Engineering Report

Rochester BRF 0162(16)

Bridge No. 15 – VT 73 over Brandon Brook

Bridge Improvement Project – Rochester, VT

Prepared for: Vermont Agency of Transportation
Prepared by: Vanasse Hangen Brustlin, Inc.
Date: July 13, 2012

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Executive Summary

The purpose of this Engineering Report is to evaluate the replacement alternatives for the bridge on VT 73 over Brandon Brook (Bridge No. 15) in Rochester, Vermont. This report summarizes the study and provides a discussion of the existing conditions, replacement alternatives, and recommendations.

Bridge No. 15 is in poor condition. There is wide spread efflorescence, deterioration, and spalling present on all parts of the structure. There is a 90˚ curve with a 57 foot radius located immediately west of the bridge. This results in impact damage to the northwest approach rail from vehicles traveling east on VT 73 for failing to properly decelerate prior to the curve or from tractor trailers traveling east on VT 73 which impact the southwest approach rail on the inside of the curve with their trailers as a result of the small turning radius and insufficient bridge width, which does not match the existing roadway width. The bridge does not meet the required roadway width based on the current Average Daily Traffic (ADT) for a rural collector in accordance with the Vermont State Standards. The bridge is also not hydraulically adequate as it constricts the channel width and due to the large amounts of ice traveling downstream during the spring runoff is susceptible to ice jams.

The feasible alternatives studied are:

A. Do Nothing
B. Precast Prestressed Concrete NEXT Beam Bridge
C. Precast Prestressed Concrete Slab Bridge

Alternative B, Precast Prestressed Concrete NEXT Beam Bridge is the recommended alternative primarily because it provides the shortest construction duration and is cost effective. The short construction duration will reduce the impacts to the traveling public.

Only minor environmental impacts are anticipated as a result of this project. Acquisitions of Right-Of-Way are not anticipated for this project. Temporary easements are expected as discussed in this report, and are being addressed expeditiously in order to maintain the project schedule.

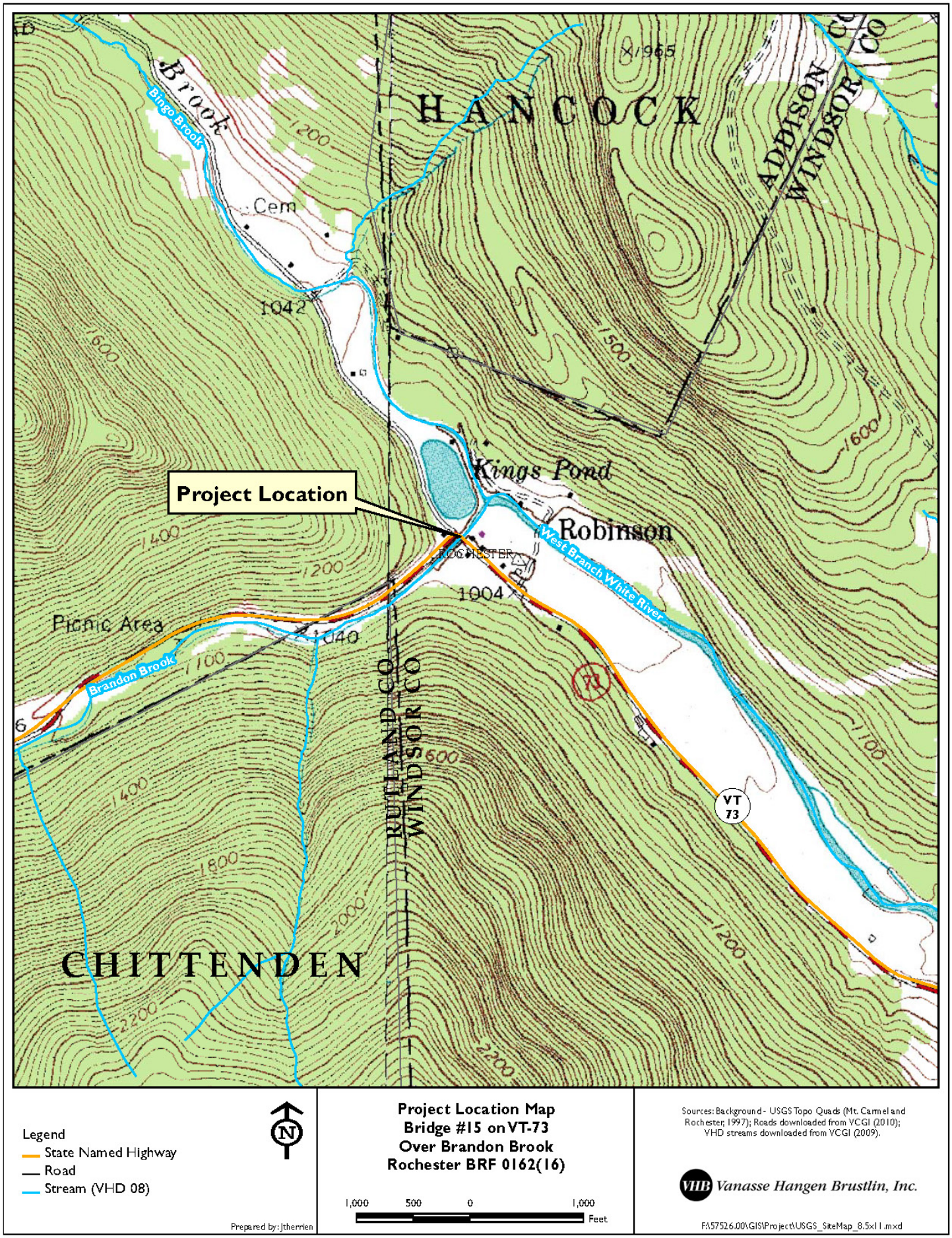
Project Overview

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 rural historic district with houses adjacent to VT 73 on the northeast, southeast, and southwest corners of the bridge. All of the houses in the area of the bridge are historic and the bridge itself is historic. Bingo Road (TH 28) intersects with VT 73 directly west of the bridge. Bingo Road is tangent with the bridge, while VT 73 turns sharply to the west on a 90˚ curve. The brook flows in a northwesterly direction under Bridge No. 15 and continues to flow northwest where it converges with Bingo Brook and forms the West Branch of the White River approximately 430 feet downstream of Bridge No. 15.

The existing bridge is a single span, two lane bridge with a curb to curb distance of 20'-0". The bridge consists of cast-in-place concrete T-beams with a cast-in-place concrete deck and a bituminous concrete wearing surface. The abutments are cast-in-place concrete. The bridge did not sustained direct damage from Tropical Storm Irene; however the storm did cause heavy erosion behind the west abutment and aggradation of the channel. Both issues have since been remediated.

Bridge No. 15 requires replacement due to its deteriorated condition, inadequate hydraulic capacity, and functionally obsolete width. Site photos of the existing bridge, roadway, and channel are included in Appendix A.


Project Location
HANCOCK
CHITTENDEN
Kings Pond
Robinson
ROCHESTER
Bingo Brook
Brandon Brook
West Branch White River
Picnic Area
Cem
1042
1004
1040
RUTLAND CO
WINDSOR CO
ADDISON CO
WINDSOR CO
VT 73
Legend
State Named Highway
Road
Stream (VHD 08)
Project Location Map
Bridge #15 on VT-73
Over Brandon Brook
Rochester BRF 0162(16)
1,000 500 0 1,000
Feet
Prepared by: Jtherrien
Sources: Background - USGS Topo Quads (Mt. Carmel and Rochester, 1997); Roads downloaded from VCGI (2010); VHD streams downloaded from VCGI (2009).
Vanasse Hangen Brustlin, Inc.
F:\57526.00\GIS\Project\USGS_SiteMap_8.5x11.mxd

BRANDON BROOK

Brandon Brook is a steep mountainous stream that originates on the eastern slopes of the Green Mountains in the Town of Rochester. The Brook flows generally west to east and intersects with Bingo Brook to form the West Branch of the White River approximately 430 feet northeast of Bridge No. 15. The Brook has a drainage area of approximately 15.8 square miles and an average gradient of 4% from its divide. The stream gradient is shallower, 2.0% when it crosses VT 73 at Bridge No. 15. The streambed is made up of boulders and cobbles.

VT 73 BRIDGE NO. 15

VT 73 is a two lane, west to east state highway starting to the west in Orwell at the intersection of 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 in a sag vertical curve with the steeper grade immediately west of the bridge and a relatively flat grade east of the bridge. There is a 90˚ curve with a 57 foot radius immediately west of the bridge. The posted speed limit is 50 miles per hour, and the estimated 2014 AADT is 770 vehicles per day (Appendix H).

The existing bridge is a single span, two lane bridge, constructed in 1929. The bridge is 43-feet in length and 20-feet curb to curb. The bridge superstructure consists of cast-in-place concrete T-beams with a cast-in-place concrete deck and a bituminous concrete pavement wearing surface. W-beam guardrail is directly attached to the concrete bridge posts. The bridge superstructure is supported by cast-in-place concrete abutments which are supported on spread footings. The bridge is located within an historic district and is also historic.

The existing superstructure components are noted as being in poor condition with wide-spread areas of map cracking, efflorescence and spalling prevalent on the fascias and underside of the concrete T-beams. Rusted reinforcing is also visible on the bottom of the downstream interior concrete T-beam and rust staining is present along the webs of all of the T-beams. The deck is in poor condition with previous concrete repairs noticeable in the first downstream bay and large areas of spall with exposed reinforcing present in the middle bay. The concrete deterioration; map cracking, efflorescence, and spalling, is also noticeable on the exposed areas of the abutments. The latest bridge inspection report states that the deck geometry is "intolerable, replacement needed" due to the narrow bridge, and on 06/20/2011 it was noted that the "The deck is in need of full replacement…Full depth holes may occur at anytime anywhere before next inspection." The bridge rail does not meet the current design standards as noted in the VTrans Inspection Report (Appendix B). There are overhead utility lines within the project area.

Right-Of-Way

The State Right-of-Way on VT 73 is approximately 1.5 rods left of VT 73 and six (6) rods right of VT 73. While the State ROW remains at 1.5 rods to the left of VT 73 the State ROW on the right side of VT 73 varies throughout the project area. Immediately after the beginning of the project, west of Bridge No. 15 the State ROW turns inwards reducing the State ROW on the right of VT 73 to 4.5 rods for a total State ROW of six (6) rods. The State ROW then transitions from 4.5 rods on the right side of VT 73 back to six (6) rods for a total State ROW of 7.5 rods. The State ROW and VT 73 both turn 90˚ and the State ROW on the right of VT 73 is 1.5 rods for a total State ROW of three (3) rods at the east abutment of the bridge. The State ROW remains at three (3) rods to the end of the project, east of Bridge No. 15. There are no Right-of-Way acquisitions or permanent easements required for this project. However, there will be temporary easements required for the removal of the existing structure, placement of stone fill on the channel banks, and construction of the roadway slopes due to an increase in the bridge width to accommodate bus and truck turning movements around the 90˚ curve at the east end of the bridge.

Environmental Resources

A Technical Memorandum, dated March 6, 2012, was prepared by VHB to summarize waters identification and regulatory discussion (Appendix C). A Resource Identification Completion Memo was prepared by VTrans on July 26, 2011 (Appendix D). The following summarizes the resource assessment to date:

- There are no mapped or field sittings of wetland features, or rare, threatened, or endangered species.
- A flood hazard area permit may be required as the project occurs within a Special Flood Hazard Area.
- The entire project area is considered to have statewide significant soils.

Cultural Resources

An Archeological Resource Assessment was provided by VTrans dated July 01, 2011 (see Appendix E). The assessment concluded the project to be cleared with avoidance to all archaeologically sensitive areas. The project is located within a historic district. Historic properties are adjacent to the project area and include the bridge itself. The historic properties identified within the project area are identified in the map included in Appendix E. These are 4(f) properties.

Hydraulic Study

The VTrans Hydraulics Unit conducted a preliminary hydraulic study for this project site on July 28, 2011 (Appendix F). The study indicates that water is up onto the beams below the Q50 and that the bridge does meet the requirements of one (1) foot of freeboard at Q50. The bridge also caused approximately two (2) feet of backwater at Q50. The Study also indicated this site is in Zone A of the flood insurance study, which means there is no detailed study for this river.

The recommendation for replacement structures from a hydraulics perspective are as follows:

- The new structure shall have a 60-feet minimum clear span, measured perpendicular to the channel. The average low chord elevation of the superstructure shall be 8.5-feet above the streambed or at elevation 1000.6' to provide one (1) foot of freeboard at Q50. The bridge should be skewed slightly with the abutments aligned with the channel. Stone Fill, Type IV shall be used to protect the substructure and the slopes in front of the abutments and wingwalls shall match the upstream and downstream slopes of the channel.

Geotechnical Investigation

VTrans performed subsurface investigations and prepared a Subsurface Investigation Memorandum submitted on April 27, 2012 (Appendix G). The purpose of the geotechnical investigations was to determine the existing soil conditions and verify the depth of ledge at the bridge location. As part of the subsurface investigation two (2) borings were completed.

The subsurface investigations revealed that ledge was approximately 32.0 to 35.0 feet below existing grade and the recommended substructure should be integral abutments.

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):

- Depth and Transportability of superstructure components
- Best fit for existing roadway geometry
- Construction costs
- Future maintenance costs
- Environmental impacts
- ROW impacts

Alternative A: Do Nothing

The "Do Nothing" alternative would allow the existing bridge to continue to function in its current condition. Although this is not a viable alternative, it is included in our study. The Do Nothing alternative would result in the continued deterioration of the existing superstructure, inadequate hydraulic capacity of the structure, and continued impact damage to the west approach railing. The Do Nothing alternative does not meet the project need.

Alternative B: Precast Prestressed Concrete NEXT Beam Bridge

Construction of a precast prestressed concrete NEXT beam bridge using integral abutments, each on a single row of piles, is a simple and cost effective solution for this type of project. The required span length, based on the specified hydraulic opening, is approximately 20' longer than the existing span. The increase in structure length places the proposed abutments behind the existing abutments. This feature, in combination with the proposed style of abutment, will allow the new abutments to be constructed while leaving the existing abutments in-place and undisturbed. The proposed abutments can be constructed using daytime single lane closures while the

existing bridge remains open. After the abutments are constructed the existing bridge will be closed for an extended weekend, at which time the bridge will be removed and the proposed superstructure will be set in-place and opened to traffic. The NEXT beam superstructure for the specified bridge width requires four precast superstructure units, whereas a box beam superstructure requires nine precast beams. The channel embankments at the bridge will be armored with stone fill.

Advantages of Alternative B

- Rapid construction and short construction duration
- Simple method of construction
- Fewest number of required precast superstructure units
- Low construction cost
- Low future maintenance costs

Disadvantages of Alternative B

- Requires weekend bridge closure for superstructure replacement

Alternative C:
Precast Prestressed Concrete Box Beam Bridge

The precast prestressed concrete box beam bridge is another alternative that provides ease and low cost of construction, and can be constructed using daytime lane closures and an extended weekend closure similar to Alternative B. This alternative also utilizes integral abutments, each supported by a single row of piles. Proposed substructure location, construction sequencing, and duration is identical to that of Alternative B. The major difference between this alternative and Alternative B is the type of superstructure. The box beam superstructure for the specified bridge width requires nine precast superstructure units, whereas Alternative B requires four precast NEXT beams. Additionally, box beam bridges require transverse post-tensioning to ensure sufficient load sharing between adjacent beams. Because there are more superstructure units, there is greater flexibility in bridge width if phased construction is used, however for construction cost, schedule, and safety reasons phased construction is not desirable at this location. The channel embankments at the bridge will be armored with stone fill.

Advantages of Alternative C

- Rapid construction and short construction duration
- Low construction cost
- Low future maintenance costs
- Conducive to phased construction for this bridge width (not recommended for this location)

Disadvantages of Alternative C

- Requires weekend bridge closure for superstructure replacement
- Greater number of required precast superstructure units
- Transverse post-tensioning required

Maintenance of Highway Traffic during Construction

Due to the Roadway geometry and the location of the dwellings adjacent to the roadway 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. Therefore as discussed in both Alternative B and Alternative C above the preferred method of maintaining traffic during construction is to utilize single lane daytime closures with an extended (6 PM Friday to 6 AM Monday) weekend closure. Flaggers would be used for the single lane daytime closures and a detour would be required for the extended weekend roadway closure. As there are no local detours 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.

Additional Considerations

The following considerations were also evaluated during the scoping of this project:

Roadway Alignment – Off Alignment Alternative: An alternate alignment study was completed by the Agency in the mid-1980's. At that time it was found to be not feasible to change the alignment due to costs and significant impacts to property owners and archaeological and historically sensitive areas. Permitting would be exceptionally difficult. With costs many times higher than the alternatives presented in this report and relatively low traffic counts, it would be many years before the project would be a priority for funding and the bridge would likely be closed due to deterioration before then. For these reasons, an "off alignment" option is not presented as a feasible alternative in this report.

Roadway Alignment – Turning Radius: Alternatives were considered which maintained the existing bridge location and increased the radius of the 57 foot roadway curve at the west approach. In all instances, it was not feasible to increase the radius to achieve the 50 mph posted speed limit without impacting historic properties and adversely affecting sight distance, a primary safety concern, to drives and Bingo Road. These alternatives were evaluated with VTrans in-depth and the proposed alternative, which maintains a curve radius similar to that of the existing alignment, was accepted. Advanced traffic warning signage shall be included as part of the final design package.

Evaluation Matrix - Rochester VT 73 Bridge No. 15 over Brandon Brook				
Scoping Report		**Alternative A**	**Alternative B**	**Alternative C**
		Do Nothing	Precast PreStressed Concrete Next Beam Bridge	Precast Prestressed Concrete Slab Bridge
Cost	Roadway Improvements	$0.00	$360,000.00	$360,000.00
	Bridge Improvements	$0.00	$840,000.00	$840,000.00
	Construction Engineering	$0.00	$200,000.00	$200,000.00
	Right-of-Way Acquisition	$0.00	$50,000.00	$50,000.00
	Preliminary Engineering	$50,000.00	$50,000.00	$50,000.00
	SUBTOTAL:	$50,000.00	$1,500,000.00	$1,500,000.00
	TOTAL:	**$50,000.00**	**$1,500,000.00**	**$1,500,000.00**
Engineering	Typical Section Roadway	No Change	3-11-11-3	3-11-11-3
	Typical Section Bridge	No Change	3-11-11-7	3-11-11-7
	Traffic Safety	No Change	Enhancement	Enhancement
	Alignment Change	No Change	No Change	No Change
	Hydraulic Performance	No Change	Enhancement	Enhancement
	Utility	No Change	No Change	No Change
Impacts	Agricultural Lands	No	Yes	Yes
	Archaeological	No	No	No
	Historic Structures, Sites and Districts	No	Yes	Yes
	Hazardous Materials	No	No	No
	Floodplain	No	Yes	Yes
	Fish & Wildlife	No	No	No
	Rare, Threatened & Endangered Species	No	No	No
	Public Lands	No	No	No
	LWCF	No	No	No
	Wetlands	No	No	No
Local and Regional Issues	Concerns	Not Met	Satisfied	Satisfied
	Community Character	No Change	No Change	No Change
	Economic Impacts	No Change	Unknown	Unknown
	Satisfies Project Need	No	Yes	Yes
Permits	Act 250 Amendment	No	No	No
	401 Water Quality	No	Yes	Yes
	404 ACOE Permit	No	Yes	Yes
	Stream Alteration Coordination	No	Yes	Yes
	Vermont Wetlands Permit	No	No	No
	Stormwater Discharge	No	No	No
	Lakes and Ponds	No	No	No
	Endangered and Threatened Species Taking	No	No	No
	Construction Stormwater Discharge	No	No	No
	SHPO	No	Yes	Yes
Other	Land Acquisition	No	No	No

Figure 2 – Evaluation Matrix

Recommendations

Alternative B – Precast Prestressed Concrete NEXT Beam Bridge with integral abutments is the recommended alternative, primarily because it provides a low construction cost, is simple to construct, and allows the bridge to be replaced quickly, thereby minimizing disturbance to the traveling public.

Appendix

APPENDIX A

PROJECT PHOTOGRAPHS

Looking East on VT 73

Looking West on VT 73

Sharp Corner and Bingo Road on West Side of the Bridge

West Abutment

East Abutment

Concrete T-Beams and Underside of Deck

Looking Upstream

Looking Downstream

APPENDIX B

STRUCTURE INSPECTION, INVENTORY AND APPRAISAL SHEET

STRUCTURE INSPECTION, INVENTORY and APPRAISAL SHEET

Vermont Agency of Transportation ~ Structures Section ~ Bridge Management and Inspection Unit

Inspection Report for ROCHESTER **bridge no.:** 00015 **District:** 4

Located on: VT 00073 ML **over** BRANDON BROOK **approximately** 3.9 MI W JCT. VT.100 **Owner:** 01 STATE-OWNED

CONDITION

Deck Rating: 4 POOR

Superstructure Rating: 5 FAIR

Substructure Rating: 6 SATISFACTORY

Channel Rating: 7 GOOD

Culvert Rating: N NOT APPLICABLE

Federal Str. Number: 200162001514152

Federal Sufficiency Rating: 43.7

Deficiency Status of Structure: SD

AGE and SERVICE

Year Built: 1929 **Year Reconstructed:** 0000

Service On: 1 HIGHWAY

Service Under: 5 WATERWAY

Lanes On the Structure: 02

Lanes Under the Structure: 00

Bypass, Detour Length (miles): 19

ADT: 001300 **% Truck ADT:** 06

Year of ADT: 1998

GEOMETRIC DATA

Length of Maximum Span (ft): 0040

Structure Length (ft): 000043

Lt Curb/Sidewalk Width (ft): 0.5

Rt Curb/Sidewalk Width (ft): 0.5

Bridge Rdwy Width Curb-to-Curb (ft): 20.8

Deck Width Out-to-Out (ft): 23.3

Appr. Roadway Width (ft): 028

Skew: 00

Bridge Median: 0 NO MEDIAN

Min Vertical Clr Over (ft): 99 FT 99 IN

Feature Under: FEATURE NOT A HIGHWAY OR RAILROAD

Min Vertical Underclr (ft): 00 FT 00 IN

STRUCTURE TYPE and MATERIALS

Bridge Type: CONCRETE T-BEAM

Number of Approach Spans: 0000 **Number of Main Spans:** 001

Kind of Material and/or Design: 1 CONCRETE

Deck Structure Type: 1 CONCRETE CIP

Type of Wearing Surface: 6 BITUMINOUS

Type of Membrane: 0 NONE

Deck Protection: 0 NONE

APPRAISAL *AS COMPARED TO FEDERAL STANDARDS

Bridge Railings: 0 DOES NOT MEET CURRENT STANDARD

Transitions: 0 DOES NOT MEET CURRENT STANDARD

Approach Guardrail: 1 MEETS CURRENT STANDARD

Approach Guardrail Ends: 1 MEETS CURRENT STANDARD

Structural Evaluation: 5 BETTER THAN MINIMUM TOLERABLE CRITERIA

Deck Geometry: 2 INTOLERABLE, REPLACEMENT NEEDED

Underclearances Vertical and Horizontal: N NOT APPLICABLE

Waterway Adequacy: 6 OCCASIONAL OVERTOPPING OF ROADWAY WITH INSIGNIFICANT TRAFFIC DELAYS

Approach Roadway Alignment: 3 INTOLERABLE, CORRECTIVE ACTION NEEDED

Scour Critical Bridges: 8 STABLE FOR SCOUR

DESIGN VEHICLE, RATING, and POSTING

Load Rating Method (Inv): 2 ALLOWABLE STRESS (AS)

Posting Status: A OPEN, NO RESTRICTION

Bridge Posting: 5 NO POSTING REQUIRED

Load Posting: 10 NO LOAD POSTING SIGNS ARE NEEDED

Posted Vehicle: POSTING NOT REQUIRED

Posted Weight (tons):

Design Load: 2 H 15

INSPECTION and CROSS REFERENCE

X-Ref. Route:

Insp. Date: 062011 **Insp. Freq. (months)** 24 **X-Ref. BrNum:**

INSPECTION SUMMARY and NEEDS

09/06/2011 - Irene note: Bridge open. Heavy erosion behind abutment #1 filled in and aggradation of waterway. Channel opened up with excavator work. Bridge fine otherwise. ~ MJ/DK

06/20/2011 The deck is in need of full replacement. The right beam rail of approach No.1 is in need of full replacement. Full depth holes may occur at anytime anywhere before next inspection. PLB

06/11/2009 The overall condition of this bridge is poor, due to progressive deterioration of the deck surface and soffit areas. The T-beams throughout continue to breakdown with a slow and steady progression. Local deck soffit failures are eminent in bays 1 and 2. PLB

APPENDIX C

WATERS IDENTIFICATION AND REGULATORY DISCUSSION TECHNICAL MEMORANDUM

TECHNICAL MEMORANDUM

Rochester BRF 0162(16)
Rochester, Vermont

Proposed Bridge Replacement

Town of Rochester Bridge No. 15, Route 73, Over Brandon Brook,
Rochester, Vermont

Date: Draft: March 6, 2012
Re: Waters Identification and Regulatory Discussion

INTRODUCTION:
Vanasse Hangen Brustlin, Inc. (VHB) performed stream Top-of-Slope and Ordinary High Water delineations in support of Bridge No. 15 replacement on Vermont Route 73 (Project), near the intersection of Bingo Road and Vermont 73 in Rochester, Vermont. The location currently consists of a bridge which is a single span concrete T-beam, with concrete abutments on spread footings. This technical memorandum describes the applicable Vermont and Federal regulatory programs for the stream resources investigated, site characteristics, study methods, and resource determinations conducted for the investigation area. The additional Natural Resource work has previously been conducted by VTRANS in June 2011. Included in the Attachment are the Waters Delineation and Natural Resources Map, Watershed Sizes Map, and Waters Delineation Representative Photographs.

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

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

SITE DESCRIPTION:
Town of Rochester Bridge 15 on Route 73 is located near the intersection of Bingo Road and Route 73 and is located in a rural area (43°51'29.123"N, 72°52'24.194"W) with scattered residential development (see Attachment, page 1, Waters Delineation and Natural Resources Map). The study site is within Orange County, in the Town of Rochester, Vermont and located in the White River Sub-basin, Vermont. (HUC 8: 01080105). The investigation area occurs at approximately 1000 feet above sea level and the soil types within the investigation area are

[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)

predominately Peru-Colonel-Marlow association (3-35 percent slopes) and Croghan and Sheepscot fine sandy loams (0-8 percent slopes). The investigation concentrated on an approximately 2 acres around the bridge that would likely be needed for replacement construction activities.

ASSESSMENT METHODOLOGIES:

Waters

VHB Environmental Scientists Chelsea Martin and Nicholas Sibley conducted the waters delineation on February 7 and 9, 2012. 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 Top-of-Slope is flagged using orange survey tape and labeled "TOS" and includes the stream ID and flag number (e.g., VHB 2012-TOS-C1a-1). OHW limits in the investigation area are marked with blue flagging tape and labeled by stream ID and flag number (e.g., VHB 2012-OHW-1a-1). Stream flow regimes are typically preliminarily classified as ephemeral, intermittent, or perennial and are determined based on qualitative observations of instream hydrology indicators at the time of observation, as well as geomorphic characteristics and subject to professional judgement.

FEMA floodway data was obtained from the Vermont Center for Geographic Information (VCGI) (2010) and included on the Waters Delineation and Natural Resources Map (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).

FEMA floodway data was received from Vermont Center for Geographic Information (VCGI) (2010) and included on the Waters Delineation and Natural Resources Map (page 1, of the Attachment). VHB also reviewed the USACE list of navigable waters in New England to determine if Brandon Brook is considered a Section 10 navigable water (USACE 2007).

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

VHB located stream delineation flags in the field using a Trimble® GPS unit capable of sub-meter accuracy. Data was post-processed using Trimble® Pathfinder software for enhanced accuracy.

RESULTS:

Waters

VHB delineated one perennial stream feature, Brandon Brook, from within the investigation area. Stream features are shown on the Waters Delineation and Natural Resources Map (Page 1 of the Attachment). The OHW and TOS of Brandon Brook were delineated using the methodologies described above and are identified in the field as 2012-TOS-1 and 2012-OHW-1. Brandon Brook runs along Vermont 73 and has large boulder and cobble substrate. Brandon Brook has an OHW range of approximately 25 to 50 feet within the investigation area. (See photos of stream features on pages 3 of the Attachment).

Brandon Brook is considered a Class B water under the Vermont Water Quality Standards (NRB 2008). According to the VT DEC Watershed Sizes Map (page 2, in the Attachment) the drainage area for Brandon Brook is greater than 10 square miles at the bridge site (approximately 15.8 square miles). Based on the calculated

drainage area using the Vermont Regional Hydraulic Geometry Curve, the bank full width of Brandon Brook would be 29.0 feet (VT DEC 2006).

Brandon Brook is not considered a navigable water under Section 10 of the Rivers and Harbors Act and also not considered EFH by the NMFS (USACE 2007).

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
Any work within a perennial stream will require Stream Alteration Consultation under Title 19 review for VTrans projects. The Brandon Brook watercourse has a drainage area mapped greater than 10 square miles therefore Title 19 review following the requirements of a Stream Alteration Individual Permit may be required. VHB recommends initial coordination with the Vermont River Management Engineer (Patrick Ross) to identify if the Project is exempt from Stream Obstruction review. Equilibrium conditions of Brandon Brook should be maintained if the Project can maximize adherence with the equilibrium standard (VT DEC 2011).

Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act
The USACE regulates the placement of fill material into U.S. waterways and their tributaries including adjacent wetlands 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 Water Quality Certification
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 the Army Vermont General Permit is applicable then a General 401 Water Quality Certification is included. If a USACE Individual Permit is necessary then an Individual 401 Water Quality Certification would be required.

REFERENCES

U.S. Army Corps of Engineers (USACE). 2005. "Regulatory Guidance Letter. Subject: Ordinary High Water Mark Identification." No. 05-05. Available online at: http://www.usace.army.mil/cw/cecwo/reg/rglsindx.htm

U.S. Army Corps of Engineers (USACE). 2007. Department of the Army General Permit State of Vermont. Effective December 5, 2007. Available online at http://www.nae.usace.army.mil/Regulatory/SGP/VT_PGP.pdf

U.S. Geological Survey (USGS). 2012. Vermont Stream Stats Basing Characteristic Report. Available online at http://streamstatsags.cr.usgs.gov/vt_ss/default.aspx?stabbr=vt&dt=1329238683658

Vermont Agency of Natural Resources (VT ANR). 2005. Riparian Buffer Guidance: December 9, 2005. Available online at http://www.state.vt.us/site/ht ml/buff/ anrbuffer2005.htm

Vermont Agency of Natural Resources (VT ANR). 2007. Flood Hazard Area Permit: December 27, 2007. Available online at http://www.anr.state.vt.us/dec/permit_hb/sheet32_3.pdf

Vermont Center for Geographic Information. 2010. Accessed online March 2011 at: http://www.vcgi.org/

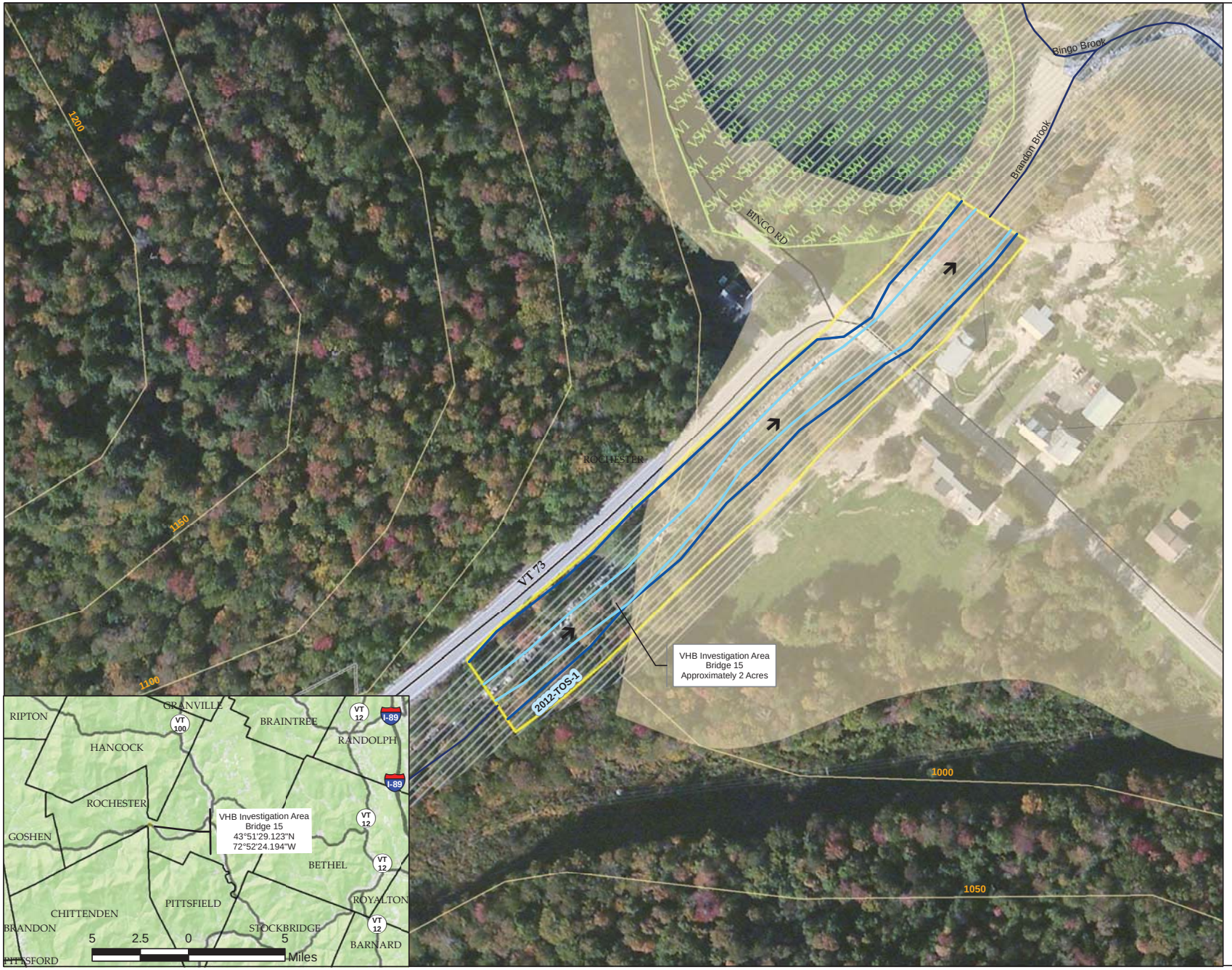
Vermont Department of Environmental Conservation (VT DEC). 2006. The Vermont Regional Hydraulic Geometry Curves.
Available online at: http://www.anr.state.vt.us/dec/waterq/rivers/docs/rv_hydraulicgeocurves.pdf

Vermont Department of Environmental Conservation (VT DEC). 2011. The Vermont Stream Alteration regulatory program guidelines and watershed size maps can be found at http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_management.htm

Vermont Natural Resources Board (NRB). 2008. Vermont Water Quality Standards (Vt. Code R 12 004 052), Effective January 1, 2008.

Attachments:

- Waters Delineation and Natural Resources Map
- Rochester Watershed Sizes Map
- Waters Delineation Representative Photographs



Rochester BRF 0162(16) Waters Delineation and Natural Resources Map Vermont 73 Over Brandon Brook Bridge 15 Rochester, Vermont

March 06, 2012

100 50 0 100
Feet

Legend

- Bridge 15 Investigation Area
- VHB Ordinary High Water
- VHB Stream Top of Slope
- Stream (VHD 08)
- Hydric Soils
- Prime Agricultural Soils
- VSWI Wetland
- 100 Year Floodzone
- Deer Wintering Habitat (VT ANR)
- RTE Species/ Communities (NHIP)
- County Boundary
- Town Boundary
- Roads (VTRANS)
- 50' Contours
- Direction of Stream Flow

N

Vanasse Hangen Brustlin, Inc.

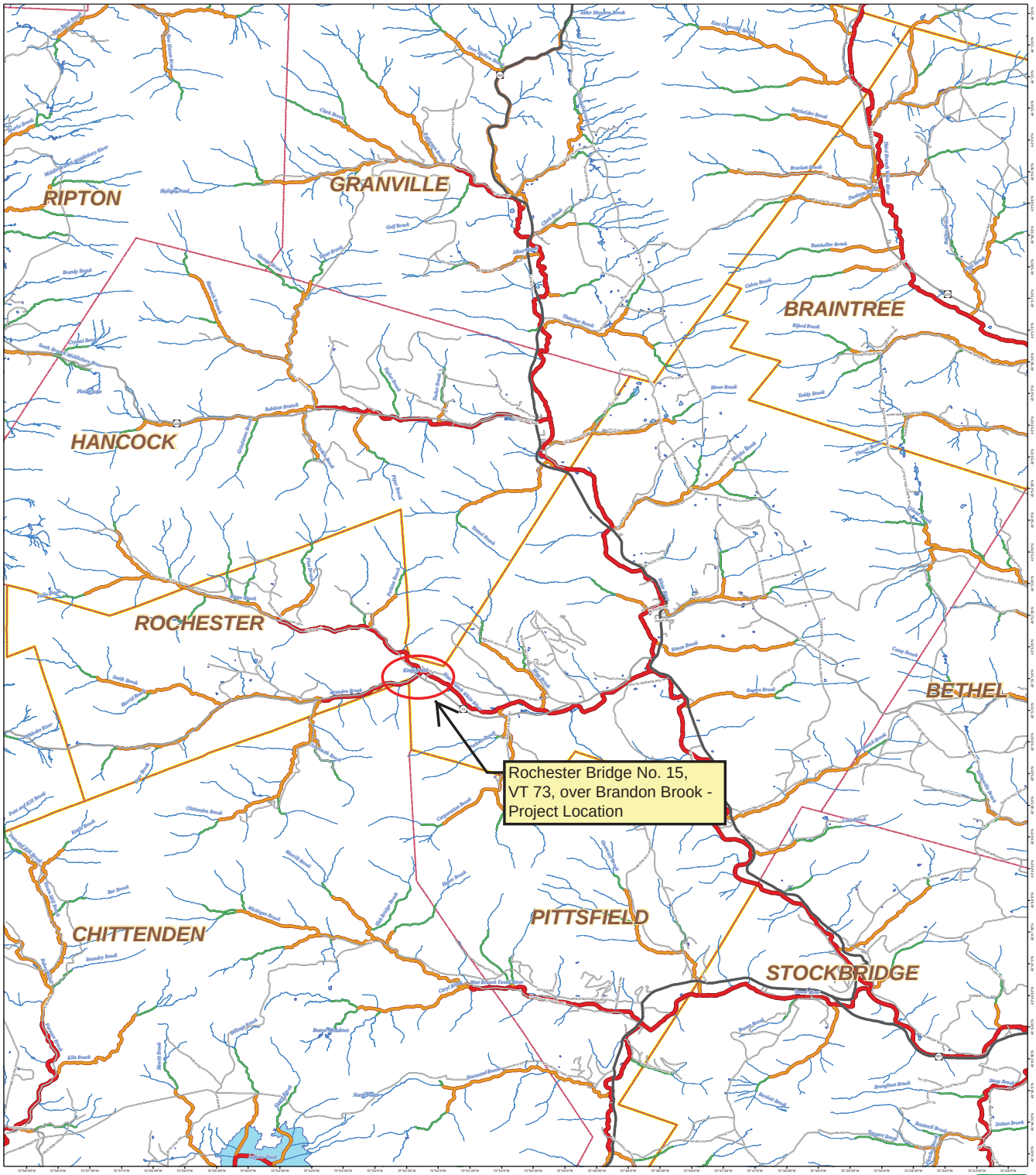
Sources: BING Aerial Photography (2011); VHD Streams, Flood data, Contours, Town and County Boundaries and Roads from VCGI (2010); RTE and VSWI Features by ANR (2011); Investigation area, OHW and TOS by VHB (2012)

Prepared by: NSibley

Path: F:\57526.00\GIS\Project\RochesterWetland_fieldmap_Bridge15.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

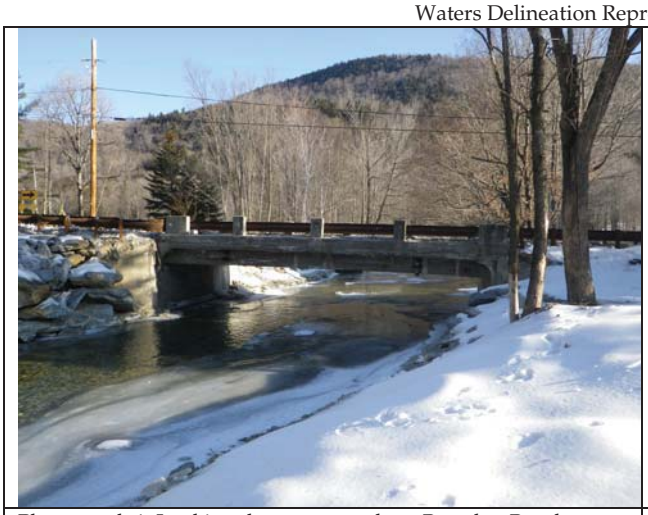
Roads: Principal Arterial, Minor Arterial, Urban, Rural, Local

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

Rochester BRF 0162(16)
Town of Rochester Bridge No. 15, VT 73, Over the Brandon Brook
Rochester, Vermont
Waters Delineation Representative Photographs



Photograph 1. Looking downstream along Brandon Brook at Bridge 15

Photograph 2. View of left bank descending and Route 73 ROW embankment

Photograph 3. View of VT 73 ROW looking downstream and Bridge 15 over Brandon Brook

Photograph 4. Looking upstream Brandon Brook along Route 73

Photograph 5. View of Right bank descending and adjacent structure

Photograph 6. View of adjacent house and Brandon Brook looking upstream towards Bridge 15

Photograph taken by VHB Environmental Scientist Chelsea Martin on February 7 and 9, 2012

APPENDIX D

NATURAL RESOURCES IDENTIFICATION MEMORANDUM

OFFICE MEMORANDUM

AOT - PROGRAM DEVELOPMENT DIVISION

RESOURCE IDENTIFICATION COMPLETION MEMO

TO: Chris Williams, Project Manager
FROM: James Brady, Environmental Specialist
DATE: 07/26/2011

Project: Rochester BRF 0162(16)

ENVIRONMENTAL RESOURCES:

Wetlands:	___ Yes	_X_ No	See - Rochester BRF 0162(16)NR.doc
Historic/Historic District:	_X_ Yes	___ No	See – Rochester BRF 0162(16) historic resource id.pdf
Archaeological Site:	___ Yes	_X_ No	See – RochesterBRF0162(16)Arch.pdf
4(f) Property:	_X_ Yes	___ No	See – Rochester BRF 0162(16) historic resource id.pdf
6(f) Property:	___ Yes	_X_ No	See – RochesterBRF0162(16)ConservedLand.pdf
Agricultural Land:	_X_ Yes	___ No	See - Rochester BRF 0162(16)NR.doc
Fish & Wildlife Habitat:	___ Yes	_X_ No	See - Rochester BRF 0162(16)NR.doc
Floodplains:	_X_ Yes	___ No	FEMA Map is informational only, do not draw, use hydraulics report
Endangered Species:	___ Yes	_X_ No	See - Rochester BRF 0162(16)NR.doc
Hazardous Waste:	___ Yes	_X_ No	See – RochesterBRF0162(16)HazMat.pdf
Stormwater:	___ Yes	_X_ No	Not able to plot at this time
USDA-Forest Service Lands:	___ Yes	_X_ No	See - RochesterBRF0162(16)ConservedLand.pdf
Wildlife Habitat Connectivity:	_X_ Yes	___ No	See - Rochester BRF 0162(16)NR.doc
Scenic Highway/ Byway:	___ Yes	_X_ No	See - RochesterBRF0162(16)ScenicByway.jpg

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

James Brady
cc:
Project File

VERMONT

State of Vermont *Agency of Transportation*

[phone] 802- -
[fax] 802- -
www.aot.state.vt.us [ttd] 800-253-0191

Memorandum

To: James Brady, VTrans Environmental Specialist

From: Glenn Gingras, VTrans Environmental Biologist

Date: 6/30/11

Subject: **Rochester BRF 0174 (16)**
Natural Resource Identification

I have identified resources for the above mentioned project. I have reviewed existing mapped environmental mapping and I performed a field visit.

The above referenced project is located on VT 73, Bridge #15 over the Brandon Brook in the town of Rochester.

Wetlands/Watercourses:
No wetlands exist in the project area. The Brandon Brook, a tributary to the West Branch of the White River is regulated by the US COE and the River Management Division of ANR.

Rare, Threatened and Endangered (R/T/E) Species:
No R/T/E species are mapped within the project area.

Agricultural Soils:
The entire area is mapped as statewide significant soils.

Fish and Wildlife Habitat:
The Brandon Brook would support a variety of aquatic organisms. As this is a bridge project aquatic organism passage is not an issue.

Temporary Bridge Options:
A temporary bridge on either side of the existing structure would not be a concern from natural resources.

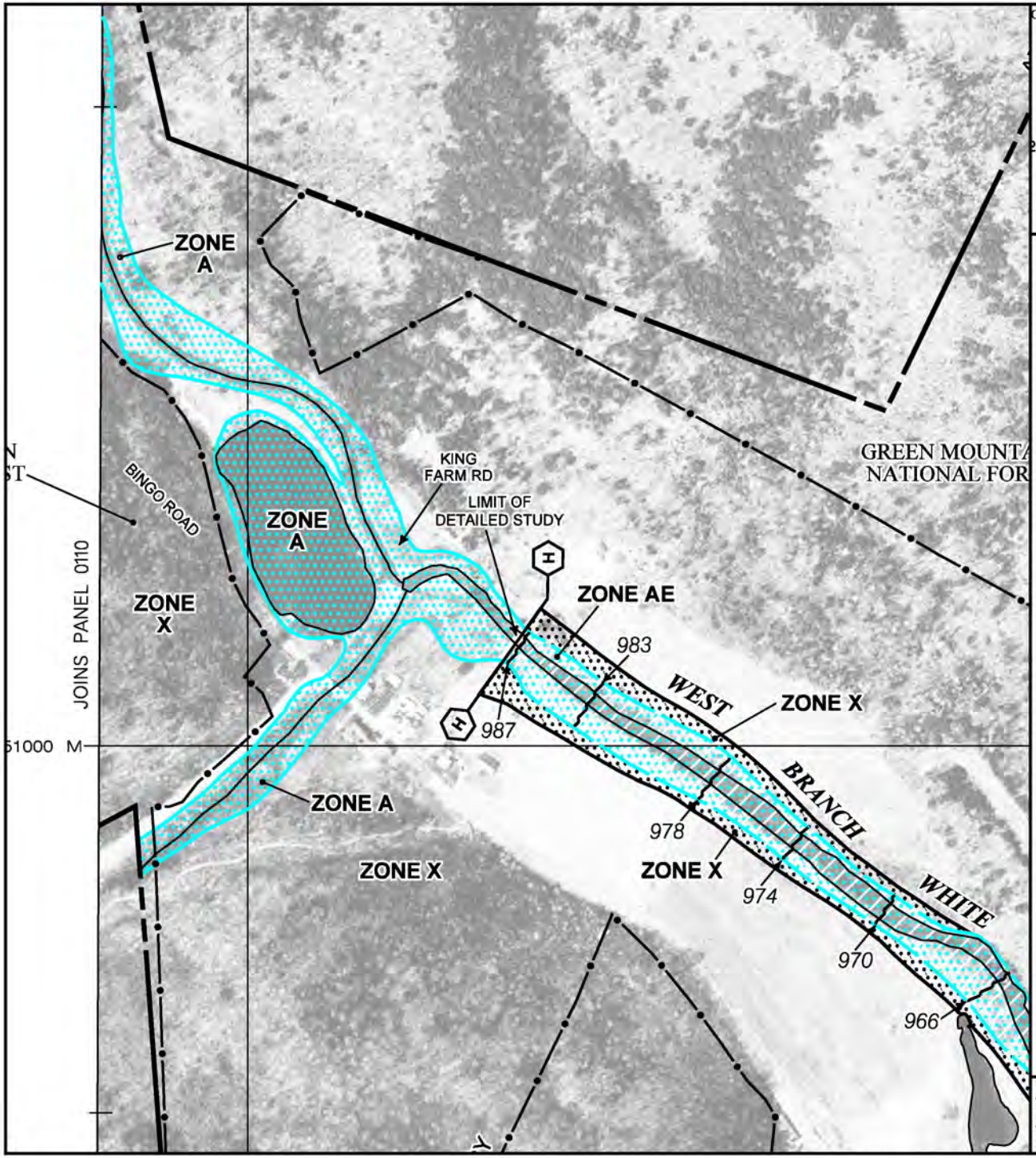
If you have any questions, please feel free to contact me.

Cc

Chris Williams, VTrans Project Manager
Natural Resource Environmental File

C:\JDA\Projects\Rochester73 57526\Scoping Study\57526 Appendices\ResourceIDandClearances\Rochester BRF 0162(16)NR.docx


Rochester BRF 0162(16)
1:3,713
0 0.01 0.02 0.04 0.06 0.08
Miles
N
Green Mountain National Forest
Green Mountain National Forest
Green Mountain National Forest
BRANDON MOUNTAIN RD
VT-73
Bridge No 15
73
Map created by J. Brady, PDD-Environmental Section on 07/26/2011.



onal Flood Insurance Program at 1–800–638–6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0126E

FIRM

FLOOD INSURANCE RATE MAP

WINDSOR COUNTY
VERMONT
(ALL JURISDICTIONS)

PANEL 126 OF 831

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ROCHESTER, TOWN OF	500299	0126	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
50027C0126E

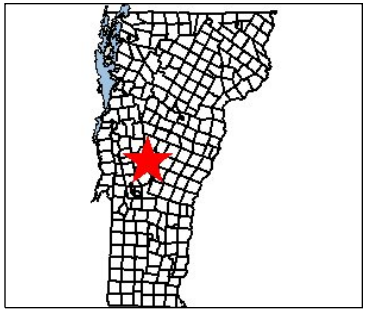
EFFECTIVE DATE
SEPTEMBER 28, 2007

Federal Emergency Management Agency

ANR Environmental Interest Locator

Vermont Agency of Natural Resources (ANR)

Rochester BRF 0162(16)



Legend

- Brownfields
- Hazardous Waste Site
- Hazardous Waste Site Generator
- Underground Storage Tank
- Roads
- US Highway
- Vermont State Highway
- Class One
- Class Two
- Legal Trail
- Emergency U-Turn Area
- Proposed Class Two
- Proposed Class Three
- Proposed Vermont State Highway
- Proposed US Highway
- Proposed Interstate
- Discontinued Interstate
- Class Three
- Class Four
- State/National Forest Highway
- Military Road (No Public Access)
- Private Road
- Hydrography Lakes and Ponds (VHD 5k)
- Hydrography (VHD 5k)
- VT County Boundary
- VT Town Boundaries (No Fill)
- NAIP Color Orthophotos 2009
- VT State Boundary (Fill)

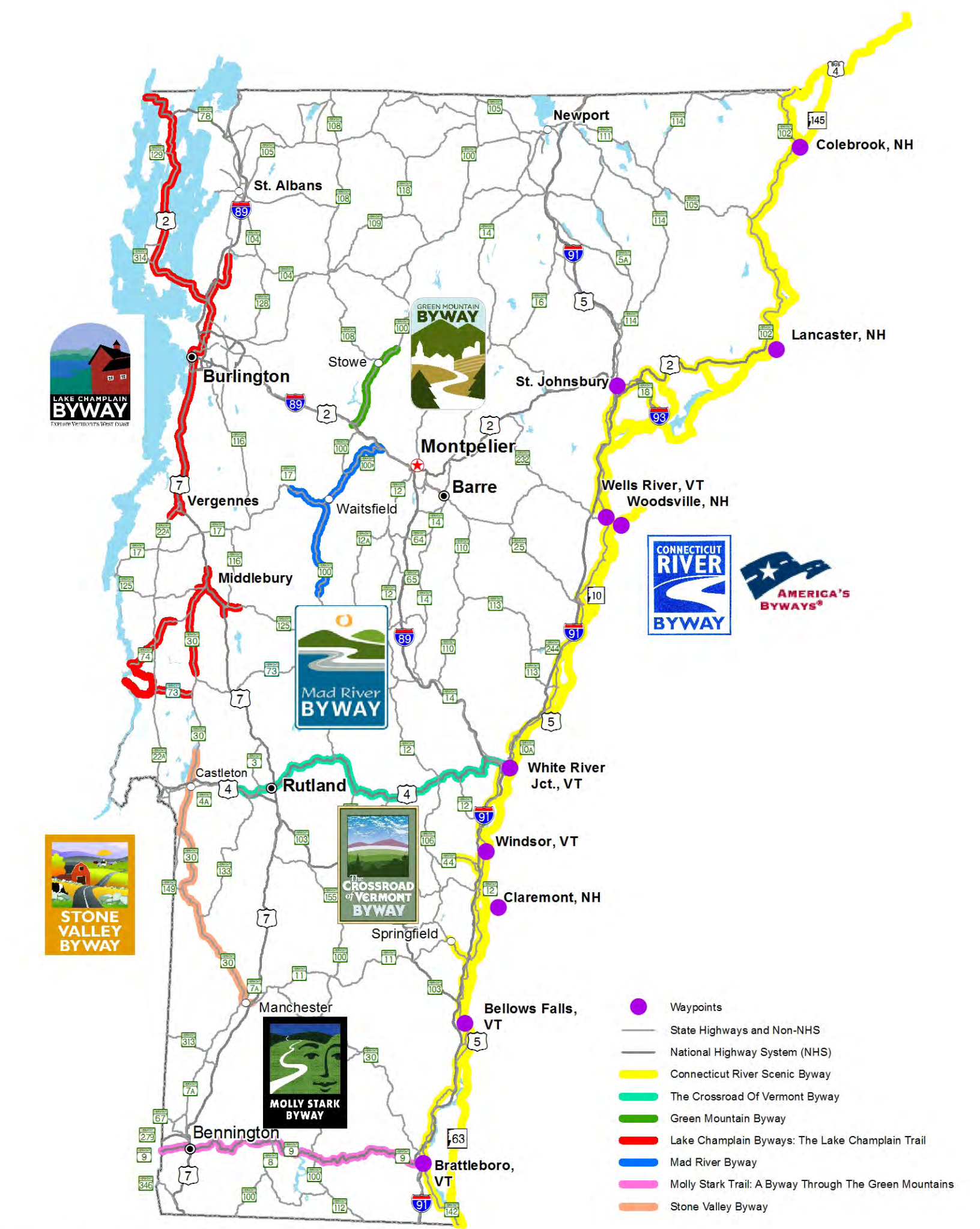
VT State Plane Meters (NAD83)

Map center: 470071, 151045

Scale: 1:3,323

URL: http://maps.vermont.gov/imf/sites/ANR_NATRESViewer/jsp/launch.jsp

7/26/11



VTrans Mapping Unit - April 05, 2011

APPENDIX E

ARCHAEOLOGICAL RESOURCE ASSESSMENT AND HISTORIC RESOURCE IDENTIFICATION MEMORANDUM

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

FROM: Jeannine Russell, VTrans Archaeology Officer
DATE: 7/1/2011

SUBJECT: ARCHAEOLOGICAL ISSUES ONLY **Field Visit: YES** ☒ **NO** ☐

Project Name: Rochester VT 73 Bridge 15
Project Number: BRF 0162(16)

On 7/1/2011, the VTrans Archaeology Officer reviewed the above project with the Transportation Archaeologist(s) and agreed to the following:

**********Archaeological Resource Assessment**********

☒ That the Archaeological Resource Assessment of the Area of Potential Effect (APE) conducted by **VTrans** ☒, **Consultant** ☐ _____, or **Sub-consultant** ☐ _____and dated 7/1/2011 is adequate to identify archaeological resources, and **Does** have a CADD map with the archaeological resources on it.
Date ARA was approved 7/1/2011.

☒ **Plans dated** 6/29/2011 reviewed by **VTrans** ☒, **Consultant** ☐_____or **Sub-consultant** ☐_____.
Recommendations:
☐ Project **CLEARED** as **EXEMPT** (based on the PA 12/28/00).
☒ Project **CLEARED** with avoidance to all archaeologically sensitive areas.
☐ Project **CLEARED** with the following Conditions(See Conditions below)
☐ Recommend more archaeological study - **Phase I**

**********PHASE 1 & Beyond**********

☐ **ARA Proposal received** _____ and **approved** _____.

☐ **The above project is being reviewed at which level: ARA.**
Authorization Date: _____ Consultant Firm _____.
End of field letter/report Date _____.
Determination of Effect: **NO EFFECT**(NE) ☐
CONDITIONAL NO ADVERSE EFFECT ☐(See conditions below)
NO ADVERSE EFFECT(NAE) ☐ **ADVERSE EFFECT**(AE) ☐
Consultant Recommends:_____
Draft Report Received:_____
Comments to Consultant:_____
Final Report Received:_____
Clearance of **Phase I** Date:_____
Phase I Costs: $_____
Number of sites found:_____
Number of National Register(NR) sites:_____
Number of NR sites Mitigated:_____

☒ **Additional comments or conditions that apply to this project.(see page 2 for additional conditions)**

J Russell

_____ 7-1-11
(***Signature of VTrans Archaeology Officer***) (***Date***)

Prepared by Brennan Gauthier, VTrans Assistant Archaeologist

Project: Rochester **BRF 0162(16) VT 73 Br 15**

Additional Comments from Page 1:

A field visit conducted on 6/15/2011 by VTrans Archaeology Officer Jen Russell and Assistant Archaeologist Brennan Gauthier was adequate to identify potential archaeological resources within the project area. The location has been highly disturbed by road and bridge construction, and is an unlikely location for precontact archaeological sites. Potential historic archaeology within the area is confined to farm and domestic activities which are located outside the scope of the project.

KINGS POND

TH 28
TO HANCOCK

VT 73
TO ROCHESTER

FLOW

BRANDON BROOK

VT 73
TO GOSHEN

N

VT STATE PLANE GRID

20 0 20
SCALE: 1" = 20'-0"

No archaeological resources in the area

ENVIRONMENTAL RESOURCE	LEVEL	LINESTYLE NAME	CHECKED BY	DATE
Wetlands	EWB_P	wetland-lt, wetland-rt		
Historic/Historic District	MHBC	historic dist.		
Archeological Site	LAAS	arch. area	Brennan Duerden	6/15/2011
4f Property	MPL	4f property		
6f Property	MPL	6f property		
Agricultural Land	LAPB	agricult. land		
Fish & Wildlife Habitat	EHA	critical hab.		
Flood Plains	EWB_P	fld. plains		
Endangered Species	EHA	thr. & end. spec.		
Hazardous Waste	EDEFAULT	haz. waste		
Stormwater	DDEFAULT	Diamond		
USDA-Forest Service Lands	MJPB	Phantom		
Wildlife Habitat Suit/Conn	EHA	Divide		

VT 73 BR 15

PROJECT NAME: ROCHESTER
PROJECT NUMBER: BRF 0162(16)

FILE NAME: s10c418base.dgn
PROJECT LEADER:
DESIGNED BY:
RESOURCE ID LAYOUT SHEET

PLOT DATE: 29-JUN-2011
DRAWN BY:
CHECKED BY:
SHEET 1 OF 1

KINGS POND

TH 28
TO HANCOCK

BR 15
(H)

VT 73 →
TO ROCHESTER

Church
#5562

(H)

(H)

(H)

(H)

FLOW

VT 73
TO GOSHEN

BRANDON BROOK

1000
1010
1020

N
VT STATE PLANE GRID

20 0 20
SCALE: 1" = 20'-0"

Project lies within a historic district.

Historic Resources
(H) = Historic Property - Section 106 & Section 4f resource

ENVIRONMENTAL RESOURCE	LEVEL	LINESTYLE NAME	CHECKED BY	DATE
Wetlands	ENB_P	wetland-lt, wetland-rt		
Historic/Historic District	NHBC	historic dist.		
Archeaological Site	LAAS	arch. area		
4f Property	MPL	4f property		
6f Property	MPL	6f property		
Agricultural Land	LAPB	agricult. land		
Fish & Wildlife Habitat	EHA	critical hab.		
Flood Plains	ENB_P	fld. plains		
Endangered Species	EHA	thr. & end. spec.		
Hazardous Waste	EDEFAULT	haz. waste		
Stormwater	DDEFAULT	Diamond		
USDA-Forest Service Lands	MJPB	Phantom		
Wildlife Habitat Suit/Conn	EHA	Divide		

VT 73 BR 15
Historic Resource ID

PROJECT NAME:	ROCHESTER
PROJECT NUMBER:	BRF 0162(16)
FILE NAME: s10c418base.dgn	PLOT DATE: 29-JUN-2011
PROJECT LEADER:	DRAWN BY:
DESIGNED BY:	CHECKED BY:
RESOURCE ID LAYOUT SHEET	SHEET 1 OF 1

K. O'Shea 7/21/2011

APPENDIX F

PRELIMINARY HYDRAULICS MEMORANDUM

VT AGENCY OF TRANSPORTATION PROGRAM DEVELOPMENT DIVISION

HYDRAULICS UNIT

TO: Chris Williams, Structures Project Manager

FROM: David Willey, Hydraulics Project Supervisor

DATE: July 28, 2011

SUBJECT: Rochester BRF 0162(16) VT 73 Br. 15 over Brandon Brook

---

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

EXISITNG BRIDGE INFORMATION

The existing bridge was built in 1929. It replaced a temporary bridge that was likely installed after the previous bridge was washed out in the 1927 flood. The present bridge is a single span concrete T-beam, with concrete abutments on spread footings. It has a clear span length of about 39' and a clear height of about 9'. There is a 90 degree turn in the road, just off the west end of the bridge.

We reviewed this site in 1976, after an ice jam related flood caused extensive damage to the adjacent property. We did a preliminary hydraulic study, without survey, in 1984. We have correspondence in our file from a project to replace the bridge from 1986 through 1990. We also visited the site to view high ice in 2000.

The stream is straight through the bridge reach. The bridge is centered well on the channel, but constricts the channel width. The bridge should ideally be skewed slightly to be better aligned with the channel, rather than being perpendicular to the road. This site is prone to large amounts of damaging ice.

Our calculations show the existing structure is not adequate hydraulically. Water is up onto the beams below the Q50 and the bridge does not have 1' of vertical clearance above the design Q50, as required to meet the standards. The bridge causes about 2' of backwater at Q50.

RECOMMENDATIONS

As the scope of the project has not been determined, we looked at several options.

Rehabilitation

As noted above, the existing bridge is not adequate to meet the current hydraulic standards. If the existing abutments were to be reused, the bridge would need to be raised about 1.3' to provide 1' of freeboard at Q50 to meet the hydraulic standards. We do not recommend raising the roadway at this site without increasing the bridge span, as that would raise the overtopping relief elevation and could increase upstream flooding. This site has a history of ice jam flooding and there are buildings upstream, so upstream water surface elevations should not be increased. Therefore, any bridge rehabilitation, such as placing a new superstructure on the existing abutments, should not raise the roadway and would not meet the hydraulic standards. If rehabilitation is considered, the hydraulic conditions should not be worsened and the waterway area should not be reduced. If the existing

wingwalls are replaced, flared wingwalls should be used on all corners. We would need to check the effects of any widening, as that might increase upstream water surface elevations, which should not be done at this site. If the abutments were built according to the record plans, the footings are deep enough to meet our current deign policy of 6' below streambed, and based on scour calculations the footings are deep enough for the calculated scour depth.

New Bridge on Existing Alignment or on an Alignment Just Upstream

We recommend a new bridge have a 60' minimum clear span measured perpendicular to the channel. In order to have 1' of freeboard at Q50, as required to meet the standards, the bridge would need at least 8.5' of vertical clearance above the stream bed. Stone fill slopes in front of the abutments should match the upstream and downstream channel banks. Roadway overtopping relief should be maintained on the eastern approach. Thus the eastern roadway approach should not be raised significantly. It is always desirable for a new structure of this size 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. This size bridge would fit the channel well, would lower upstream water surface elevations and reduce the potential for ice jam flooding upstream.

Stone Fill, Type IV should be used to protect any disturbed channel banks or roadway slopes at the structure's inlet and outlet. The stone fill should not constrict the channel or structure opening.

Preliminary hydraulics should be revised if the proposed bridge is going to be located a significant distance upstream or downstream from the existing bridge.

Temporary Bridge

At this time we do not know where a temporary bridge will be placed, if one is needed. For a preliminary sizing, we recommend a bridge with a 50' minimum clear span and at least 8' of vertical clearance above the stream bed. We can refine the temporary bridge size at Final Hydraulics, when we know where it will be located and how long it will be in place. It would be preferable to have any temporary bridge removed before winter, due to the ice potential at this site.

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

DCW

cc: Hydraulics Project File via NJW
Hydraulics Chrono File

ROCHESTER BRF 0162(16), VT 73 Br. 15 over BRANDON BROOK

Preliminary Hydraulics by D.C. Willey - July 28, 2011
PIN 10C418
CADD files on M drive under 10C418
NonCADD files on Z drive under Rochester BRF0162(16)

PROJECT HISTORY and BACKGROUND

The existing bridge was built in 1929. It is a single span concrete T-beam with concrete abutments on spread footings. Record plans show bottom of footings were installed about 5' below the low point of the channel and about 8' below the higher edges of the channel. The previous bridge probably washed out in 1929, as there was a temporary bridge in place in 1929.

The stream is straight through the bridge reach. The bridge is centered well on the channel, but appears to constrict the channel some and the bridge should ideally be skewed some to be aligned with the channel rather than being perpendicular to the road. There is a 90 degree turn in the road just off the west end of the bridge.

We reviewed this site in 1976, after an ice jam related flood caused extensive damage to the adjacent property. We noted several possible causes for the ice jam, including the fact that the stream is steeper upstream and flattens out near the bridge. We have pictures after the ice jam. We did a preliminary hydraulic study, without survey, in 1984. We said the existing bridge was undersized and recommended a larger bridge.

We have correspondence in the file from a project to replace the bridge in 1986 through 1990. Consideration was being given to relocating the bridge to improve the roadway alignment. We attended a site meeting, but there is no indication any other work was done at that time. We have pictures from 1990.

We also have several pictures of high ice from 2000. I was just passing by and took the pictures. No work was done at that time.

A flood insurance study was done for Rochester in 1991. This river was studied by approximate methods, with no detailed study done.

There was no apparent scour during my site visit, and the channel appears to be stable near the bridge. However, a comparison of older bridge inspection pictures to current pictures appears to show the stream has scoured or degraded in front of the abutments, as the weep holes are now higher above the streambed than they were in the past. Record plans show the stream about 3' higher in front of the abutments than in the center of the channel. The channel is now closer to being level from abutment to abutment, so maybe only material in front of the abutments has been getting scoured out. See below under 'Existing Bridge Rehabilitation Evaluation' for more on scour.

Based on scrape marks on trees, it is apparent large ice has overtopped the southern channel bank upstream and downstream of the bridge.

The bridge inspection reports do not indicate any hydraulic problems. They say the bridge is in poor condition. The deck is the worst but the beams and abutments have cracks and deteriorated concrete.

The scope of this project has not been determined. A temporary bridge may be required. The project was recently surveyed using English units and NAVD88 vertical datum. Preliminary Hydraulics was requested.

HYDROLOGY

There is not a detailed FIS for this river. Using our hydrologic methods I arrived at the following: (See hydrology sheets and graph.)

D.A. = 15.8.9 sq. mi.
Q2.33 = 900 cfs
Q10 = 1900 cfs
Q25 = 2500 cfs
Q50 = 3000 cfs
Q100 = 3600 cfs
Q500 = 5000 cfs (Based on 1.4 X Q100.)

HYDRAULICS

I will use Hydraulics Engineering Center - River Analysis System (HEC-RAS) version 4.1.0 for the hydraulic analysis. Survey information required in HEC-RAS was taken from CADD - Inroads. CADD files are on the CADD server under the PMS# 10c418 in the Hydraulics directory. I created a channel line down the middle of the channel. That channel line crosses the roadway centerline at roadway station 4+00. There is an 85 degree angle between the channel and roadway center lines. Channel line stationing runs from 50+00 upstream to 57+50 downstream. Sections were cut along that channel line, from left to right facing downstream. Hec-Ras stationing has to run from downstream to upstream, but the sections are supposed to face from left to right facing downstream. So the section orientation is correct, but the stationing had to be revised to go from downstream to upstream.
The most downstream section in HEC-RAS is at hydraulics channel line sta. 57+25 = HEC-RAS river station 5375. This point is 175' downstream of the center of the bridge, which is at Chan. 55+50 = RS 5550. Inroads Channel Station 50+50 = Hec-Ras river station 6050 at the upstream limit of the study
A channel section station/offset/elevation report file was created in Inroads. That file was converted to channel sections.xls in Excel, and the information copied from there to HEC-RAS.

Downstream conditions used normal depth with a slope of 0.02'/', based on the slope at the downstream section. Upstream conditions used critical depth.

Some sections had to be extended on the ends as survey did not go out far enough to have the end of section above the water elevation.

Running mixed flow resulted in water surface profiles that did not look correct, as different flows crossed each other. For example Q100 was below Q25 at some sections. Running either subcritical or supercritical flow gave better looking profiles, so the problem is with the flow type changing with different flows. When the bridges were added, the flow profiles looked better. So I used the mixed flow results. However, we may decide to use subcritical or supercritical flow results at some point in the future if they seem better.

Existing Bridge HEC RAS Modeling:
The bridge is centered at RS 5550. Bridge width is 20' measured along the channel and the upstream fascia is approx. 40' from upstream river station 5600. So the upstream fascia is at RS 5560. There are no piers. Using the channel alignment as a baseline for the Hec-Ras input

(station offset data) the following are the positions used for the bridge. Upstream section face of abutments are at -18.8' and +20.6', providing a 39.4' clear span and downstream section face of abutments are at -20.6' and +18.8', providing a 39.4' clear span.
Existing roadway elevations were taken from Inroads. The existing bridge has a 39.4' minimum clear span perpendicular to abutments. The roadway overtopping elevation is 1002.5'at about sta. 5+50. The existing finish grade elevation on each end of the bridge was found to be 1004.7' and 1003.7', in CADD. The bridge superstructure depth was determined to be 3.0' to 3.3', from a site visit on 7-19-11. I will use 3.3'. That results in bottom of beam elevations of 1001.4' to 1000.4', with an average of 1000.9'. The stream bed is at elev. 992.1', so the bridge has about 9' maximum of vertical clearance.
Internal bridge sections were adjusted vertically to fit the profile better. Expansion and contraction coefficients were set from .1 and .3 in the natural channel to .2 and .4 through the constriction area caused by the bridge. Ineffective areas were not needed on sections upstream and downstream of the bridge, as the bride does not constrict the natural channel much and there is no floodplain flow.

Existing Bridge Evaluation:
Results show Q50 WS at the first section upstream is 1001.1'. So water is onto the superstructure below the Q50. Thus the bridge does not have 1' of freeboard at Q50 and is not adequate hydraulically. The Q25 is 1000.3', so water is below the low end of the beams at Q25. The bridge constricts the channel and causes about 1.9' of backwater at Q50.

Existing Bridge Rehabilitation Evaluation:
As the scope of the project has not been determined, it is possible they will decide to replace the superstructure on the existing abutments. So I will evaluate and comment on that option.

If the bridge is rehabilitated, the waterway area should not be reduced and flared wingwalls should be used on all corners. We would need to check the effects of any widening, as that might increase upstream water surface elevations, which should not be done. (Widening might lower the upstream fascia, due to the superelevation, as well as move the upstream fascia upstream where the channel is higher. It also makes the structure longer along the channel.)

I modified the existing bridge input by raising the superstructure to see how much it would need to be raised to get 1' of freeboard at Q50. For this quick check, I did not raise the approach roadways. In order to provide 1' of freeboard, a new superstructure on existing abutments would need to be raised 1.3' higher than the existing. I don't think the road should be raised without a larger bridge, based on past ice jam floods. We do not want to create a dam effect. Also it would not be practical to raise the road very much due to site constraints. Therefore, it is not practical to place a new superstructure on the existing abutments and meet the hydraulic standards. Due to the fact the bridge does not meet the hydraulic standards, and the history with ice jams, it would be preferable to replace the bridge with a larger one. Maintaining or slightly improving the existing conditions would not meet standards but might be acceptable.

Record plans show bottom of footings were installed about 5' below the low point of the channel and about 8' below the higher edges of the channel. Record plans show bottom of east footing 18.3' below finish grade, which is now 1003.7', thus bottom of footing at 985.4'. Bottom of west footing 19.3' below finish grade which is now 1004.7', thus bottom of footing also at 985.4'. Low point of stream bed is now 991.3', so bottom of footings are about 6' below the bottom of streambed. So it appears 2' or 3' of material in front of the abutments may have washed out over the years, but the low point of the channel is still about the same as in 1929.

There does not appear to be any degradation or scour and if built according to plans, footings are deep enough to meet our current deign policy of 6' below streambed.

I ran scour calculations for the existing bridge. I used a D50 of 130 mm (5"), based on my site visit. The streambed is made up of cobbles and boulders. Maximum contraction scour up to Q100 contraction scour was 0.8' and Q500 contraction scour was 1.5'. So the existing abutments should be ok for scour.

New Bridge HEC RAS Modeling:
Per Chris Williams, a new bridge may be on existing alignment, with a temporary bridge upstream, or a new bridge may be upstream with traffic maintained on the existing bridge.

To simplify the preliminary hydraulics and because the scope has not been determined, I will analyze a new bridge on existing alignment. New bridge HEC-RAS sections will be the same as those used for the existing bridge. Bridge width was estimated to be is 32', measured along the channel and the upstream fascia was input 34' from Station 2600. That keeps the bridge centered on the existing alignment. A new bridge will need to be larger to meet the standards. My field notes say a new bridge should be about 10' longer to fit the channel better. That would result in a bridge with a 50' clear span. That length looks ok on the channel sections and layout. The abutments should be aligned with the channel. Using the channel alignment as a baseline for the Hec-Ras input (station offset data) the following are the positions I used for the abutments at the u/s and d/s locations: Face of abutments = -25' and +25', providing a 50' clear span. There will be no piers.

The Q50 W.S. elevation for this bridge is 1000.3', so the bottom of bridge superstructure would need to be at elevation 1001.3' to provide 1.0' of freeboard at Q50. That would be about 0.4' higher than the existing bridge. The roadway might have to be raised even more, as the longer bridge may require a deeper superstructure depth. I am not sure if that can be done with the site constraints, and it might not be desirable hydraulically.

Next I tried a bridge with a 60' clear span. Q 50 would be 999.3', so the bottom of bridge superstructure would need to be at elevation 1000.3' to provide 1.0' of freeboard at Q50. That would be about 0.6' lower than the existing bridge. The 60' span improved hydraulics considerably compared to the 50' span. The Q50 for this bridge is 1.8' lower than with the existing bridge, so the bridge would be a big improvement. Spans much longer than 60' don't improve hydraulics much, as the abutments are near the top of banks and do not constrict the channel. So I will recommend a new bridge have a 60' minimum span. I am not sure how much deeper the superstructure would need to be compared to the existing. HEC-RAS does not show any roadway overtopping up to Q100, but ice jam flooding could be higher, so roadway overtopping relief should be maintained. The roadway could be raised a little at the bridge as long as the approach roadway is not raised considerably. Site constraints will prevent the roadway from being raised much anyway.

A new bridge upstream should have the same 60' minimum clear span length. The bottom of beams will have to be higher to provide the same waterway area at the upstream location. Vertical clearance for the 60' bridge on existing alignment is 1000.3' – chan.bot. 992.1' = 8.2'. That is the minimum height I will recommend, and I will round it up to 8.5'.

Temporary Bridge
A temporary bridge would probably be upstream, although nothing has been decided yet. I will do a very preliminary sizing at this time. We can refine it when we know where the temporary

bridge will be located. I will design it to be left in place over the winter, although I will recommend it not be left in place over the winter due to ice concerns at this site. In selecting a temporary bridge length, I tried to keep the abutments back out of the channel. A 50' clear span would be ok. I used the 50' bridge information from above. I recommend an 8' minimum clear height. That will provide about 1.3' of freeboard at Q25 and 0.4' at Q50. This size temporary bridge will exceed all the spec book requirements. It will be longer than the existing bridge and almost as high as that bridge. This is a state route, the bridge may be left in place over the winter, ice is a big concern at this location and I don't know where the bridge will be located. So conservative sizing is warranted at this time. We can refine this when we know where the bridge will be and whether it will be in place over the winter.

404 Permit Information

Average Daily Flow = 30 cfs — See 404 permit spreadsheet. Based on old methods.
Ordinary Low Water = 15 cfs — " "
Ordinary High Water = 400 cfs

Stone Fill

I recommend Type IV, based on the size of stones in the channel and on the channel banks. Ice forces are high here.

HEC RAS Models created:
Natural channel
Existing 39.4' clear span bridge
New 50' clear span bridge
New 60' clear span bridge

APPENDIX G

SUBSURFACE INVESTIGATION MEMORANDUM

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

To: Jennifer Fitch, Structures Project Manager

NSM CCB

From: Nicholas S. Meltzer, Geotechnical Engineer, via Christopher C. Benda, P.E., Soils and Foundations Engineer

Date: April 27, 2012

Subject: Rochester BRF 0162(16) Preliminary Information

1.0 INTRODUCTION

We have completed our preliminary investigation for the proposed replacement of Bridge 15 on VT 73, in the town of Rochester, VT. The proposed project includes the replacement of the existing bridge with a new structure, with related channel and approach work. Contained herein are the results of our subsurface investigation and foundation recommendations.

2.0 FIELD INVESTIGATION

The field investigation was conducted between April 11th and April 16th, 2012. Four standard penetration borings were drilled to determine the subsurface profile to aid in design and construction. A summary of the location of each boring can be found in Table 1. The values for the northings and eastings found on the logs are based on the Vermont State Plane Grid NAD 83 Coordinate System.

Table 1. Boring Locations

Boring	Station (ft)	Offset (ft)	Ground Elev. (ft)	Depth of Bedrock
B-101	3+69.8	-15.1	1004.1	35.0
B-104	4+30.2	18.7	1000.2	32.0

Two borings were initially completed at opposite corners to determine soil information for design. Sampling was continuous for 20', and then taken at 5' intervals thereafter, until bedrock was encountered, upon which it was cored for 10'. When bedrock was encountered at a relatively level elevation, it was determined the borings at the additional two corners were no necessary.

Soil samples were visually described in the field and SPT blow counts were recorded on the boring logs. Soil samples were then preserved and returned to the Materials and Research Laboratory for testing and further evaluation. Upon completion of the laboratory testing, the field boring logs were revised to reflect the results of the laboratory classification tests. The attached boring logs indicate the types of soils and strata encountered and include the laboratory test results, SPT data, and any pertinent observations made by the boring crew.

3.0 FIELD AND LABORATORY TESTS

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 2.0 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 45 Track Rig was used, with a C_E=1.34. This value, included on the boring logs, was used in calculations to determine soil parameters. Selected specimens obtained from the standard penetration borings were tested in the laboratory to assess their physical properties. Moisture contents were determined, as well as the percent of each soil type. Boring logs can be found attached.

A detailed description of the rock cores is presented on the logs including run length, drill times, recovery and Rock Quality Designation (RQD). Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. In accordance with ASTM D6032, 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. The Rock Mass Rating (RMR) is also included on the logs, which is AASHTO's preferred classification of rock cores, and in based on five different parameters, that all have relative ratings which combine to form the RMR. Additional information can be found in AASHTO Section 10.4.6.4

4.0 RECOMMENDATIONS

Based on this information, integral abutments are a feasible alternative. The Agency's *Integral Abutment Bridge Design Guidelines, 2008 Edition*, should be consulted, and is available on our website.

If additional foundation options would like to be discussed, or a detailed analysis completed, please contact us.

5.0 CONCLUSION

Computer generated boring logs are attached and are available at:
M:Projects\10c418\MaterialsResearch.

If you would like to discuss this report or have any other questions, please contact us by phone at (802) 828-6911, or via email at Nick.Meltzer@state.vt.us.

Attachments: Boring Logs (2)

c: Project File/CCB
NSM

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

BORING LOG

ROCHESTER
BRF 0162(16)
VT-73 BR-15

Boring No.: **B-101**
Page No.: 1 of 1
Pin No.: 10C418
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/11/12 Date Finished: 4/11/12
VTSPG NAD83: N 495621.99 ft E 1542259.40 ft
Station: 3+69.77 Offset: -15.13
Ground Elevation: 1004.1 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
04/12/12	10.8	AM

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, SiGrSa, brn, Moist, Rec. = 1.4 ft				2-2-3-3 (5)	14.4	22.1	56.6	21.3
		A-1-b, GrSa, brn, Moist, Rec. = 0.6 ft, NXDC				4-4-3-3 (7)	8.0	39.8	43.1	17.1
5		A-1-b, GrSa, brn, Moist, Rec. = 1.0 ft, NXDC				4-3-3-3 (6)	12.5	35.8	54.6	9.6
		Field Note:, No Recovery				2-3-2-3 (5)				
		Field Note:, No Recovery				R@5.0"				
10		Field Note:, NXDC, Cobbles Visual Description:, Broken Rock with silty sand, brn, Moist, Rec. = 0.2 ft Field Note:, NXDC, Cobbles				5-R@1.0"	28.5			
15		A-1-b, SaGr, brn, Wet, Rec. = 0.4 ft				5-3-3-4 (6)	16.5	48.7	38.8	12.5
		Visual Description:, Broken Rock with sandy gravel, brn, Moist, Rec. = 0.4 ft, NXDC				4-6-13-15 (19)	14.9			
		A-1-b, SaGr, brn, Moist, Rec. = 1.2 ft				12-12-15-17 (27)	13.3	43.0	42.5	14.5
20		Field Note:, NXDC, Gravel								
		A-1-b, SaGr, brn, Moist, Rec. = 1.4 ft				9-11-13-15 (24)	12.7	42.7	42.4	14.9
25		Field Note:, NXDC, Cobbles								
30		A-1-b, SiSaGr, brn, Moist, Rec. = 1.0 ft, Broken Rock was within sample. NXDC.				5-17-7-4 (24)	14.7	45.7	30.9	23.4
		Visual Description:, Broken Rock with some weathering, gry, Moist, Rec. = 0.6 ft				24-R@1.0"	9.4			
35		35.0 ft - 40.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Schist, with minor beds of quartzite. Moderately hard, Unweathered, Fair rock, NXMDC, Closely spaced joints. RMR = 44	1 (65)	96 (42)	4 2 3 4 4	Top of Bedrock @ 35.0 ft				
40		40.0 ft - 45.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Schist, with minor beds of quartzite. Moderately hard, Unweathered, Fair rock, NXMDC, Closely spaced joints. RMR = 49	2 (65)	96 (78)	4 4 4 5 4					
45		Hole stopped @ 45.0 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 of groundwater may occur due to other factors than those present at the time measurements were made.

BORING LOG 2 ROCHESTER BRF 0162(16).GPJ VERMONT AOT.GDT 4/26/12

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

BORING LOG

ROCHESTER
BRF 0162(16)
VT-73 BR-15

Boring No.: **B-104**
Page No.: 1 of 1
Pin No.: 10C418
Checked By: NSM

Boring Crew: SALISBURY, GARROW
Date Started: 4/12/12 Date Finished: 4/16/12
VTSPG NAD83: N 495555.70 ft E 1542284.34 ft
Station: 4+30.24 Offset: 18.71
Ground Elevation: 1000.2 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
04/16/12	7.8	AM

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, GrSa, brn, Moist, Rec. = 1.2 ft, NXDC				2-3-17-5 (20)	15.3	39.3	44.9	15.8
		Field Note:, NXDC, Cobbles								
		SaGr, grn, Moist, Rec. = 0.6 ft, 3.0 ft - 3.8 ft, Lots of Broken Weathered Rock.				10-R@3.5"	8.5	62.1	24.4	13.5
5		Field Note:, NXDC, Boulders & Cobbles, Very hard rock. Had to change bit.								
10		Field Note:, NXDC, Cobbles								
		Visual Description:, Wood with sandy gravel, blk, Moist, Rec. = 0.3 ft				8-R@2.5"				
		Field Note:, NXMDC, Concrete, Possible spread footing.								
		Field Note:, NXDC, Sand								
15		A-1-b, GrSa, brn, Moist, Rec. = 0.8 ft, Broken Rock was within sample. NXDC.				7-13-16-16 (29)	12.3	42.0	44.0	14.0
		A-4, Si, brn, Moist					28.4	0.2	5.9	93.9
		A-4, Si, gry, Moist, Rec. = 0.8 ft, A very thin layer of clay was noticeable, but the total sample was non-plastic.				5-4-4-6 (8)	34.1	2.5	1.7	95.8
20		Rec. = 1.2 ft				7-5-5-8 (10)				
25		SaGr, grn-brn, Moist, Rec. = 1.2 ft, 24.0 ft - 26.0 ft, Lots of Broken and some Weathered Rock. NXDC.				8-12-10-14 (22)	11.2	60.3	26.8	12.9
		Field Note:, NXDC, Cobbles								
30		SaGr, grn-brn, Moist, Rec. = 1.0 ft, 29.0 ft - 31.0 ft, Lots of Broken and some Weathered Rock. NXDC.				18-30-18-35 (48)	10.5	50.5	30.8	18.7
		Lab Note, Boulder								
		32.0 ft - 36.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Schist, with minor beds of quartzite. Moderately hard, Slightly weathered, Poor rock, NXMDC, Closely spaced joints. RMR = 33	1 (65)	97 (12)	2 4 3 3	Top of Bedrock @ 32.0 ft				
35		36.0 ft - 41.0 ft, Light-greenish-gray to pale-green, chlorite-muscovite-quartz Schist, with minor beds of quartzite. Moderately hard, Poor rock, NXMDC, Top 0.4' moderately to severely weathered. 38.0' - 38.4' moderately weathered. Remainder of core run unweathered. Closely spaced joints. RMR = 33	2 (65)	56 (8)	3 5 3 5 5					
40		Hole stopped @ 41.0 ft								
45										

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 BRF 0162(16).GPJ VERMONT AOT.GDT 4/26/12

APPENDIX H

TRAFFIC DATA

CPW

AGENCY OF TRANSPORTATION **OFFICE MEMORANDUM**

POLICY, PLANNING AND INTERMODAL DEVELOPMENT DIVISION

TO: Christopher P. Williams, Structures Project Manager

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

DATE: July 18, 2011

RE: Rochester BRF 0162(16)
VT 73, BR #15 > Also use for Rochester BRF 0162(17) VT 73, Br. 16

As requested in your May 31, 2011 email, 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	770	810	~
DHV	160	160	~
ADTT	65	100	~
%T	8.7	12.6	~
%D	65	65	~
FLEXIBLE ESAL	~	2014~2034 398,000	2014~2054 950,000

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

APPENDIX I

PROJECT PURPOSE AND NEED STATEMENT

ROCHESTER

BRF 0162(16)

VT 73 Bridge #15 over Brandon Brook

Project Purpose & Need:

The purpose of the project is to replace the existing structure with one that is hydraulically adequate, increase the bridge width, and improve the roadway alignment. The existing hydraulically undersized structure has a history of flooding due to ice jams. This bridge is also at the end of its design life and is structurally deficient.

The need for the project is due to a hydraulically undersized structure, a structurally deficient bridge, and a narrow bridge width.

Right of Way

New ROW Acquisition fee simple Yes X No _____

permanent easement Yes X No _____

temporary easement Yes X No _____

Description of taking: land immediately upstream from Bridge #15 on the south bank of the channel.

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 X No _____ Date TBD

Comments by Local Officials/RPC's: Channel constriction is a problem for water and ice. The roadway alignment needs to be fixed.

APPENDIX J

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 BRF 0162(16)
VHB Vanasse Hangen Brustlin, Inc.