Engineering Report

Rochester ER STP 0162(19)

Culvert No. 13 – VT 73 over Brandon Brook

Culvert Improvement Project – Rochester, VT

Prepared for: Vermont Agency of Transportation
Prepared by: Vanasse Hangen Brustlin, Inc.
Date: June 1, 2012

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Executive Summary

The purpose of this Engineering Report is to evaluate the replacement alternatives for the large culvert conveying the Brandon Brook under VT 73 (Culvert No. 13) in Rochester, Vermont. This report summarizes the study and provides a discussion of the existing conditions, replacement alternatives, and recommendations.

A temporary culvert was installed as an emergency repair in response to the destruction of the previous culvert during Tropical Storm Irene in August 2011. This structure was not intended as a permanent solution. The existing temporary culvert is hydraulically undersized and could be compromised in another large storm event. In addition, there is an agreement with the Agency of Natural Resources (ANR) that the temporary structure would be replaced with a permanent structure which would allow appropriate aquatic organism passage (AOP).

The feasible alternatives studied are:

A. Do Nothing
B. Precast Concrete Arch
C. Precast Prestressed Concrete Solid Slabs
D. Bridge-in-a-Backpack

Alternative B is the recommended alternative primarily because it provides the best fit to the site geometry which has steep slopes on the east side of the inlet and the west side of the outlet. Additionally, it is the lowest projected construction cost and the simplest method of construction for a structure with a steep channel gradient and large skew.

Only minor environmental impacts are anticipated as a result of this project. Acquisition of Right-Of-Way and/or permanent and temporary easements are not expected as discussed in this report.

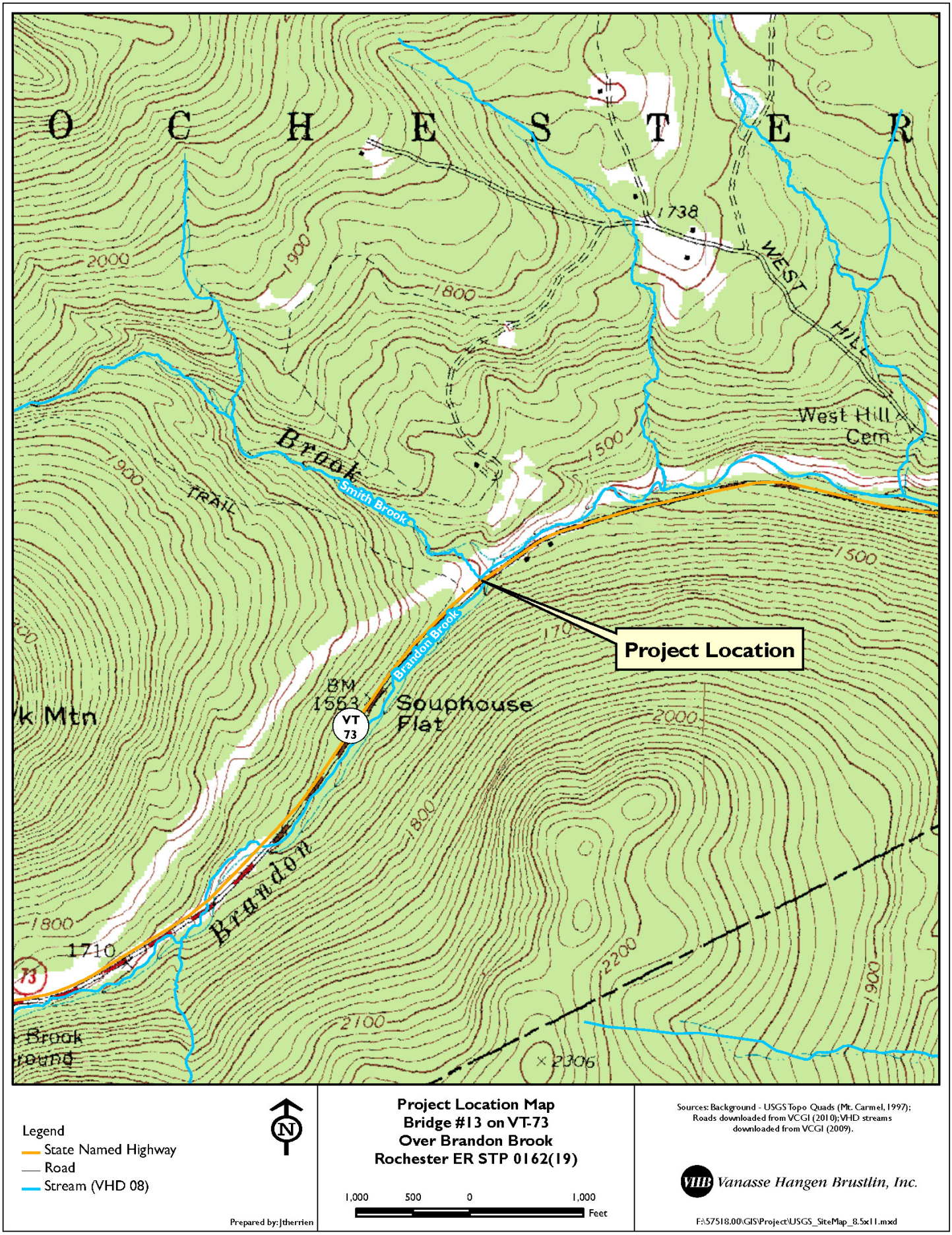
Project Overview

Project Background

The project is located in the Town of Rochester, Vermont on VT 73 at its intersection with Brandon Brook. The project is located in a generally undeveloped area, surrounded by the Green Mountain National Forest. There are two dwellings adjacent to VT 73 east of the existing culvert. The brook flows in a northeasterly direction under VT 73 through Culvert No. 13 where it converges with Smith Brook and continues easterly parallel with VT 73 crossing the roadway a few more times before flowing into the West Branch of the White River.

Culvert No. 13 was completely destroyed during Tropical Storm Irene in August 2011. In order to reopen VT 73 a temporary one lane bridge was used prior to the reconstruction of the current culvert. The current 10-foot diameter 134-foot long corrugated metal pipe culvert was constructed later in the fall of 2011 to provide a safer two lane crossing over Brandon Brook.

While the condition of the existing culvert is not a justification for its replacement, Culvert No. 13 requires replacement due to its inadequate hydraulic capacity and to be in concurrence with the agreement with the Vermont Agency of Natural Resources (ANR) to provide appropriate Aquatic Organism Passage (AOP). Site photos of the temporary culvert, roadway, and channel are included in Appendix A.


O C H E S T E R
1738
WEST HILL
West Hill Cem
1500
1900
TRAIL
Brook
Smith Brook
Project Location
Brandon Brook
BM 1553
Souphouse Flat
VT 73
2000
1800
1710
Brandon
2100
2200
2306
Legend
State Named Highway
Road
Stream (VHD 08)
N
Project Location Map
Bridge #13 on VT-73
Over Brandon Brook
Rochester ER STP 0162(19)
1,000 500 0 1,000
Feet
Prepared by: Jtherrien
Sources: Background - USGS Topo Quads (Mt. Carmel, 1997); Roads downloaded from VCGI (2010); VHD streams downloaded from VCGI (2009).
Vanasse Hangen Brustlin, Inc.
F:\57518.00\GIS\Project\USGS_SiteMap_8.5x11.mxd

Brandon Brook

Brandon Brook is a steep mountainous stream that flows generally west to east and intersects the West Branch of the White River several miles east of the project site. The stream has a drainage area of approximately 3.0 square miles and an average gradient of 11% from its divide. The streambed is made up of boulders and cobbles. The stream turns to the northeast immediately upstream of the culvert due to ledge outcroppings on the eastern bank. Smith Brook converges with Brandon Brook approximately 200 feet downstream of the culvert.

VT 73 Culvert No. 13

VT 73 is a two lane, west to east state highway starting to the west in Orwell at the intersection with VT 22A and ending to the east in Rochester at the intersection with VT 100. A majority of the road is maintained by the State, including the project area. The roadway through the immediate project area is a rural major collector and is on a downhill gradient from west to east. The posted speed limit is 50 miles per hour, and the estimated 2014 AADT is 750 vehicles per day. The existing structure is an emergency repair installed after the loss of the previous culvert during Tropical Storm Irene.

The temporary culvert is in good condition with a dry laid stone headwall at its inlet. Stone rip rap is located to the west of the dry laid stone along the south side of VT 73 prior to the culvert. Stone riprap has been placed on both sides of the outlet to repair the erosion caused by Tropical Storm Irene. There is a stone lined ditch along the northwest side of VT 73 which drains into Brandon Brook at the culvert outlet. Beyond the culvert the north side slopes of VT 73 extend down to Brandon Brook at a 1.5H:1V slope and are stabilized with stone fill. The south side of VT 73 is forested and extends upward with visible ledge outcroppings along the south side of VT 73. There are no overhead utility lines along VT 73 within the project area.

Right-of-Way

The State Right-of-Way on VT 73 is approximately seven (7) rods at the start of the project west of Culvert No. 13. The State ROW transitions from seven (7) rods at the culvert to three rods approximately 500 feet east of the culvert at the end of the project. There are no right-of-way easements or takings required for this project.

Environmental Resources

Resource mapping based on available GIS databases and wetland and stream delineation was performed by VHB. A Natural Resources Identification

Memorandum, dated March 5, 2012, was prepared to summarize this information (Appendix B). The following summarizes the resource assessment to date:

- There are no mapped or field sightings of wetland features, necessary wildlife habitat, significant natural communities, rare, threatened, endangered species, or prime agricultural soils.
- VHB recommends coordination with the Vermont River Management Engineer (Patrick Ross) to determine whether this project is exempt from further Title 19 review or Stream Obstruction review.
- The project will likely qualify for a Section 404 General Permit under category 1, if certain conditions can be met.
- If a Section 404 permit is required, then a Section 401 Water Quality Certification from VT DEC would be required.

Cultural Resources

Historic resources in the project investigation area were investigated by (1) recording results of a Vermont Division for Historic Preservation site file search for previously recorded above-ground historic properties, and (2) field observations on February 16, 2012 to determine potential effects to historic properties. The results of investigations are summarized in a memo dated March 1, 2012 (Appendix C). The following summarizes the resource assessment to date:

- There are no previously recorded or listed properties in the vicinity of the project area. The field visit identified one property adjacent to the project area, but it is not eligible for the National Register due to its recent date of construction.
- The proposed project will not have any adverse effect to any historic properties listed in, or potentially eligible for, listing in the National Register.

Hydraulic Study

The VTrans Hydraulics Unit conducted a preliminary hydraulic study for this project site in 2005. A follow up memo was prepared on September 29, 2011 (Appendix D). The study indicates a drainage area of approximately 3.0 square miles of forested, hilly to mountainous vegetation. A Q50 flowrate of 725 cfs was determined as the appropriate State Highway Design Flow for VT 73, and a Q100 flowrate of 850 cfs was determined as the appropriate check flow for VT 73. These were calculated in 2005. VHB reviewed the VTrans Hydraulic Unit's preliminary hydrology and existing condition analysis and is in the process of developing preliminary hydraulics to determine the required hydraulic opening.

VHB's preliminary recommendation for replacement structures from a hydraulics perspective are as follows:

- A precast concrete arch with a 20.0′ clear span perpendicular to the stream with an 8′-6″ rise from the stream bed.

- A bridge with a 20.0′ clear span perpendicular to the stream with a minimum clear height of 8.5′ from the streambed.

Geotechnical Investigation

VTrans performed subsurface investigations and prepared a Subsurface Investigation Memo submitted on May 1, 2012 (Appendix E). The purpose of the geotechnical investigations was to determine the existing soil conditions and verify the depth of ledge at the culvert location. As part of the subsurface investigation four (4) borings were completed.

The subsurface investigations revealed that ledge was approximately 20.0 to 15.0 feet below existing grade and the recommended substructure should be a spread footing bearing on competent bedrock.

Alternatives Analysis

Alternative Identification

This section of the report provides a discussion of alternatives which have been identified for this project, involving a combination of structure types and methods of construction.

Following are the most critical considerations in development and evaluation of the project alternatives (not in order of priority):

- Length of Roadway Closure (rapid bridge construction methods)
- Best fit for existing topography
- Construction costs
- Future maintenance costs
- Environmental impacts
- ROW impacts

Alternative A: Do Nothing

The "Do Nothing" alternative would require the temporary culvert to remain permanently. Although this is not a viable alternative, it is included in our study. The Do Nothing alternative would result in the stream overtopping the roadway during a Q25 storm event and could result in the failure of the culvert during a larger storm event. Additionally, the Do Nothing alternative does not meet the need to provide AOP as agreed upon between VTrans and ANR. The Do Nothing alternative does not meet the project need.

Alternative B: Precast Concrete Arch

Construction of a precast concrete arch structure using an open cut excavation is generally the simplest and most cost effective solution for this type of project. While a precast concrete arch allows for rapid bridge construction since most sections are available as precast units the 56˚ skew of the existing culvert causes the precast concrete arch to be 120'-0" long. Due to the steep gradient of the stream it will be necessary to support the precast concrete arch on concrete pedestals instead of being

supported directly on a footing. The top of the pedestal wall will be sloped 5% to minimize the distance between the streambed and the underside of the precast concrete arch. Gabion walls or large rip rap will be used to minimize the length of the northeast wingwall.

Advantages of Alternative B

- Rapid construction
- Simplest method of construction
- Lowest construction cost
- Low future maintenance costs

Disadvantages of Alternative B

- Requires build out for phased construction with one-way alternating traffic due to large skew
- Large area of earth disturbance

Alternative C: Prestressed Precast Concrete Slab Bridge

The precast prestressed concrete slab bridge is another alternative that provides ease of construction. The construction of this bridge would also require an open cut excavation. Due to the steep gradient of the stream the abutments and wingwwalls on the north side of the bridge would be approximately 18′ to 20′ tall. The northwest wingwall would also be approximately 50′ to 60′ long to accommodate the steep existing grade. Gabion walls or large rip rap will be used to minimize the length of the northeast wingwall.

Advantages of Alternative C

- Moderate ease of construction
- Allows for on-line phased construction with one-way alternating traffic
- Low future maintenance costs

Disadvantages of Alternative C

- Taller abutments and wingwalls
- Higher projected construction cost
- Complex temporary earth retaining structures during construction for traffic control

Alternative D: Bridge-in-a-Backpack

The bridge-in-a-Backpack is a proprietary product produced by Advanced Infrastructure Technologies that uses Fiber Reinforced Polymer (FRP) composite tubes filled with concrete and HDPE corrugated deck spanning between the tubes to produce an arch bridge. The construction of this bridge would also require an open

cut excavation. Due to the steep gradient of the stream it will be necessary to support the Bridge-in-a-Backpack on concrete pedestals instead of being supported directly on a footing. Gabion walls or large rip rap will be used to minimize the length of the northeast wingwall.

Advantages of Alternative D

- Rapid Construction
- Low future maintenance costs

Disadvantages of Alternative D

- Complex geometry and site constrains that challenge the viability of this type of structure
- Not a familiar type of construction for area contractors
- Requires build out for phased construction with one-way alternating traffic due to large skew
- Large area of earth disturbance

Maintenance of Traffic

Due to the topography of the site an offline temporary bridge is not a viable option. In order to maintain one-way alternating traffic, phased construction is preferred. However, utilizing phased construction will increase the project cost, extend the construction duration, and will decrease safety for the traveling public and the contractor. Additionally, the cost for temporarily supporting the excavation will be increased due to the shallow ledge. Therefore a short closure period of two weeks with a detour using accelerated bridge construction would be the preferred method of maintaining traffic during construction. There are no local detours, therefore the detour would require traffic to continue north on VT 100 or US 7 and head west or east on VT 125. The approximate detour length would be 34 miles. The distance between Rochester and Brandon on VT 73 is 17 miles.

Evaluation Matrix - Rochester VT 73 Bridge No. 13 over Brandon Brook					
Scoping Report		**Alternative A**	**Alternative B**	**Alternative C**	**Alternative D**
		Do Nothing	Precast Concrete Arch	Prestressed/Precast Concrete Slab Bridge	Bridge-in-a-Backpack
Cost	Roadway Improvements	$0.00	$400,000.00	$400,000.00	$400,000.00
	Bridge Improvements	$0.00	$900,000.00	$1,100,000.00	$900,000.00
	Construction Engineering	$0.00	$200,000.00	$200,000.00	$200,000.00
	Right-of-Way Acquisition	$0.00	$0.00	$0.00	$0.00
	Preliminary Engineering	$70,000.00	$70,000.00	$70,000.00	$70,000.00
	SUBTOTAL:	$70,000.00	$1,570,000.00	$1,770,000.00	$1,570,000.00
	TOTAL:	**$70,000.00**	**$1,600,000.00**	**$1,800,000.00**	**$1,600,000.00**
Engineering	Typical Section Roadway	No Change	3-11-11-3	3-11-11-3	3-11-11-3
	Typical Section Bridge	No Change	3-11-11-3	3-11-11-3	3-11-11-3
	Traffic Safety	No Change	No Change	No Change	No Change
	Alignment Change	No Change	No Change	No Change	No Change
	Hydraulic Performance	No Change	Enhancement	Enhancement	Enhancement
	Utility	No Change	No Change	No Change	No Change
Impacts	Agricultural Lands	No	No	No	No
	Archaeological	No	No	No	No
	Historic Structures, Sites and Districts	No	No	No	No
	Hazardous Materials	No	No	No	No
	Floodplain	No	No	No	No
	Fish & Wildlife	No	Enhancement	Enhancement	Enhancement
	Rare, Threatened & Endangered Species	No	No	No	No
	Public Lands	No	No	No	No
	LWCF	No	No	No	No
	Wetlands	No	No	No	No
Local and Regional Issues	Concerns	Not Met	Satisfied	Satisfied	Satisfied
	Community Character	No Change	No Change	No Change	No Change
	Economic Impacts	No Change	Unknown	Unknown	Unknown
	Satisfies Project Need	No	Yes	Yes	Yes
Permits	Act 250 Amendment	No	No	No	No
	401 Water Quality	No	Yes	Yes	Yes
	404 ACOE Permit	No	Yes	Yes	Yes
	Stream Alteration Coordination	No	Yes	Yes	Yes
	Vermont Wetlands Permit	No	No	No	No
	Stormwater Discharge	No	No	No	No
	Lakes and Ponds	No	No	No	No
	Endangered and Threatened Species Taking	No	No	No	No
	Construction Stormwater Discharge	No	No	No	No
	SHPO	No	No	No	No
Other	Land Acquisition	No	No	No	No

Figure 2 – Evaluation Matrix

Recommendations

Alternative B – Precast Concrete Arch with Open Cut Excavation and a two week roadway closure is the recommended alternative, primarily because it provides the lowest construction cost and the simplest method of construction. Further evaluation is required to determine whether Alternative B can be constructed within a lesser timeframe as recently discussed with VTrans.

Appendix

APPENDIX A

PROJECT PHOTOGRAPHS

Looking East on VT 73

Looking West on VT 73

Inlet of Temporary Culvert

Outlet of Temporary Culvert

Upstream of Temporary Culvert

Downstream of Temporary Culvert (Upstream of Confluence with Smith Brook)

Stone Lined Ditch on Northwest side of Temporary Culvert

Outlet of Stone Lined Ditch and Riprap Side Slope at Temporary Culvert Outlet

APPENDIX B

NATURAL RESOURCES IDENTIFICATION MEMORANDUM

VHB MEMORANDUM

NATURAL RESOURCES IDENTIFICATION MEMORANDUM

TO: Jennifer Fitch, Project Manager
Mark A. Colgan, PE, VHB Project Manager
FROM: Joseph L. Burt, VHB Environmental Scientist
Adam R. Crary, PWD, PWS, VHB Senior Wetland Scientist
DATE: DRAFT: March 5, 2012

Project: Rochester ER STP 0162 (19) – VT 73 Bridge No. 13 over Brandon Brook

The attached technical memorandum addresses the following environmental criteria:

1. Wetlands
2. Waters (and Floodways)
3. Significant Natural Communities
4. Necessary Wildlife Habitat
5. Rare, Threatened, and Endangered Species
6. Prime Agricultural Soils

If you have any questions or require additional information, please let me know.

Thanks,

Joseph L. Burt

cc: Project File

NATURAL RESOURCE MEMORANDUM
Rochester ER STP 0162 (19)
Rochester, Vermont

Proposed Bridge Replacement

Town of Rochester Bridge No. 13, Route 73 over the Brandon Brook
Rochester, Vermont

Date: Draft: March 5, 2012
Re: Natural Resources Identification and Regulatory Discussion

INTRODUCTION:
Vanasse Hangen Brustlin, Inc. (VHB) performed natural resource assessments in support of Bridge No. 13 replacement (Project) on Vermont Route 73 in Rochester, Vermont. The location consists of a temporary 10-foot diameter culvert carrying Route 73 over Brandon Brook. The previous culvert was eroded away due to flooding related to Tropical Storm Irene in late August 2011. This technical memorandum describes the applicable Vermont and Federal regulatory programs for the resources investigated, site characteristics, study methods, and resource determinations conducted for the study area. Included in the Attachment are the Wetland and Waters Delineation Map, Watershed Sizes Map, and Wetlands and Streams Photographs.

The study for the Project site included both database review as well as a field investigation, and is intended to include an evaluation of the following resources:

Wetlands (*Vermont Wetland Rules (VWR), U.S. Army Corps of Engineers (USACE) Section 404 of the Clean Water Act (CWA), and Vermont Department of Environmental Conservation (VT DEC) Water Quality Certification pursuant to Section 401 of the CWA*)
Projects are required to comply with the VWR (VT NRB 2010), which regulate impacts to significant wetlands (Class I and Class II wetlands) and their buffers; impacts to Class III wetlands are not regulated by the VWR. All impacts to jurisdictional wetlands are regulated by the USACE under the Section 404 permit program, which also triggers review under Section 401 Water Quality Certification (WQC) from the Vermont Department of Environmental Conservation (VT DEC).

Waters (*Vermont Title 19 Stream Alteration Review, Vermont Stream Obstruction Review, USACE Section 404, Section 10 of the Rivers and Harbors Act, VT DEC Section 401 Water Quality Review, Federal Emergency Management Agency (FEMA) Special Flood Hazard Areas/National Flood Insurance Program (NFIP), and Essential Fish Habitat (EFH)*)
Currently, non-exempt work within a perennial stream often requires a Stream Alteration Permit (SAP) from the VT DEC, which is reviewed under 19 VSA Section 10 (12) (VT DEC 2011). In-stream work may also require stream obstruction review by a Vermont Agency of Natural Resources (ANR) fisheries biologist[1]. The Section 404 regulatory program, administered by the USACE, regulates the placement of fill within jurisdictional waters of the United States; unavoidable impacts resulting from Project activities may require authorization under Sections 404 and/or 401 of the Clean Water Act. Additionally, work in or over designated navigable waters may require approval under Section 10 of the Rivers and Harbors Act[2]. As part of a Permit screening process, USACE will coordinate with National Marine Fisheries Service (NMFS) to determine EFH protective measures.

[1] Stream Obstruction Vermont law (10 V.S.A. § 4607) prohibits the installation of a structure that prevents fish movement, such as a rack, weir or other obstruction, unless an approval has been granted by the Commissioner of Fish and Wildlife.
[2] Section 10 of the Rivers and Harbors Appropriation Act of 1899. (33 U.S.C. 403. Construction of bridges, overhead lines, causeways, dams or dikes generally)

Work within designated FEMA Special Flood Hazard Areas may require approval by VT DEC Rivers Management Program under NFIP regulations (VT ANR 2007).

Significant Natural Communities *(§ 6086(a)(8))*
Should the bridge Project require an Act 250 Permit or Permit Amendment, the Vermont Natural Heritage Information Program (NHIP) can recommend that significant natural communities be deemed Rare and Irreplaceable Natural Areas (RINA) under Act 250 Criterion 8 based on the combination of the natural community rarity and quality ranking. Under Act 250, a project must be shown to have no undue adverse effect on RINA. The presence of rare, threatened, or endangered (RTE) species and these communities may be used by the NHIP to make RINA recommendations. Rare (S1 and S2) natural communities can be considered RINA when quality-ranked as A, B, or C. Uncommon (S3) types require a quality rank of A or B to be considered as RINA. Assemblages of natural communities can also be considered RINA.

Necessary Wildlife Habitat *(§6086(a)(8)(A))*
Should the bridge Project require an Act 250 Permit or Permit Amendment, it must not cause an undue adverse impact on necessary wildlife habitat (NWH). NWH is most often defined as deer wintering areas (DWA), black bear forage habitat (beech mast or wetlands), black bear travel corridors, or in some cases, moose overwintering area.

Rare, Threatened, and Endangered Species (RTE) (*Vermont State Takings Permit, Federal Endangered Species Act (ESA) Section 7 Interagency Cooperation, ESA Section 10 Takings Permit*)
The Project should also not significantly impact or destroy Vermont or Federally listed Endangered or Threatened Species.[3] If impacts to State threatened or endangered species or their critical habitat are unavoidable, a Vermont takings permit will likely be required (VT ANR 2004). If impacts to Federally listed species or their critical habitat are unavoidable, as determined through ESA Section 7 - Interagency Cooperation, a Section 10 Takings Permit may be required (USFWS 2011).

Prime Agricultural Soils *(§ 6086(a)(9)(B))*
Should the bridge Project require an Act 250 Permit or Permit Amendment, the Project must be shown to have no undue adverse effect on any reduction in the agricultural potential of the primary agricultural soils under Act 250 Criterion 9.

SITE DESCRIPTION:
Town of Rochester Bridge No. 13 is part of VT Route 73 and is located in an undeveloped area (72°55'25.028"W, 43°51'4.586"N) with one camp near the Project (see Attachment, page 1, Wetland and Waters Delineation Map). The investigation area is predominately within surrounding Green Mountain National Forest with a transmission line right-of-way to the north of Route 73, approximately parallel with the road. The investigation area is within Windsor County and located in the White River Basin (HUC 8: 01080105). The study concentrated on four acres around the proposed bridge replacement that would likely be needed for replacement construction activities. The Brandon Brook was scoured during the Tropical Storm Irene flooding event, and currently there is a temporary culvert.

[3] Federal-listed species are protected under the U.S. Endangered Species Act and Vermont-listed species are protected under 10 V.S.A. §123.

ASSESSMENT METHODOLOGIES:

Wetlands

VHB Environmental Scientists Chelsea Martin and Joseph Burt identified wetland resources in the field during non-growing season conditions (December 28, 2011) in accordance with applicable methodologies outlined in the USACE regional wetland delineation supplement (USACE 2009). The regional supplement requires the presence of three parameters to establish the occurrence of wetland resources: hydric soils, hydrophytic vegetation, and wetland hydrology. Under normal circumstances, all three parameters must be met for an area to qualify as a wetland. Wetlands are classified in accordance with the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, et al. 1979). Wetlands are also classified using guidance from Section 4 of the VWR (VT NRB 2010). Since the delineation occurred outside the growing season and during frozen ground conditions, surface hydrology and remnant hydrophytic vegetation were relied on when soil profiles could not be examined. When applicable, wetlands are flagged in the field using pink "wetland delineation" survey tape and labeled to include wetland ID and flag number (e.g., VHB-2011-C1-1). Information pertaining to the vegetation, soil type, and hydrologic characteristics were noted in the field.

Waters

VHB Environmental Scientists Chelsea Martin and Joseph Burt conducted the stream and wetland delineation on December 28, 2011. Ordinary High Water (OHW) width and Top of Slope (TOS) was flagged in the field using guidance provided in the USACE "Regulatory Guidance Letter: Subject- Ordinary High Water Identification" (USACE 2005). Streams are also flagged according to the Agency of Natural Resources (ANR) Riparian Buffer Guidance (ANR 2005). Stream TOS is flagged on larger channels using orange survey tape and labeled "TOS" and includes the stream ID and flag number (e.g., VHB 2011-TOS-C1a-1). Stream center-line is flagged for smaller channels, with orange survey tape, and labeled "SC" and includes the stream ID and flag number (e.g. VHB 2011-SC-C2-1). OHW limits in the investigation area are marked with blue flagging tape and labeled by stream ID and flag number (e.g., VHB 2011-OHW-C1a-1). Streamflow regimes are typically preliminarily classified as ephemeral, intermittent, or perennial, and are determined based on qualitative observations of in-stream hydrology indicators at the time of observation, as well as geomorphic characteristics.

VHB located wetland and stream delineation flags in the field using a Trimble® GPS unit capable of sub-meter accuracy. Data were post-processed using Trimble® Pathfinder software for enhanced accuracy. A VHB survey crew also surveyed delineation flags to be used in bridge design planning.

FEMA floodway data were obtained from VCGI (2010) and included on the Wetland and Waters Delineation map (see page 1 of the Attachment). Stream drainage areas were obtained using VT DEC Watershed Sizes Maps (VT DEC 2011) and the U.S. Geological Survey (USGS) website Stream Stats (USGS 2012). The bank full width was calculated by inputting the approximate drainage area into the Vermont Regional Hydraulic Geometry Curve (VT DEC 2006).

EFH locations were reviewed to determine if NMFS has declared the bridge site portion of the White River to be EFH (USACE 2007).

Significant Natural Communities

In order to identify potential occurrences of known significant natural communities, VHB researched the NHIP database for the presence of known Element Occurrences (EOs) of significant natural community types within

and adjacent to the study area. A one-mile radius was used when querying the NHIP database and information specific to each EO identified within the radius was requested and received from NHIP on January 13, 2012.

Necessary Wildlife Habitat
In order to identify the potential occurrence of NWH, VHB reviewed GIS data provided by the Vermont Agency of Natural Resource for the presence of NWH. VHB Wildlife Biologist, Joseph Burt, also field reviewed the study site on December 28, 2011 for evidence of on-site NWH.

Rare, Threatened, and Endangered Species
In order to identify known or potential occurrences of RTE, particularly those that are Federal or Vermont-listed threatened or endangered, VHB researched the NHIP database for the presence of known EOs of RTE within and adjacent to the study area. A one-mile radius was used when querying the NHIP database and information specific to each EO identified within the radius was requested and received from NHIP on January 13, 2012.

Prime Agricultural Soils
VHB researched available data provided by the VCGI for U.S. Geological Survey mapped prime agricultural soils within and adjacent to the study area.

RESULTS:
Wetlands:
No wetland features were identified within the study area.

Waters:
VHB delineated five stream features in and adjacent to the study area and are shown on the Wetland and Waters Delineation Map (Page 1 of the Attachment). Two VHD mapped perennial streams, Brandon Brook and Smith Brook, occur within the investigation area and were delineated using the methodologies described above. Brandon Brook has an OHW range of approximately 21 to 60 feet and Smith Brook has an OHW range of 28 to 65 feet within the investigation area. Brandon Brook is identified as 2011-TOS-C1 and 2011-OHW-C1 and Smith Brook as 2011-TOS-C4 and 2011-OHW-C4. The OHW estimated in the field is based on the new normal circumstances as the original OHW field indicators were removed during the 2011 Tropical Storm Irene flood event (see photos of stream features on pages 3 through 6 of the Attachment). Three intermittent streams were delineated, two of which flow into Brandon Brook upstream of the Project, and one flows into Brandon Brook below the Project.

The investigation area is not located within a FEMA Special Flood Hazard Area (see Wetland and Waters Map, page 1 in the Attachment) and waters are considered Class B water the Vermont Water Quality Standards (VT NRB 2008). According to the Vermont DEC Watershed Sizes Map (page 2 of the Attachment), the drainage areas for the Brandon Brook and Smith Brook are both one to ten square miles (approximately 3.6 square miles for Brandon Brook and approximately 3.0 square miles for Smith Brook as calculated using USGS Stream Stats). The bank full width of Brandon Brook averages approximately 23 feet and the Smith Brook bank full width averages approximately 21 feet.

Brandon Brook and Smith Brook are not considered navigable waters and are not listed as EFH by the NMFS (USACE 2007).

Necessary Wildlife Habitat:
The ANR database review did not identify any mapped NWH within or adjacent to the investigation area. Field investigations corroborated database review results.

Significant Natural Communities:
A query of the NHIP database returned no known EOs of significant natural communities within the Project investigation area or within a one mile search radius. Based on the NHIP database query results it is unlikely there are significant natural communities within the investigation area and therefore further significant natural community field surveys are not warranted.

A review of on-site habitat conditions and vegetative composition determined the project investigation area generally consists of Hemlock - Northern Hardwood Forest (S4- Widespread) and maintained ROW and maintained roadsides (Thompson and Sorenson 2005).

Rare, Threatened, and Endangered Species:
A query of the NHIP database returned no known EOs of State or Federal-listed Threatened or Endangered species within the project investigation area or within a one mile search radius.

Prime Agricultural Soils:
No prime agricultural soils were identified in the database review of NRCS soils mapping.

REGULATORY DISCUSSION:
The following is a brief discussion of the most pertinent regulatory programs that may be applicable to this review and also provides VHB's recommendations to coordinate under the specific program requirements:

Vermont Stream Alteration Permit (Title 19 Review)
Any work within a perennial stream will require Title 19 review for VTrans projects if the project will result in the movement, excavation, or fill involving 10 or more cubic yards within the watercourse. The Brandon Brook watercourse has a drainage area less than 10 square miles therefore Title 19 review following the requirements of a Stream Alteration General Permit may be required. The bridge replacement may be considered exempt or a Non-Reporting Activity under Vermont Stream Alteration General Permit requirements under Title 19 review if the Project can meet the following guidelines:

- Scour protection or erosion treatments do not reduce the channel cross section dimensions and cross sectional area; and
- There is no channel realignment; and
- There is no roadway realignment ; and
- The repaired or replacement structure provides a span length 1.2X bank full width or greater at the streambed elevation; and
- The repaired or replacement structure provides a Q25 headwater depth + one (1) foot that is no higher than the elevation of the lowest superstructure element; and
- Any temporary structure for traffic maintenance during construction provides a span length 1.0X bank full width or greater.

VHB recommends initial coordination with the Vermont River Management Engineer (Patrick Ross) to determine if the Project is exempt from further Title 19 review or Stream Obstruction review (VT DEC 2011).

Section 404 of the Clean Water Act
The USACE regulates the placement of fill material into U.S. Waterways and their tributaries under Section 404 of the Clean Water Act. As a waterway crossing activity under Appendix A.I (c), the project will likely qualify for a General Permit under Category 1, if certain conditions can be met. If the conditions of Category 1 cannot be met, the Project may be considered for a Category 2 General Permit or Individual Permit (USACE 2007).

Section 401 of the Clean Water Act
If the Project requires a Section 404 permit for impacts to jurisdictional waters of the United States, then a Section 401 Water Quality Certification from the VT DEC would be required. If a Department of Army Vermont General Permit is necessary, then a General 401 Water Quality Certification would be required, and if a USACE Individual Permit is necessary, then an Individual 401 Water Quality Certification would be required.

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ATTACHMENT:

- Wetland and Waters Delineation Map
- Watershed Sizes Map
- Wetlands and Streams Photographs

ATTACHMENT

Rochester, ER BRF 0162 (19)
Wetlands and Waters Delineation
Rochester, Vermont
VT73 over Brandon Brook Bridge 13

DRAFT: February 17, 2012

200 100 0 200 Feet

Smith Brook

Brandon Brook

2011-TOS-C1

2011-TOS-C4

2011-SC-C3

2011-SC-C2

2011-SC-C5

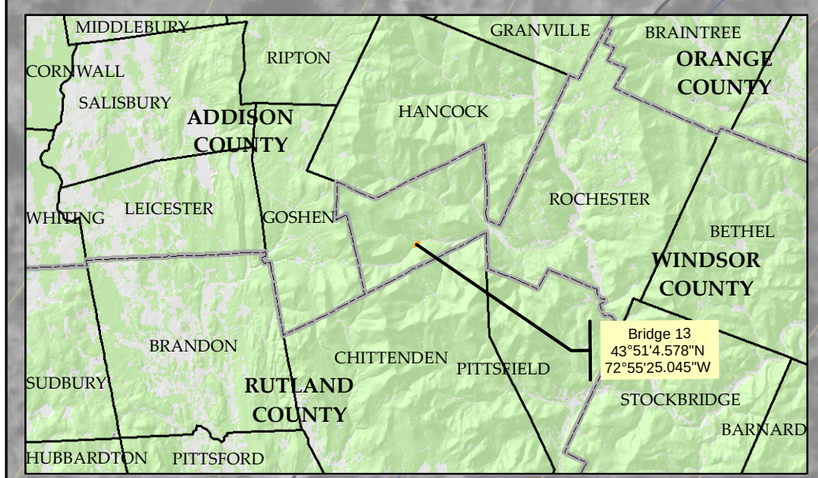
VT 73

TOWN OF ROCHESTER

WINDSOR COUNTY

1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950

VHB Investigation Area
Bridge 13
(4 acres)



Legend

- VHB Investigation Area
- VHB Streams
- Type
- Intermittent (Stream Center)
- Perennial (Top-of-Slope)
- VHB Ordinary High Water (2011)
- RTE Species/ Communities (NHIP)
- VSWI Wetland
- Hydric Soils
- Prime Agricultural Soils
- Roads (VTRANS)
- VHD Streams (08)
- Waterbody
- 100 Year Floodzone (FEMA)
- 50' Contour
- County Boundary
- Town Boundary

N

Vanasse Hangen Brustlin, Inc.

Sources: Aerial Photography provided by USDA NAIP (2009); VHD Streams, Contours, Town and County Boundaries, Soil, Waterbodies and Roads from VCGI (2010); RTE and VSWI Features ANR (2010);Investigation Area and Delineated Streams by VHB (2011)

Prepared by: cmartin

Path: F:\57518.00\GIS\Project\RochesterWetland_fieldmap_Bridge13.mxd

Watershed Sizes Used as Guidance in Stream Alteration Regulations

ROCHESTER

Map Disclaimer

This map represents guidance on watershed sizes using data and methods that have a certain amount of error associated with them. The accuracy of watershed sizing maps using the Vermont Hydrography Data Set and produced with computer automated methods may be exceeded by other methods using more accurate data. The regulated public may request River Management Program (RMP) approval, or the RMP may decide, to use watershed sizes based on more accurate methods and data.

0 0.45 0.9 1.8 2.7 3.6 Miles

Map Description

This map product indicates the reaches of stream and river in a given town that would be at or below the 0.5, 1.0, and 10.0 square mile watershed thresholds used for jurisdictional determinations under the Vermont ANR Stream Alteration Regulatory Program.

RMP contacts and information about the Stream Alteration GP may be obtained at: http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_management.htm

Map Created by, Erik Engstrom. ANR GIS. April 1st, 2011.

LEGEND

Roads
- Principal Arterial
- Minor Arterial
- Urban
- Rural
- Local

Drainage Area
- >10 Square Miles
- 1 - 10 Square Miles
- .5 - 1 Square Mile
- <.5 Square Mile
- Lake/Pond

- VT Town Boundaries
- VT County Boundary

N

NATURAL RESOURCES MEMORANDUM
Rochester ER STP 0162 (19) - Rochester, VT
Bridge No. 13 WETLAND AND STREAM DELINEATION PHOTOGRAPHS
February 16, 2012

Photo 1: View looking at upstream invert of Bridge No. 13 temporary culvert on Brandon Brook. Photograph taken by VHB on 12/29/11

Photo 2: View of Brandon Brook looking northeast from Vermont Route 73 Photograph taken by VHB on 12/28/11

NATURAL RESOURCES MEMORANDUM
Rochester ER STP 0162 (19) - Rochester, VT
Bridge No. 13 WETLAND AND STREAM DELINEATION PHOTOGRAPHS
February 16, 2012

Photo 3: View of 2011-SC-C2 looking south
Photograph taken by VHB on 12/28/11

Photo 4: View of Route 73 and residence looking northeast along Vermont Route 73. Photograph taken by VHB on 12/05/11

NATURAL RESOURCES MEMORANDUM
Rochester ER STP 0162 (19) - Rochester, VT
Bridge No. 13 WETLAND AND STREAM DELINEATION PHOTOGRAPHS
February 16, 2012

Photo 5: View of Brandon Brook and Smith Brook confluence (in background), downstream of Bridge No. 13. Photograph taken by VHB on 12/05/11

Photo 6: View of 2011-SC-C3 on south side of Route 73. Photograph taken by VHB on 02/09/12

NATURAL RESOURCES MEMORANDUM
Rochester ER STP 0162 (19) - Rochester, VT
Bridge No. 13 WETLAND AND STREAM DELINEATION PHOTOGRAPHS
February 16, 2012

Photo 6: View of 2011-SC-C5 from Route 73 looking upstream. Photograph taken by VHB on 02/09/12

Photo 7: View of Smith Brook from the confluence, looking upstream. Photograph taken by VHB on 02/09/12

APPENDIX C

HISTORIC PROPERTIES MEMORANDUM

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

101 Walnut Street
P. O. Box 9151
Watertown, MA 02471-9151
617 924 1770
FAX 617 924 2286

Memorandum

To: Mark Colgan, Director of Transportation Engineering

Date: March 1, 2012

Project No.: 57518.00

From: Nicole Benjamin-Ma, Preservation Planner and Rita Walsh, Senior Preservation Planner

Re: Results of Vermont Division for Historic Preservation (DHP) site file search and field visit, Bridge 13, Rochester, VT

Introduction

This memo serves three purposes: 1) to record the results of a Vermont Division for Historic Preservation (DHP) site file search for previously recorded above-ground historic properties, 2) to report field observations regarding potential effects to historic properties, both previously listed or inventoried or newly identified, within the area of effect for the Bridge 13 replacement project in Rochester, Vermont, and 3) to present our opinion as to whether or not the project will have an effect or adverse effect on any historic properties.

The limit of direct physical work for this project is defined as the area immediately surrounding the current bridge, extending approximately 600 feet north and south of the bridge along Brandon Mountain Road (Route 73). The site file investigation and field inspection extended further out from this direct impact area, to account for historic properties' views to and from the bridge.

The intention of the site file search was to identify properties in the vicinity of the project area listed in the National and State Registers of Historic Places and/ or recorded in the state inventory. During the subsequent field visit, an evaluation was made regarding the potential effects of the bridge replacement on any recorded properties, as well as additional properties that would be considered potentially eligible for listing in the National Register.

It is our opinion that the project will not have an adverse effect to any historic properties listed in, or potentially eligible for listing in, the National Register.

Methods

Site file search

We limited our site file search to a one-half mile radius around the project area, which was anticipated to be a reasonable distance to consider possible visual impacts. The extent of this study radius was modified during the subsequent field investigation to reflect actual field visibility (see field visit methods). The site file search was conducted on February 16, 2012 at the DHP office in Montpelier. Maps accompanying the National Register nomination forms on file were used to identify listed individual property and districts in the vicinity of the project area. Properties listed in the State Register, as well as recorded properties which have not been added to either the State Register or the National Register, were accompanied by a map of the property location.

Field visit

A field visit was conducted on February 16, 2012 to evaluate potential effects of the bridge replacement on previously recorded properties identified during the site file search. An effort was also made during the field visit to identify properties that have the potential to be considered eligible for the National Register, and to evaluate any potential effects to these resources. The only road located in the vicinity of the project area is Brandon Mountain Road (Route 73). Approximately 1600 feet along Brandon Mountain Road (Route 73) was included in the field visit to identify potentially eligible properties; the densely wooded area and curvature of the road impeded views of the bridge beyond this distance.

Results and Recommendations

Site file search

There are no previously recorded properties located within the vicinity of the project area. There are no properties listed in the National Register or State Register located within the vicinity of the project area.

Field investigation

Along Brandon Mountain Road (Route 73), the bridge was visible from approximately 800 feet north and south of the project area. The field investigation located only one property from which the bridge is visible. One late 20th century house, with two associated storage sheds, is located adjacent to the project area on the southeast side of Brandon Mountain Road. Due to its recent date of construction, the property is not eligible for the National Register.

Conclusions

There were no previously recorded or listed properties in the vicinity of the project area. The field visit identified one property adjacent to the project area, but it is not eligible for the National Register due to its recent date of construction.

Our opinion is that the proposed project will not have any adverse effect to any historic properties listed in, or potentially eligible for listing in, the National Register.

Please let me or Rita Walsh know if we can be of any further assistance.

APPENDIX D

PRELIMINARY HYDRAULICS MEMORANDUM

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Tim Fillbach, Structures Project Engineer

FROM: Nick Wark, P.E., Hydraulics Engineer

DATE: September 29, 2011

SUBJECT: Rochester VT73 Br13

We have completed our preliminary hydraulic study for the above referenced site in 2005. Since that time we have tried to better span bank full width of the channel. We offer the following size recommendations as an update to our 2005 study.

- A concrete box with an 18' wide by 9' high inside opening, with 12 inch high bed retention sills (baffles) in the bottom. The box invert should be buried 2', so the top of the baffles will be 12 inches below the channel bottom. That will result in an 18' wide by 7' high waterway opening, or 126-sq. ft. of waterway area. Baffles should be spaced no more than 8'-0" apart throughout the structure with one baffle placed at the inlet and one at the outlet. Sills should be cast in a V shape with a 10:1 lateral slope, to create a low flow channel in the center if the bed material in the structure is washed out. This structure will result in a headwater depth at Q50 = 6.2' and at Q100 = 7.0'.

- A bridge with an 18' minimum clear span between abutments, measured perpendicular to the abutments. The bridge should have a clear height of at least 7.5' from the average stream bed to the bottom of the deck, and should have a minimum waterway opening of 135 sq. ft. This structure would result in a headwater depth at Q50 = 6.2' and at Q100 = 7.0'. Thus it would have the required 1' of freeboard at Q50.

For a temporary structure we would recommend an 8' CMP, providing 50.3 sq. ft. of waterway area, as a minimum. A larger structure should be considered if the pipe will be in for longer than one year.

Please contact us if you have any questions or if we may be of further assistance.

NJW

cc: Hydraulics Project File
Hydraulics Chrono File

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Gary Schelley, Maintenance Programs Project Supervisor

FROM: Nick Wark, Civil Engineer III

DATE: December 2, 2005

SUBJECT: Rochester VT 73 Br 13 over Brandon Brook

We have completed our preliminary hydraulic study for the above referenced sites, and offer the following information for your use:

Hydrology

This site has a forested, hilly to mountainous drainage basin. The total contributing drainage area is about 3.0 sq. mi. There is an overall length of 16,750' from the divide to the site, with a 1,800' drop in elevation, giving an average slope of 11%. The slope at the site is approximately 8%. Using several hydrologic methods, we determined the following design flow rates:

Recurrence Interval in Years	Flow Rate in Cubic Feet per Second (CFS)
Q2.33	225
Q10	450
Q25	600
Q50	725 - State Highway Design Flow
Q100	850 - Check flow

Existing Structure

The existing CMPP has a diameter of 10'-6" providing a waterway opening of about 87 sq. ft. Our calculations show this structure to be hydraulically adequate. Headwater to depth ratios are within the state standards. This structure results in headwater depths at Q50 = 10.6' and Q100 = 12.1'.

Recommendations

Repair of the existing structure may be an option at this site based on hydraulics:

- Placing a liner with a diameter of 9' inside the existing structure and a full headwall at the inlet would be hydraulically adequate. That would provide 63 sq. ft. of waterway area and would result in headwater depths at Q50 = 11.1' and Q100 = 13.0'.

- The invert of the pipe could be repaired by placing up to 2' of concrete. This would provide a waterway area of 75 sq. ft. and with a full headwall at the inlet result in headwater depths at Q50 = 10.2' and Q100 = 11.6'.

In sizing a new structure we attempted to select structures that meet the hydraulic standards, fit the natural channel width, the roadway grade and other site conditions. Based on these considerations the following would best fit the site:

- A concrete box with a 16' wide by 9' high inside opening, with 12 inch high bed retention sills in the

bottom. That will result in a 16' wide by 8' high waterway opening, or 128-sq. ft. of waterway area. The box invert should be buried 12 inch, so the top of the sills will be even with the channel bottom. Sills should be spaced no more than 8'-0" apart throughout the structure with one baffle placed at the inlet and one at the outlet. We also recommend that the bed retention sills be cast in a V-shape with a 10:1 lateral slope. This structure will result in a headwater depth at Q50 = 6.8' and at Q100 = 7.5'.

- A bridge with a 16' minimum clear span between abutments, measured perpendicular to the abutments. The bridge should have a clear height of at least 8' from the average stream bed to the bottom of the deck, and should have a minimum waterway opening of 126 sq. ft. This structure would result in a headwater depth at Q50 = 6.8' and at Q100 = 7.5'. Thus it would have the required 1' of freeboard at Q50.

- Other structures with a minimum span of 16' and at least 128 sq. ft. of waterway area that fits the site could be considered.

General Comments

If a new bridge is installed, the bottom of abutment footings should be at least six feet below the channel bottom, or to ledge, to prevent undermining.

If a new box is installed, we recommend it have full headwalls at the inlet and outlet. The headwalls should extend at least four feet below the channel bottom, or to ledge, to act as cutoff walls and prevent undermining.

It is always desirable for any new structure to have flared wingwalls at the inlet and outlet, to smoothly transition flow through the structure, and to protect the structure and roadway approaches from erosion. The wingwalls should match into the channel banks. Any new structure should be properly aligned with the channel.

Stone Fill, Type III should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet, up to a height of at least one-foot above the top of the opening. The stone fill should not constrict the channel or structure opening.

The Agency of Natural Resources (ANR) may have additional concerns regarding replacement of this structure, or any channel work. The Stream Alteration Engineer should be contacted with respect to those concerns.

Please keep in mind that while a site visit was made, these recommendations were made without the benefit of a survey and are based on limited information. The final decision regarding the replacement of this structure should take into consideration matching the natural channel conditions, the roadway grade, environmental concerns, safety, and other requirements of the site.

Please contact us if you have any questions or if we may be of further assistance.

NJW

cc: Patrick Ross, A.N.R. Stream Alterations Engineer
Mike Hedges, VTRANS, Structures Engineer
Hydraulics Project File via MJT
Hydraulics Chrono File

APPENDIX E

SUBSURFACE INVESTIGATION MEMORANDUM

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Jennifer Fitch, Structures Project Manager

From: Callie Ewald, Geotechnical Engineer via Christopher C. Benda, P.E., Soils and Foundations Engineer

Date: May 1st, 2012

Subject: Rochester ER STP 0162(19) – Subsurface Investigation

1.0 INTRODUCTION

We have completed our geological and geotechnical subsurface investigation for the proposed replacement of Bridge 13 located on VT Route 73 in Rochester, Vermont. Currently, a 10 foot diameter culvert carries the Brandon Brook under VT Route 73. Contained herein are the results of field sampling and testing, laboratory analyses of soil and rock samples, as well as a boring location map and boring logs.

2.0 FIELD INVESTIGATION

The field investigation was conducted between March 29th and April 3rd, 2012. Four standard penetration borings were drilled to determine the existing subsurface stratum as well as attain a profile of the shallow bedrock surface. A summary of the location of each boring and corresponding ground surface elevation as well as elevation of bedrock can be found in Table 1. The values for the Northings and Eastings are based on the Vermont State Plane Grid Coordinate System NAD 83, and were located by VHB after drilling operations were complete. A boring location plan created by VHB can be found attached.

Table 1: Boring Locations and Elevations

Boring Number	Easting (ft)	Northing (ft)	Ground Elevation (ft)	Depth to Bedrock (ft)	Bedrock Elevation (ft)
B – 101	1528645.5	492752.7	1500.2	20.0	1480.2
B – 102	1528676.6	492834.7	1491.0	15.0	1476.0
B – 103	1528681.8	492781.2	1497.3	17.0	1480.3
B – 104	1528694.0	492821.5	1495.2	15.0	1480.2

During the boring operations, split spoon samples and standard penetration tests (SPT) were taken continuously to bedrock in all of the borings. When bedrock was encountered, NX rock cores were taken 10 feet into bedrock to collect five foot core sample runs. Cobbles and boulders were encountered in each of the four borings. The notation 'NXDC' found on the boring logs signifies that the core barrel was used to core ahead through either a boulder or cobble. For each boring, soil samples were visually classified and SPT blow counts were recorded on the boring logs.

3.0 FIELD AND LABORATORY TESTING

The standard penetration resistance of the in-situ soil is determined by the number of blows required to drive a 2 inch OD split barrel sampler into the soil with a 140 pound hammer dropped from a height of 30 inches, in accordance with procedures specified in AASHTO T206. During the standard penetration test (SPT), the sampler is driven for a total length of 2 feet, while counting the blows for each 6 inch increment. The SPT N-value, which is defined as the sum of the number of blows required to drive the sampler through the second and third increments, is commonly used with established correlations to estimate a number of soil parameters, particularly the shear strength and density of cohesionless soils. The N values provided on the boring logs are raw values and have not been corrected for energy, borehole diameter, rod length or overburden pressure. The VT Agency of Transportation has determined a hammer correction value, C_E, to account for the efficiency of the SPT hammer on the drill rig. For this project a CME 45C Track Rig was used, with a hammer energy correction factor of 1.34. This value, included on the boring logs, was used in calculations to determine soil parameters. Laboratory tests were conducted on all samples to evaluate grain size, moisture content, and percent finer than No. 200 sieve. This testing was conducted on all of the soil samples and results can be found on the attached boring logs.

A detailed description of the rock cores is presented on the logs in addition to Recovery and Rock Quality Designation (RQD). The percent recovery is defined as the length of core obtained expressed as a percentage of the total length cored. RQD is the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams, jointing and bedding planes.

4.0 FOUNDATION RECOMMENDATIONS

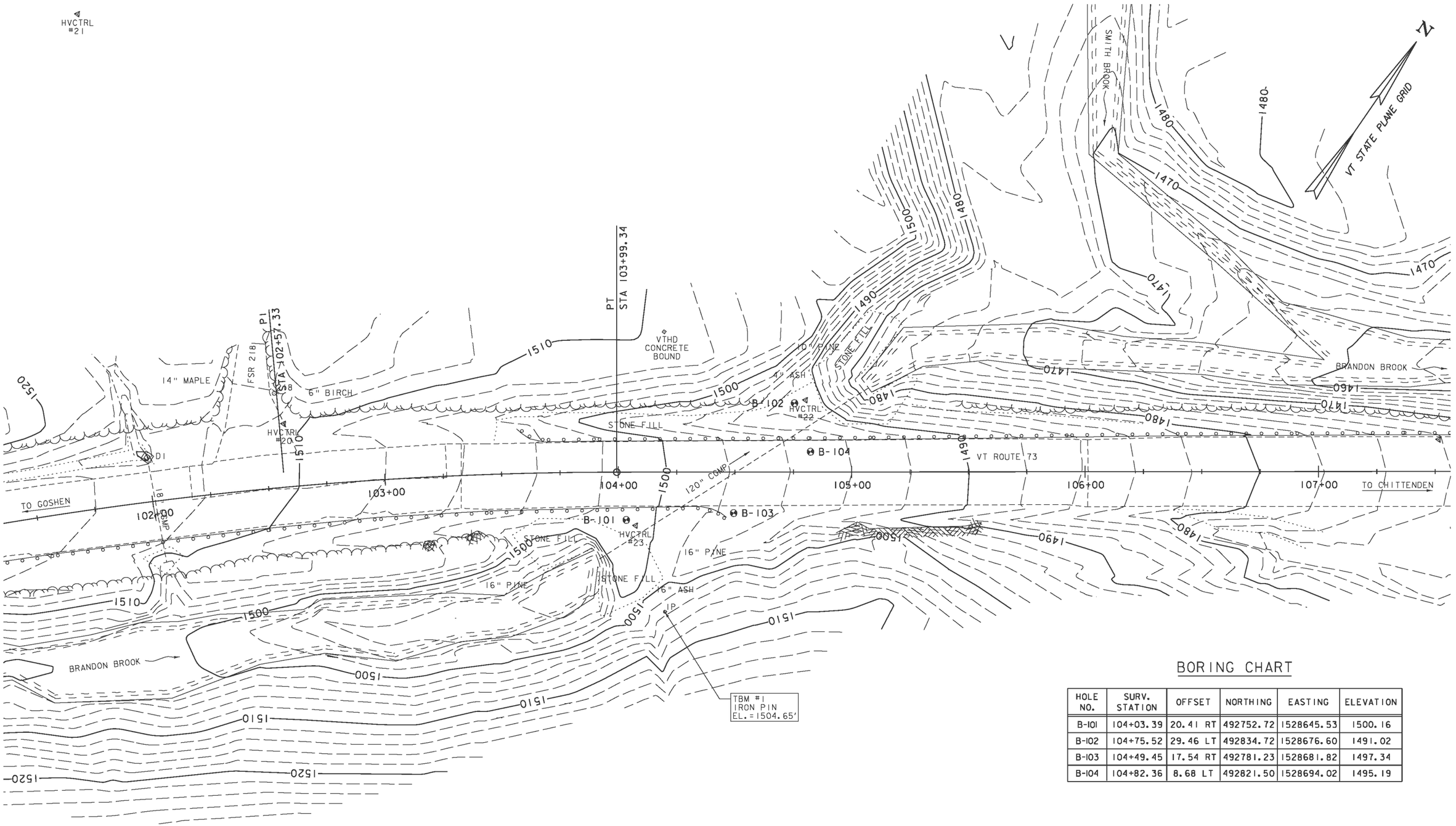
Based on a preliminary look at the subsurface investigation results and the presence of shallow bedrock across the entire footing, we recommend a spread footing bearing on competent bedrock. This assumes an alignment similar to what is currently in place.

5.0 CONCLUSION

Once further information becomes available, we would be happy to assist in the analysis and design of component of the substructure. If you have any questions, or you would like to discuss this report, please contact us at (802) 828-2561. The boring logs are attached as available in the M:Projects\11c334\MaterialsResearch folder.

Enclosures: Boring Location Plan – 1 page
Boring Logs – 4 pages

cc: Electronic Read File/WEA
Project File/CCB
CEE



BORING CHART

HOLE NO.	SURV. STATION	OFFSET	NORTHING	EASTING	ELEVATION
B-101	104+03.39	20.41 RT	492752.72	1528645.53	1500.16
B-102	104+75.52	29.46 LT	492834.72	1528676.60	1491.02
B-103	104+49.45	17.54 RT	492781.23	1528681.82	1497.34
B-104	104+82.36	8.68 LT	492821.50	1528694.02	1495.19

DATUM

VERTICAL NAVD 88

HORIZONTAL NAD 83(2007)

0 20 40

SCALE IN FEET

Vanasse Hangen Brustlin, Inc.

PROJECT NAME: ROCHESTER

PROJECT NUMBER: ER STP 0162(19)

FILE NAME: z11c334bor.dgn

PROJECT LEADER: M.A. COLGAN

DESIGNED BY: S.E. BURBANK

BORING SHEET

PLOT DATE: 4/25/2012

DRAWN BY: J.L. LEMIEUX

CHECKED BY: S.E. BURBANK

SHEET 1 OF 1

VHB 57518

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
ER-STP 0162(19)
VT-73 BR-13

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 11C334
Checked By: CEE

Boring Crew: SALISBURY, GARROW
Date Started: 3/29/12 Date Finished: 3/30/12
VTSPG NAD83: N 492752.70 ft E 1528645.50 ft
Station: 104+03 Offset: 20.50
Ground Elevation: 1500.2 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		NWTD

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-1-b, SaGr, brn, Moist, Rec. = 1.3 ft				2-2-7-7 (9)	7.9	48.0	35.9	16.1
		A-1-a, SaGr, brn, Moist, Rec. = 1.8 ft, NXDC				8-28-35-34 (63)	6.6	51.6	33.6	14.8
5		A-1-b, SaGr, brn, Moist, Rec. = 1.2 ft				9-25-28-26 (53)	9.0	46.9	36.3	16.8
		A-1-a, SaGr, brn, Moist, Rec. = 1.4 ft				15-25-31-26 (56)	9.1	52.1	32.4	15.5
		A-1-a, SaGr, brn, Moist, Rec. = 1.0 ft, NXDC				10-10-12-10 (22)	9.2	53.8	31.6	14.6
10		A-1-a, SaGr, brn, Moist, Rec. = 1.2 ft, NXDC				6-10-14-16 (24)	7.5	55.6	30.3	14.1
		A-1-a, SaGr, brn, Moist, Rec. = 1.0 ft, Lost water return at 14.0 ft. Changed bit.				10-7-6-13 (13)	9.3	67.9	24.1	8.0
15		Field Note:, NXDC, Cobbles								
		A-1-a, SaGr, brn, Moist, Rec. = 0.6 ft, The Gravel = 3 broken stones				5-6-4-R@3.5"	10.7	62.1	31.4	6.5
		Field Note:, NXDC, Cobbles								
20		20.0 ft - 25.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, RMR = 76	1 (30)	98 (98)	3 3 3 3 4	Top of Bedrock @ 20.0 ft				
25		25.0 ft - 30.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Good rock, NXMDC, Slightly weathered along joint surface at 27.25 feet. Remainder of run is unweathered. RMR = 76	2 (30)	100 (100)	3 3 3 3 4					
30		Hole stopped @ 30.0 ft								
35										

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 of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 ROCHESTER ER-STP 0162(19).GPJ VERMONT AOT.GDT 4/26/12

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
ER-STP 0162(19)
VT-73 BR-13

Boring No.: **B-102**
Page No.: 1 of 1
Pin No.: 11C334
Checked By: CEE

Boring Crew: SALISBURY, GARROW
Date Started: 4/03/12 Date Finished: 4/03/12
VTSPG NAD83: N 492834.70 ft E 1528676.60 ft
Station: 104+75 Offset: -29.50
Ground Elevation: 1491.0 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:		Auto/AWJ
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations

Date	Depth (ft)	Notes
		None 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 %
		Field Note:, NXDC, Cobbles								
5		A-1-a, SaGr, brn, Moist, Rec. = 0.4 ft				8-R@2.5"	8.9	53.6	33.5	12.9
		Field Note:, NXDC, Boulders & Cobbles								
10		Field Note:, Drilling break								
		Field Note:, NXDC, Boulders & Cobbles								
		Field Note:, Drilling break								
		Field Note:, NXDC, Boulders & Cobbles, Advanced casing to 15.0. feet.								
		Field Note:, NXDC								
15		15.0 ft - 20.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, Evenly scattered small magnetite throughout run. RMR = 71	1 (50)	98 (94)	5 2 2 2 2	Top of Bedrock @ 15.0 ft				
20		20.0 ft - 25.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, Evenly scattered small magnetite throughout run. RMR = 64	2 (50)	100 (64)	2 2 2 2 2					
25		Hole stopped @ 25.0 ft								
30										
35										

Notes:
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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 of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 ROCHESTER ER-STP 0162(19).GPJ VERMONT AOT.GDT 4/26/12

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
ER-STP 0162(19)
VT-73 BR-13

Boring No.: **B-103**
Page No.: 1 of 1
Pin No.: 11C334
Checked By: CEE

Boring Crew: SALISBURY, GARROW
Date Started: 4/02/12 Date Finished: 4/02/12
VTSPG NAD83: N 492781.20 ft E 1528681.80 ft
Station: 104+49.5 Offset: 17.50
Ground Elevation: 1497.3 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:		Auto/AWJ
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		None 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 %
		Field Note:, 3" minus Fill								
		Field Note:, No Recovery				9-14-9-15 (23)				
5		Field Note:, NXDC, Cobbles, Water return at 6 feet.								
		A-1-b, SaGr, brn, Moist, Rec. = 1.0 ft, Lost water at 10.0 ft.				7-11-10-23 (21)	12.2	45.4	35.2	19.4
10										
		Field Note:, NXDC, Cobbles								
15										
		17.0 ft - 22.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Good rock, NXMDC, Slightly weathered along joint surface at 19.0 feet. Remainder of run is unweathered. RMR = 73	1 (30)	96 (76)	3 4 3 3 3	Top of Bedrock @ 17.0 ft				
20										
		22.0 ft - 27.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, RMR = 76	2 (30)	100 (100)	3 3 3 3 3					
25										
		Hole stopped @ 27.0 ft								
30										
35										

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 of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 ROCHESTER ER-STP 0162(19).GPJ VERMONT AOT.GDT 4/26/12

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH SECTION
SUBSURFACE INFORMATION

BORING LOG

ROCHESTER
ER-STP 0162(19)
VT-73 BR-13

Boring No.: **B-104**
Page No.: 1 of 1
Pin No.: 11C334
Checked By: CEE

Boring Crew: SALISBURY, GARROW
Date Started: 4/03/12 Date Finished: 4/03/12
VTSPG NAD83: N 492821.50 ft E 1528694.00 ft
Station: 104+82 Offset: -8.50
Ground Elevation: 1495.2 ft

	Casing	Sampler
Type:	WB	SS
I.D.:	4 in	1.5 in
Hammer Wt:	N.A.	140 lb.
Hammer Fall:	N.A.	30 in.
Hammer/Rod Type:	Auto/AWJ	
Rig:	CME 45C TRACK	C_F = 1.34

Groundwater Observations		
Date	Depth (ft)	Notes
		None 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 %
		Asphalt Pavement, 0.0 ft - 0.5 ft								
		A-1-a, Gr, white, Moist, Rec. = 1.0 ft				5-11-12-22 (23)	6.2	72.9	19.8	7.3
		A-1-b, SaGr, brn, Moist, Rec. = 0.5 ft, NXDC					7.0	47.5	35.7	16.8
		A-1-a, SaGr, brn, Moist, Rec. = 1.0 ft, NXDC. Broken Rock was within sample.				10-19-11-7 (30)	8.5	61.0	27.6	11.4
5		A-1-b, SaGr, brn, Moist, Rec. = 0.8 ft, NXDC				10-18-R@6.0"	8.7	47.3	36.3	16.4
		A-1-b, SaGr, brn, Moist, Rec. = 1.4 ft, NXDC				18-15-15-15 (30)	8.1	47.6	36.9	15.5
10		A-1-a, SaGr, brn, Moist, Rec. = 1.2 ft, NXDC. Broken Rock (Cobbles) was within sample.				10-12-8-8 (20)	8.8	53.6	31.9	14.5
		A-1-a, SaGr, brn, Moist, Rec. = 0.9 ft, NXDC. Lots of Broken Rock pieces (Cobbles) were within sample.				38-16-26-19 (42)	9.1	61.0	29.6	9.4
		A-1-b, SaGr, brn, Moist, Rec. = 0.7 ft, Lots of Broken Rock pieces (Cobbles) were within sample.				10-R@3.5"	11.7	47.1	39.2	13.7
		Field Note:, NXDC, Cobbles								
15		15.0 ft - 20.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, Evenly scattered small magnetite throughout run. RMR = 68	1 (50)	100 (88)	3 2 2 2 2	Top of Bedrock @ 15.0 ft				
20		20.0 ft - 25.0 ft, Light gray, Quartz-muscovite Schist, with quartzite. Hard, Unweathered, Good rock, NXMDC, Evenly scattered small magnetite throughout run. RMR = 64	2 (50)	96 (62)	5 2 2 2 3					
25		Hole stopped @ 25.0 ft								

Notes:
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3. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 ROCHESTER ER-STP 0162(19).GPJ VERMONT AOT.GDT 4/26/12

APPENDIX F

TRAFFIC DATA

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

POLICY, PLANNING AND INTERMODAL DEVELOPMENT DIVISION

TO: Jennifer Fitch, Structures Project Manager

FROM: Maureen Carr, Traffic Analysis Engineer MC
Colin Philbrook, Traffic Analysis Technician CCP

DATE: December 29, 2011

RE: Rochester ER STP 0162(19)
VT 73, BR #13

As requested in your December 28, 2011 memo, please find complete estimated traffic data on the above project in the town of Rochester. The data for the years 2014, 2034 and 2054 is included in the table below.

If you have any questions, or if further information is needed, please call at x3667.

TRAFFIC DATA	2014	2034	2054
AADT	750	790	~
DHV	150	160	~
ADTT	95	140	~
%T	14.1	19.8	~
%D	59	59	~
FLEXIBLE ESAL	~	**2014~2034** 463,000	**2014~2054** 1,032,000

CC: Chris Cole, Director of Policy, Planning and Intermodal Development
Data Analysis Files

APPENDIX G

PROJECT PURPOSE AND NEED STATEMENT

ROCHESTER

ER STP 0162(19)

VT 73 Bridge No. 13 over Brandon Brook

Project Purpose & Need:

The purpose of the project is to replace the temporary structure with a permanent structure that is hydraulically adequate and will allow for appropriate Aquatic Organism Passage (AOP). The temporary structure was an emergency repair for complete loss of the existing culvert during Tropical Storm Irene and was not intended as a permanent solution.

The need for the project is due to a hydraulically undersized temporary structure and an agreement with the Agency of Natural Resources that the temporary structure would be replaced with a permanent structure which would allow appropriate AOP.

Right of Way

New ROW Acquisition fee simple Yes _____ No ___X___

permanent easement Yes _____ No ___X___

temporary easement Yes _____ No ___X___

Description of taking _____

Public Participation Opportunity

Pre-Design Site Meeting Yes _____ No ___X___ Date _____

Public Information Meeting Yes ___X___ No _____ Date ___5/14/2012___

Public Hearing Required (502) Yes _____ No ___X___ Date _____

Comments by Local Officials/RPC's: none

APPENDIX H

LOCAL CONCERNS MEETING NOTES

Transportation
Land Development
Environmental
Services

Vanasse Hangen Brustlin, Inc.

7056 US Route 7
Post Office Box 120
North Ferrisburgh, VT 05473
Telephone 802.425.7788
Fax 802.425.7799
www.vhb.com

Local Concerns Meeting Notes

Attendees: Joanne McDonnell, Larry Straus, Doon Hinderyckx, Rob Young (VTrans), Mark Colgan (VHB), public audience

Date/ Time: 2/ 13/ 2012
6:30 PM – 7:30 PM

Project No.: 57517.00, 57518.00, 57526.00, 57527.00

Place: Rochester Town Office
67 School Street
Rochester, VT

Re: Rochester VT 73 Four Bridges

Notes taken by: M. Colgan

MEETING PURPOSE:

The purpose of this Local Concerns Meeting was to provide the public and the local and regional officials an opportunity to provide input on their concerns for the projects.
The four projects are as follows:

Rochester ER STP 0162(19) – Bridge 13: VT73 over Brandon Brook
Rochester BRF 0162(16) – Bridge 15: VT73 over Brandon Brook
Rochester BRF 0162(17) – Bridge 16: VT73 over Corporation Brook
Rochester ER BRF 0162(18) – Bridge 19: VT73 over White River

Following are the comments received from the public during the Local Concerns Meeting. VHB responses are in ***bold italics*** following each comment.

COMMENTS:

ROCHESTER ER STP 0162(19) – BRIDGE 13 – No comments

ROCHESTER BRF 0162(16) – BRIDGE 15 –

1. A new alignment behind properties would make more sense.

   This concept will be discussed as part of the alternatives analysis. The current goal is to minimize property impacts for all four projects.

2. Channel constriction is a problem for water and ice. Would we need a longer bridge?

   A longer bridge has been recommended as part of the preliminary hydraulics analysis.

3. The State had a design ten years ago that went behind the church. Will that design be considered with this new project?

   This concept will be discussed as part of the alternatives analysis.

4. The alignment needs to be fixed.

   Options for alignment improvements will be evaluated.

ROCHESTER BRF 0162(17) – BRIDGE 16 – No comments

ROCHESTER ER BRF 0162(18) – BRIDGE 19 –

1. Please don't close the road. Through traffic should be maintained.

   Traffic control options will be evaluated for all four projects that will include both "closure" and "no closure" alternatives.

2. Will property owners receive special consideration for their concerns?

   Individual meetings will be held with those property owners who have parcels with proposed impacts.

3. There is some concern that a longer bridge would impact property more, but agreed that it should be lengthened.

   Longer bridge options would likely move the west abutment further west as existing channel is in line with the east abutment and the proximity of VT 100 restricts lengthening eastward.

4. Concern about the selection of a contractor by the low bid selection. Will the contractor be qualified?

   Vermont has a prequalification process and generally has a strong list of qualified bidders on any typical project. The procurement process requires a low bid selection.

5. Residents were labeled the "Island People" on VT 73 after Tropical Storm Irene.

   We understand many of the local hardships Rochester experienced post-Irene and we were involved in the recovery efforts locally. Efforts will be made to reduce impacts to traveling public where possible, but impacts must occur in order to replace these structures.

6. The turning radius is too tight.

   We will evaluate the truck turning radius on the East approach to the bridge.

7. How would a new bridge be built in the same place?

   There are options for this that include "no closure" and "temporary closure" of VT 73. We will evaluate both on-alignment and off-alignment options.

8. Will the septic system be impacted?

   The septic system impacts will be evaluated as part of the alternatives evaluation process.

9. Will you come back to present alternatives to the town?

   Yes, we will return to present the results of the alternatives analysis.

Rochester ER STP 0162(19)

VHB Vanasse Hangen Brustlin, Inc.