2	0+80	1651323.5	745823.2	688	18	670
2	0+85	1651328.5	745822.8	688	18	670
2	0+90	1651333.4	745822.5	688	18	670
2	0+95	1651338.4	745822.2	688	18	670
2	1+00	1651343.4	745821.9	688	18	670
2	1+05	1651348.4	745821.5	688	18	670
2	1+10	1651353.4	745821.2	688	18	670
2	1+15	1651358.4	745820.9	689	18	671
3	0+00	1651396.6	745811.1	698	28	670
3	0+06	1651397.8	745805.2	698	28	670
3	0+12	1651399.0	745799.4	698	28	670
3	0+18	1651400.1	745793.4	698	29	669
3	0+24	1651401.2	745787.6	698	30	668
3	0+30	1651402.5	745781.7	698	30	668
3	0+36	1651403.6	745775.8	698	30	668
3	0+42	1651404.8	745769.9	698	31	667
3	0+48	1651405.9	745764.1	698	31	666
3	0+54	1651407.1	745758.1	698	32	666
3	0+60	1651408.2	745752.2	698	32	666
3	0+66	1651409.4	745746.4	698	32	666
3	0+72	1651410.6	745740.5	698	32	665
3	0+78	1651411.8	745734.6	697	32	666
3	0+84	1651412.9	745728.8	697	31	666
3	0+90	1651414.1	745722.8	697	31	666
3	0+96	1651415.2	745716.9	697	31	666
3	1+02	1651416.4	745711.1	697	31	666
3	1+08	1651417.6	745705.2	697	30	667
3	1+14	1651418.8	745699.3	697	30	667
3	1+20	1651419.9	745693.4	697	30	667
3	1+26	1651421.0	745687.5	697	30	667
3	1+32	1651422.2	745681.6	697	30	667
3	1+38	1651423.4	745675.8	697	29	667
4	0+00	1651375.6	745804.2	698	28	670
4	0+06	1651376.5	745798.2	698	28	670
4	0+12	1651377.5	745792.3	698	28	670
4	0+18	1651378.4	745786.4	698	28	670

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Vermont State Plane NAD83 in US survey feet. Elevations along the seismic lines were determined from plans provided by H&A and are relative to the NAVD 1988 datum.

HRGS

TABLE 1 (CONTINUED)
SEISMIC REFRACTION RESULTS

Line	Station (ft)	Easting (ft)	Northing (ft)	Surface Elevation (ft)	Bedrock Depth (ft)	Bedrock Elevation (ft)
4	0+24	1651379.4	745780.5	697	28	669
4	0+30	1651380.2	745774.6	697	28	669
4	0+36	1651381.1	745768.6	696	28	668
4	0+42	1651382.1	745762.7	696	28	668
4	0+48	1651383.0	745756.8	696	28	668
4	0+54	1651384.0	745750.8	696	28	668
4	0+60	1651384.9	745744.9	696	28	668
4	0+66	1651385.8	745739.0	696	28	668
4	0+72	1651386.8	745733.1	696	28	668
4	0+78	1651387.6	745727.1	696	29	667
4	0+84	1651388.6	745721.2	696	29	667
4	0+90	1651389.5	745715.2	696	29	667
4	0+96	1651390.4	745709.3	696	29	667
4	1+02	1651391.4	745703.4	696	29	667
4	1+08	1651392.2	745697.5	696	29	667
4	1+14	1651393.1	745691.6	696	29	667
4	1+20	1651394.1	745685.6	696	29	667
4	1+26	1651395.0	745679.7	696	29	667
4	1+32	1651396.0	745673.8	696	29	667
4	1+38	1651396.9	745667.8	696	29	667

Estimated standard deviation of depth of interfaces for seismic lines is normally taken as 10% or 2 feet, whichever is greater. Depths and elevations of bedrock determined here are for competent bedrock. Heavily weathered or highly fractured bedrock may occur at shallower depths. The easting and northing coordinates are relative to Vermont State Plane NAD83 in US survey feet. Elevations along the seismic lines were determined from plans provided by H&A and are relative to the NAVD 1988 datum.

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TABLE 2
COMPARISON OF ELEVATIONS BETWEEN
SEISMIC DATA AND BORINGS
SCHOOL STREET BRIDGE
WOLCOTT, VERMOTT

Location of Boring Relative to Seismic Line				Bedrock Elevations (feet)		Bedrock Depth from Boring (feet)	Difference	
Seismic Line and Station		Boring	Distance from Seismic Line To Boring	Seismic Line	Boring		Feet	Percent
Line 1	0+00	B-102	18' SW	681	684	13	3	23
Line 3	0+41	B-103	5' W	667	665	32	2	6
Line 4	0+29	B-104	3' E	669	669	29	0	0
Line 4	0+38	B-103	19' E	668	665	32	3	9
				Average			2	10%
				Standard Deviation			1	10%

Each listed difference in feet reflects the absolute difference between bedrock elevation determined seismically and at a nearby boring. Each percentage difference was calculated by dividing the absolute difference in feet by the depth of bedrock reported for the nearby boring. Only borings located less than about 20 feet from a seismic line were used in this comparison. Elevations along the seismic lines were determined from plans provided by H&A and are relative to the NAVD 1988 datum.

N

H-R

APPROXIMATE SCALE (feet)

0 1000 2000

VT

LOCATION

NOTE:

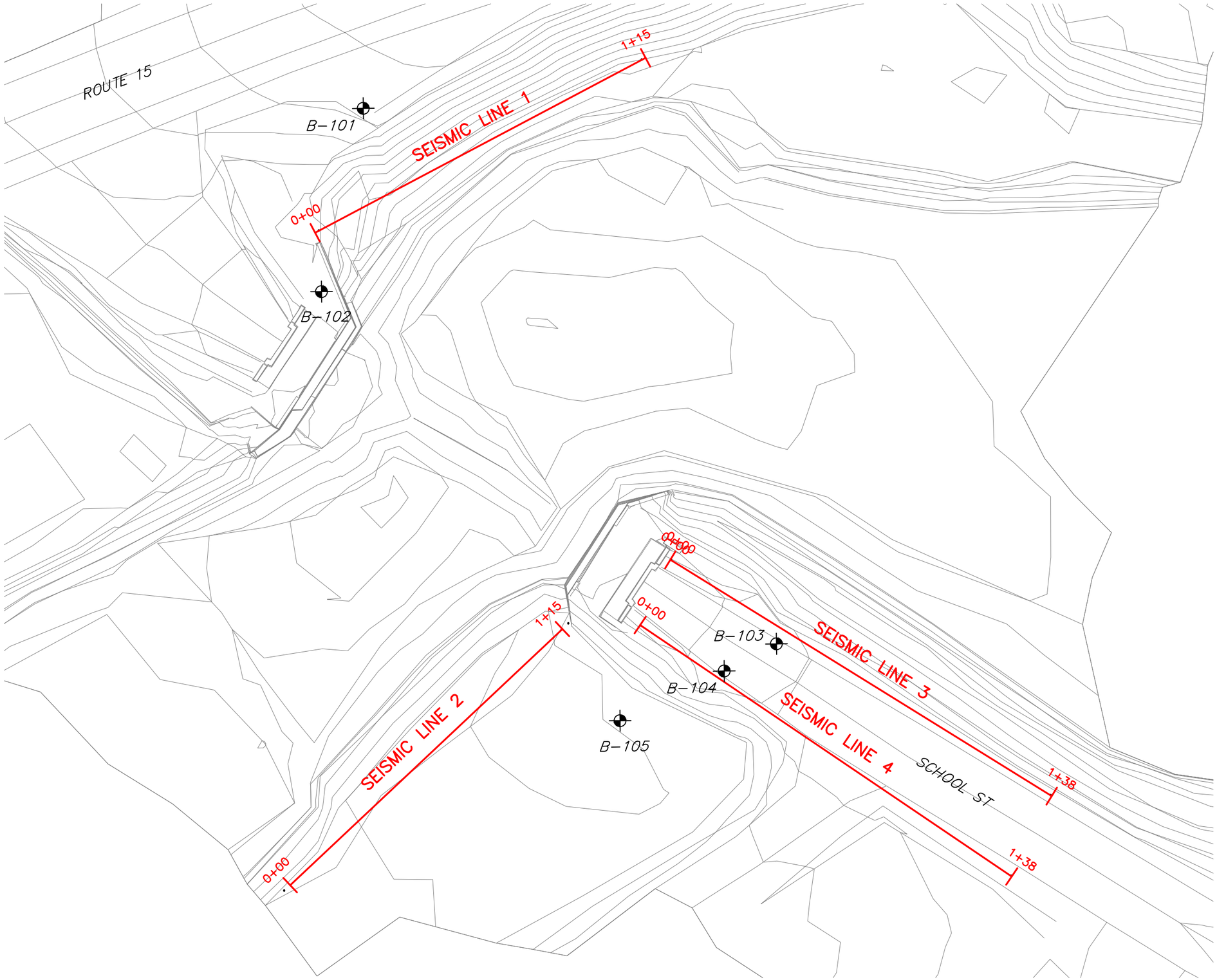
Modified from Google Earth Pro aerial photograph.

Figure 1
General Site Location
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER

Atkinson, NH | Fords, NJ



LEGEND

SEISMIC LINE

BORING

SCALE (feet)

0 30 60

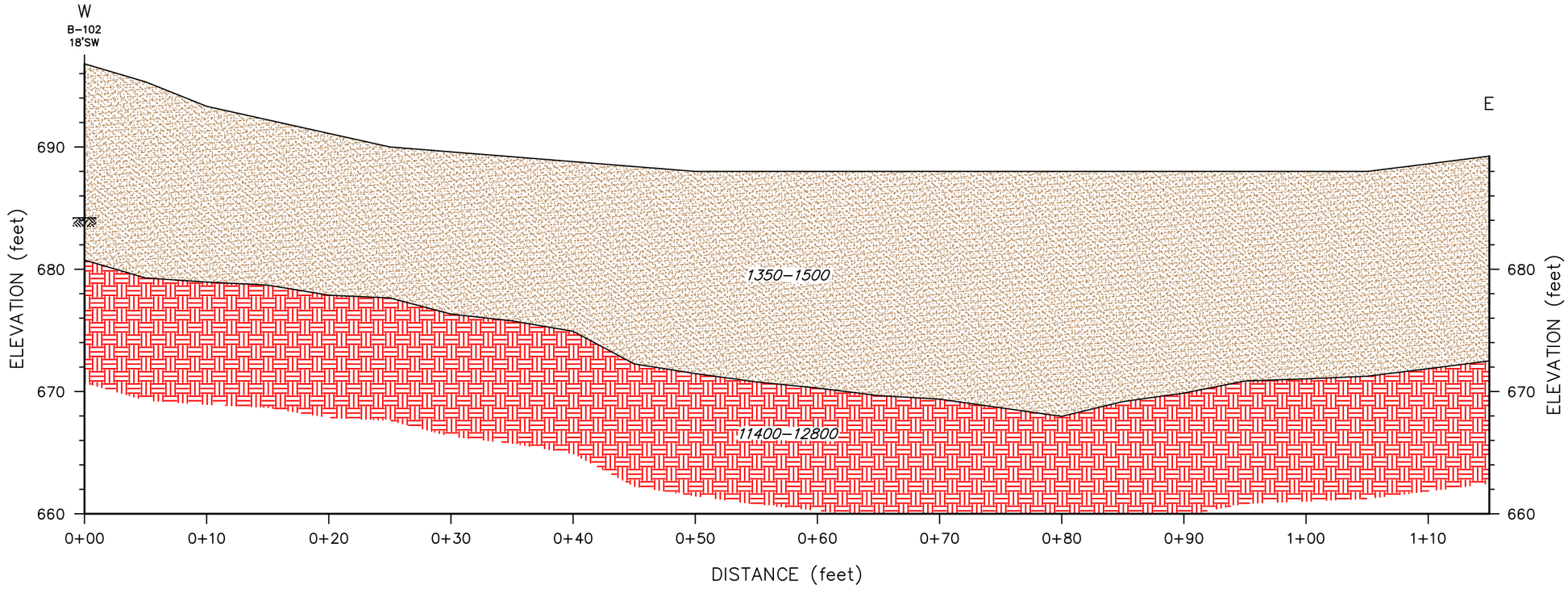
NOTE:

Modified from site plan provided by Haley & Aldrich, Inc., identified as x19j222og.dwg.

Figure 2
Seismic Line Locations
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER
Atkinson, NH | Fords, NJ



NOTES:

1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations estimated from digital elevation model derived from file "Elevation_DEMHE0p7M2014_evt1666", downloaded from the Vermont Center for Geographic Information and are relative to the NAVD 1988 datum.
4. Data were analyzed using the Generalized Reciprocal Method.

LEGEND

Unsaturated soils

Bedrock

11400–12800 Velocity (fps)

Interface determined from seismic refraction data

B–102
18'SW

Boring with identification, distance and direction from traverse, and depth of bedrock based on logs provided by Haley & Aldrich, Inc.

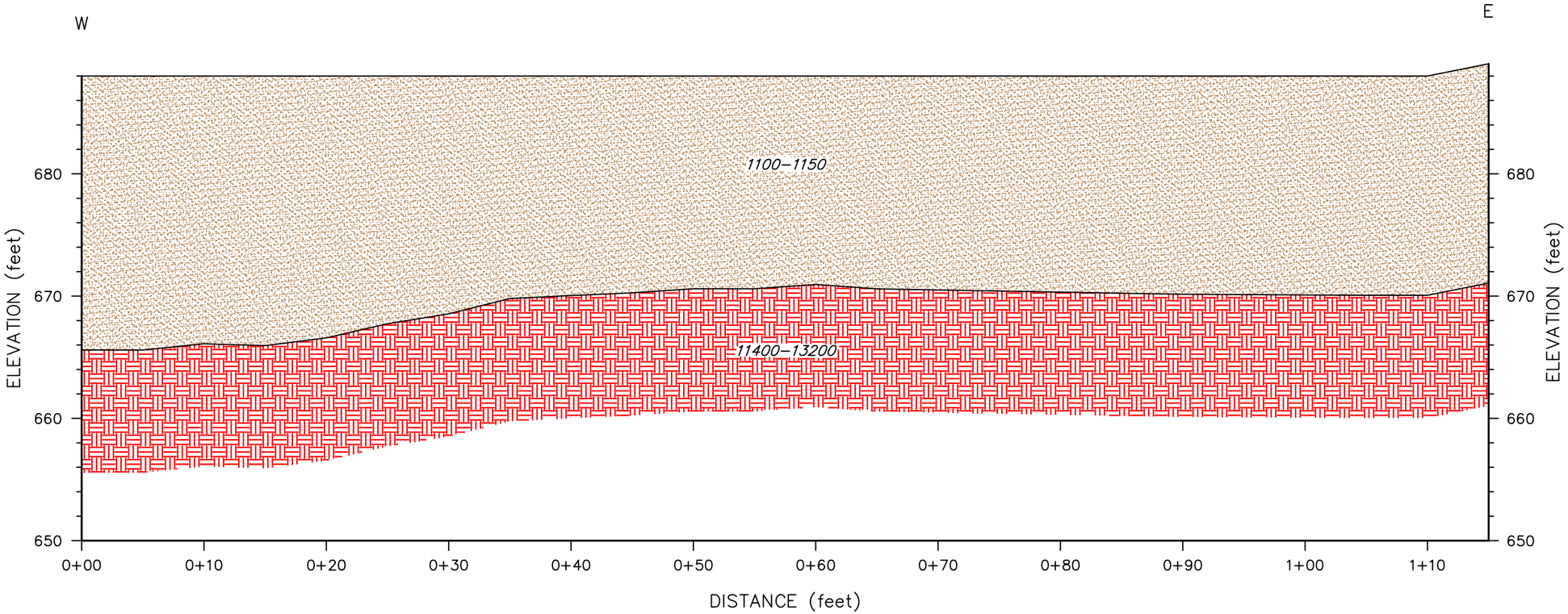
SCALE (feet)

0 10 20

Figure 3
Seismic Line 1
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER
Atkinson, NH | Fords, NJ



NOTES:

1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations estimated from digital elevation model derived from file "Elevation_DEMHE0p7M2014_evt1666", downloaded from the Vermont Center for Geographic Information and are relative to the NAVD 1988 datum.
4. Data were analyzed using the Generalized Reciprocal Method.

LEGEND

- Unsaturated soils
- Bedrock
- *11400–12800* Velocity (fps)
- Interface determined from seismic refraction data
- B–102 18'SW — Boring with identification, distance and direction from traverse, and depth of bedrock based on logs provided by Haley & Aldrich, Inc.

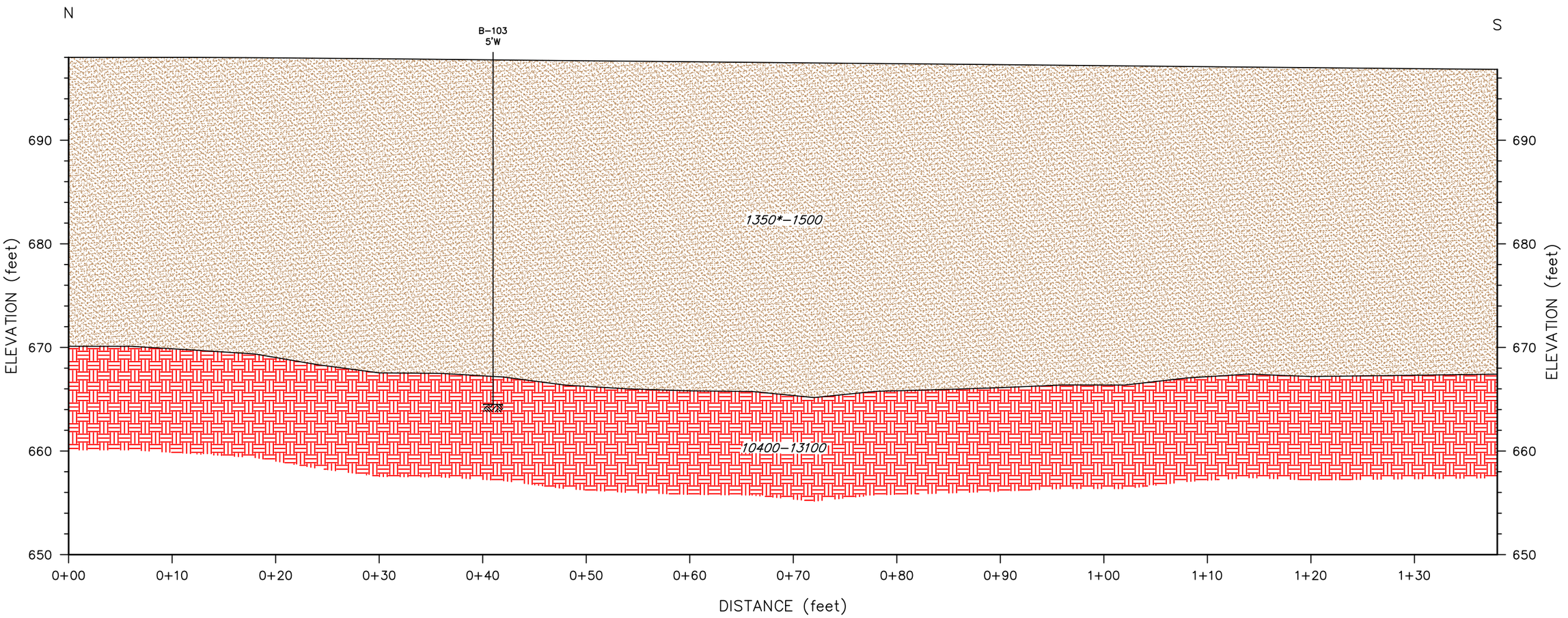
SCALE (feet)

0 10 20

Figure 4
Seismic Line 2
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER
Atkinson, NH | Fords, NJ



NOTES:

1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations estimated from digital elevation model derived from file "Elevation_DEMHE0p7M2014_evt1666", downloaded from the Vermont Center for Geographic Information and are relative to the NAVD 1988 datum.
4. Data were analyzed using the Generalized Reciprocal Method.

LEGEND

Unsaturated soils

Bedrock

11400–12800 Velocity (fps)

Interface determined from seismic refraction data

B–102
18'SW

Boring with identification, distance and direction from traverse, and depth of bedrock based on logs provided by Haley & Aldrich, Inc.

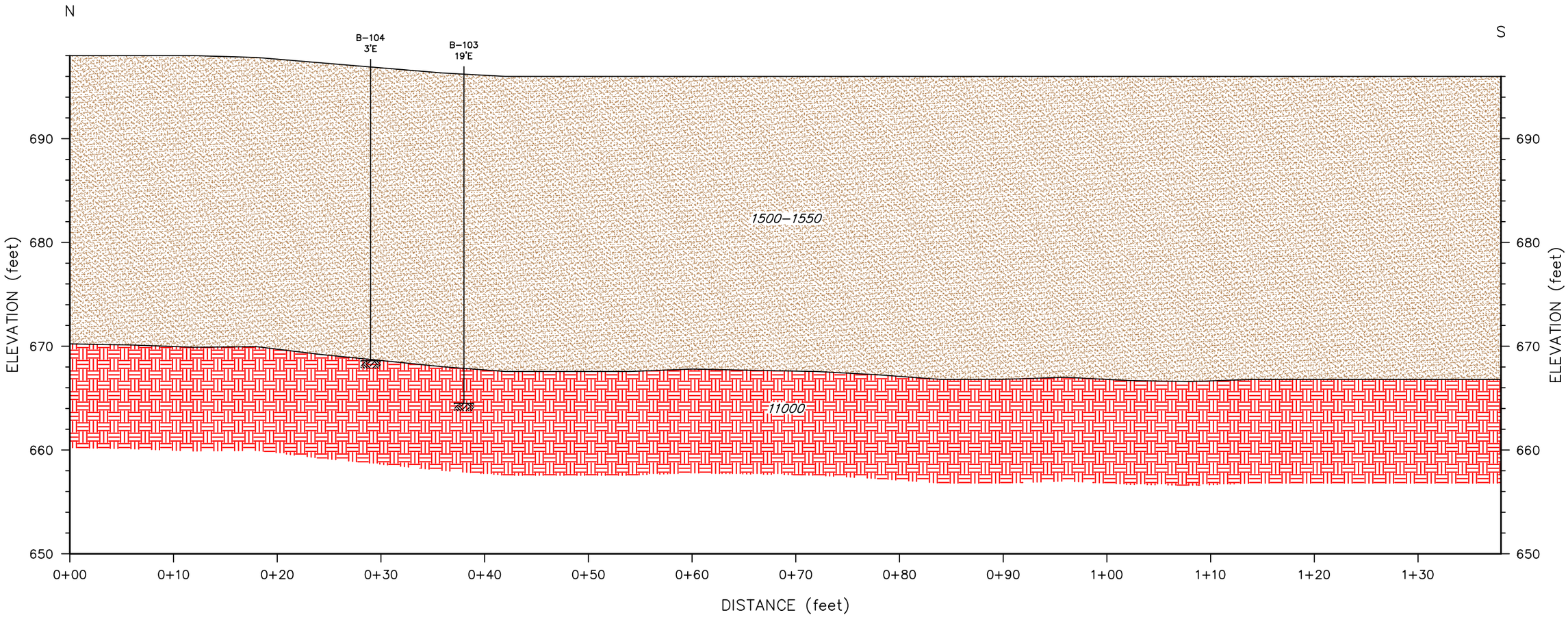
SCALE (feet)

0 10 20

Figure 5
Seismic Line 3
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER
Atkinson, NH | Fords, NJ



NOTES:

1. Estimated accuracy (standard deviation) of depth of bedrock is ±10% or 2 feet, whichever is greater.
2. The depths determined for bedrock are depths of competent rock; weathered and/or fractured bedrock might occur at shallower depths.
3. Surface elevations estimated from digital elevation model derived from file "Elevation_DEMHE0p7M2014_evt1666", downloaded from the Vermont Center for Geographic Information and are relative to the NAVD 1988 datum.
4. Data were analyzed using the Generalized Reciprocal Method.

LEGEND

- Unsaturated soils
- Bedrock
- *11400–12800* Velocity (fps)
- Interface determined from seismic refraction data
- B–102 18'SW — Boring with identification, distance and direction from traverse, and depth of bedrock based on logs provided by Haley & Aldrich, Inc.

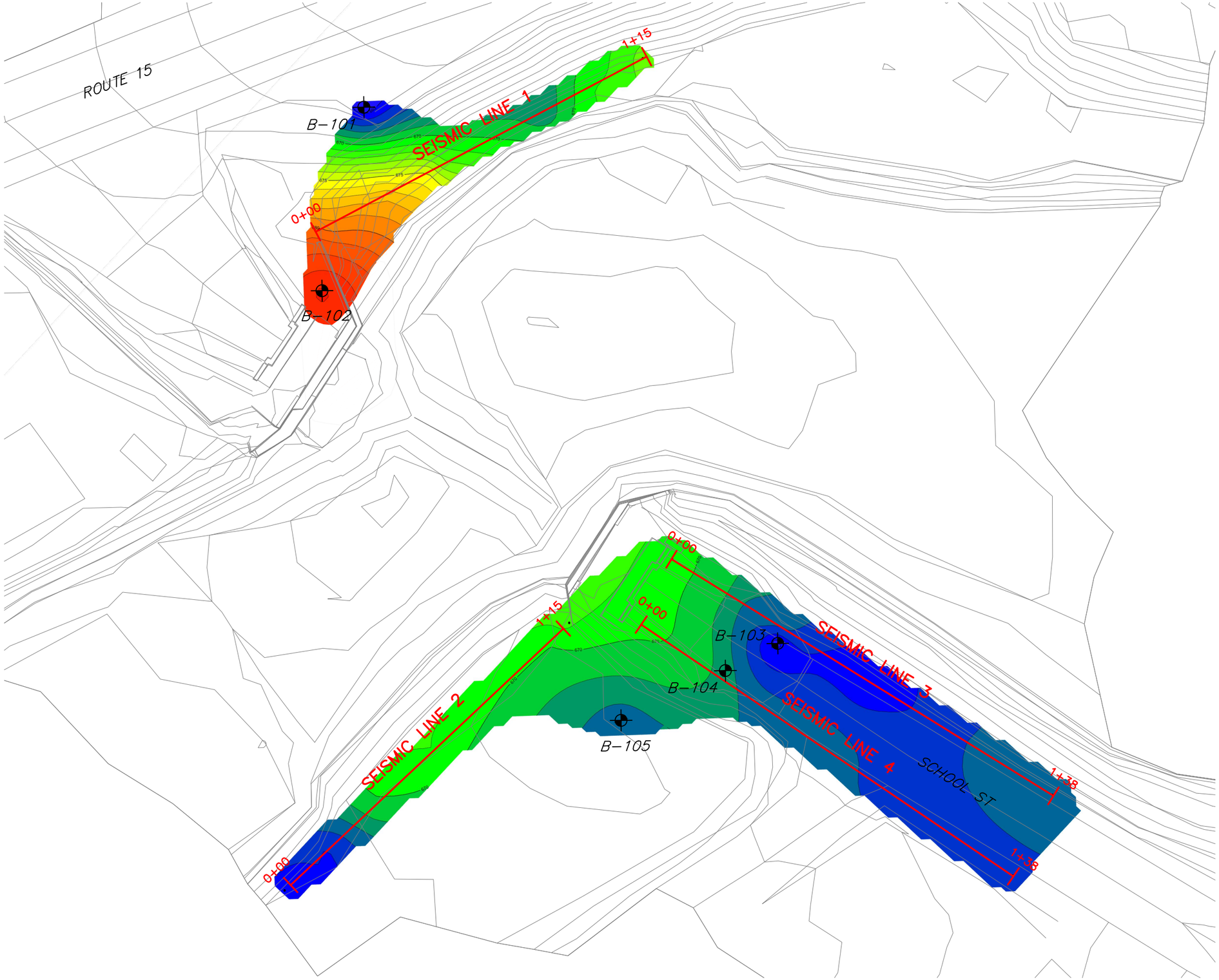
SCALE (feet)

0 10 20

Figure 6
Seismic Line 4
School Street Bridge
Wolcott, Vermont

File 23VD36 | November, 2023

HAGER–RICHTER
Atkinson, NH | Fords, NJ



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Bedrock Elevation (Feet)

N

LEGEND

SEISMIC LINE

BORING

SCALE (feet)

0 30 60

NOTES:

1. Modified from site plan provided by Haley & Aldrich, Inc., identified as x19j222og.dwg.
2. Contour Interval = 1 Foot.
3. Bedrock elevation shown on this plot is a non–unique model. The contours represent interpolations based on seismic refraction data. The elevations of the bedrock surface at any particular location may differ from that shown. Bedrock elevation based on additional data may differ significantly.

Figure 7
Bedrock Elevation
School Street Bridge
Wolcott, Vermont

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