

**To:** Chris Williams, Project Manager, Structures

**From:** Chad A. Allen, Geotechnical Engineer via Christopher C. Benda, Soils and Foundations Engineer

**Date:** June 6, 2012

**Subject:** Calais BHF 037-1(12) VT 14, Bridge 77 Geotechnical Scoping Report

---

## 1.0 Introduction

In an effort to assist the Structures Section with their bridge type study, the Soils and Foundations Unit within the Materials and Research Section has completed a review of available geological data for Bridge 77 on VT 14. Bridge 77, see Figure 1, is a single span structure that crosses over the Kingsbury Branch River in Calais, VT. This scoping report includes a review of VTrans record plans, USDA Natural Resources Conservation soil survey records, surficial geology and bedrock maps of Vermont and the Agency of Natural Resources' water well logs.



Figure 1: VT 14, Bridge 77 over Kingsbury Branch River

## 2.0 Surficial and Bedrock Geology

The Agency of Natural Resources (ANR) documents and publishes all reported water well information for wells drilled for both residential and commercial purposes. Published online, the logs can be used to determine general characteristics of soil strata in the area. There may be undocumented water wells that are not discussed herein. In addition, the soil description

recorded on the logs is provided by field personnel with unknown qualifications, and as such, should only be used as an approximation. Surrounding well logs were examined for depths to bedrock and soil strata. Well locations are shown in Figure 2 and a summary of the specific wells used to gain information on the subsurface conditions are presented in Table 1. The two closest wells, wells No. 254 and 33649 are located between 150 and 675 ft from the project location.

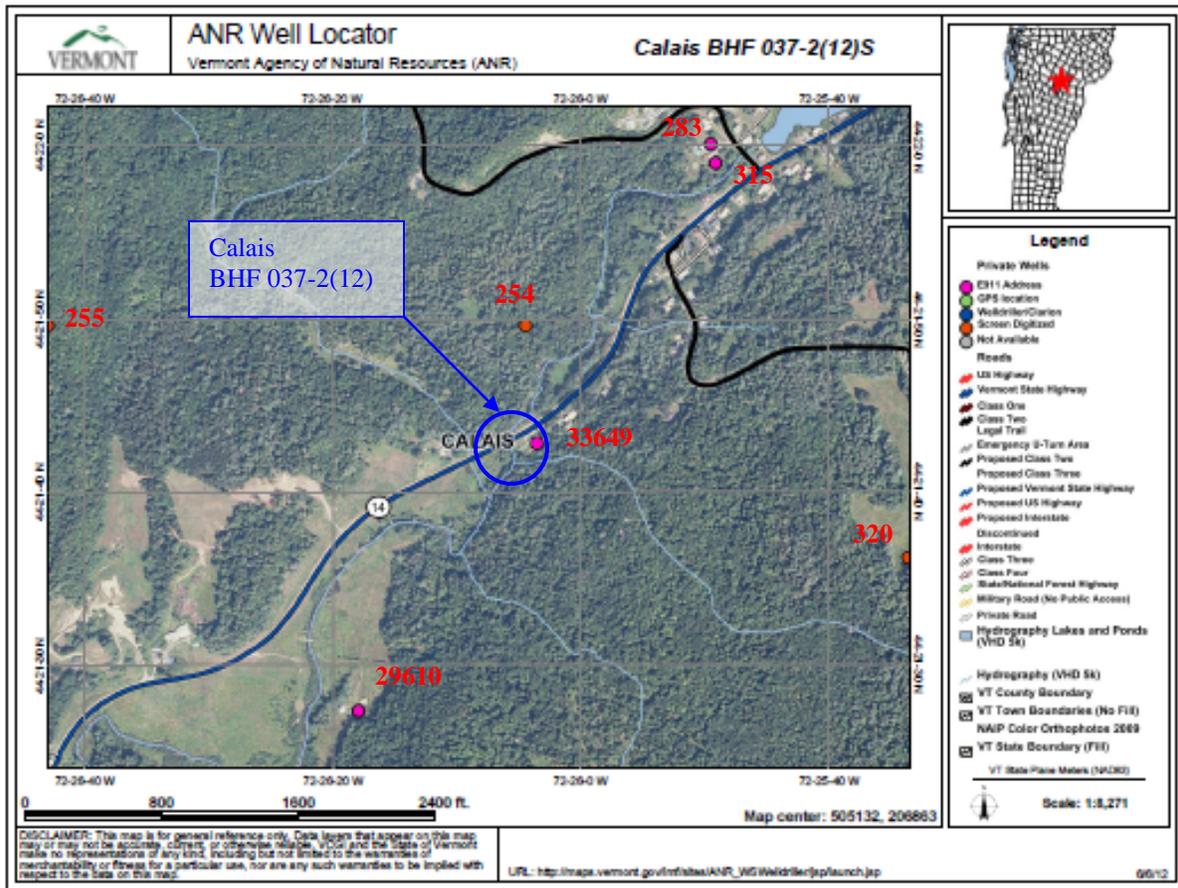


Figure 2: ANR Well Locations near Bridge 77 – VT 14 in Calais, VT

Well	Overburden Description	Overburden Thickness
254	Sand / Silt	80
33649	Unknown	40

Table 1: Summary of ANR Well Data & Well Driller Soil Stratigraphy Notes

The Calais BMA 6759 project plans from the late 1970s indicate that the bridge deck was widened and new wingwalls were constructed to support the widening of VT 14. The footings for the substructure appear to be spread footings. These plans do not indicate the soil stratigraphy beneath the existing bridge.

The 1970 Surficial Geologic Map of Vermont indicates that the Calais BHF 037-2(12) project site is located in an area classified (primarily) as Machias fine sandy loam with 3 to 8% slopes and that the geological landform is likely a terrace or kame consisting of coarse loamy glaciofluvial deposits over sandy and gravelly glaciofluvial deposits. The geography of the area, the streambed which appears to be gravelly sand with cobbles (See Figure 3) and the subsurface

information from Well 254 of the ANR Well Logs corroborate the information from the surficial geology map.

Driller's information reported for Well 254 indicates that bedrock may be at a depth of 40 ft. The abutments and wingwall heights are between 15 and 20 ft which would place the top of bedrock with 20 to 25 feet of the bottom of footing locations. Surficial bedrock maps of the area indicate that the existing bedrock deposit is of the Waits River formation (DSw) and likely consists of a combination of phyllite and limestone.

### **3.0 Utility / Construction Considerations**

This bridge is in a high speed (50 mph) rural setting. There are overhead wires along the west side of the highway. Temporary bridge construction could be problematic as the river runs tight to the west side and there is a house/business on the northern end of the west side. Potentially, a temporary may be installed to land in the parking lot at the north end of the bridge. If the temporary structure could be skewed it may reduce or eliminate potential traffic conflicts with the home/business.

Consideration should be given to orchestrating the construction of VT 14 Bridges 74 and 77 so that both projects have complete closures detouring traffic onto TH 38 (Max Gray Rd) and TH 4 (Marshfield Rd). Homes and businesses between the bridges could utilize TH 36 (Peck Hill Rd) to get back onto VT 14.

### **4.0 Recommendations**

The existing bridge is a 38 ft long, straight single span structure. The current grade difference between the abutments is negligible. The bridge is located at a bend in the river and the channel seems to be migrating south towards the southern abutment, see Figure 3. Consideration of the migration of the stream should be given, which may result in an increase in the overall superstructure length.



Figure 3: Bridge 77 Elevation View

The subsurface investigation should include, but not be limited to, a determination of the soil and bedrock properties (strength, material composition, RQD, etc), ground water conditions and the bedrock depth. Two borings are recommended to be drilled to completely assess the subsurface conditions at this site. One boring should be located in the right-of-way at the northeast and southwest corners of the proposed bridge abutment locations. The boring located in the southwest corner should be placed 15 to 20 ft behind the abutment to prevent drilling through the concrete footing.

Borings should be positioned a minimum of 10 feet away from any overhead power lines. Final recommendations for boring locations can be provided once an alignment and preliminary structure type have been selected. Temporary traffic control, including flaggers, may be necessary at this site to facilitate a safe work zone.

There does not appear to be any serious drilling equipment and/or access limitations, except for the overhead wires at this site. Bedrock is anticipated to be shallow. An integral abutment structure may be a good solution at this location and could provide the space necessary for the lateral migration of the stream. Integral abutment bridges appeared to hold up well during Irene even when the abutment backfill was hydraulically removed.

Based on the information in this scoping report, possible foundation options for this bridge replacement project include the following:

- Reinforced concrete abutments on spread footings, or
- Precast arch supported on spread footings (may be a good site for the “Bridge in a Backpack structure <http://www.maine.gov/mdot/tr/bridgebackpack.htm>), or an
- Integral abutment bridge on steel H-piles.

If you have any questions, please feel free to contact us at (802) 828-2561.

cc: WEA/Read File  
CCB/Project File