

Town of Groton- Municipal Road Erosion and Stream Crossing Inventory and Capital Budget (2015-2019)



Prepared by: Brent Smith (Town of Groton), Doug Morton (NVDA), Jim Ryan (VT DEC), and Pat Ross (VT DEC)

Funding provided by: VTrans Better Backroads (BBR) program, with in-kind match from the Town of Groton, NVDA, and VT DEC

Table of Contents

Introduction

Methods

Capital Budget Summary Table

High Priority Road Erosion Remediation Sites

Minard Hill Road (lower)

Ricker Mill Road

Great Road

Buzzy Road

Glover Road

High Priority Stream Crossing Sites

Heath Road

Minard Hill (upper)

Brock Road

Harvor Road

Additional Stream Crossings

Great Road

Powder Spring Road

Appendix- Road Best Management Practice Specifications

Introduction

This report identifies the top town road infrastructure improvement needs that will guide the town in prioritizing road erosion remediation and stream crossing replacements. By implementing this plan, the town will improve the management of its transportation infrastructure, reduce on-going road maintenance costs, reduce sediment and nutrient sources to the town's waterways, improve habitat for aquatic organisms, while increasing the flood resiliency of the town's transportation infrastructure.

Methods

The following steps were completed in the development of this report:

- funding secured from the BBR program,
- kick-off meeting with the town, NVDA and DEC,
- Review of *Road Erosion Risk Analysis* map for the town (ANR Natural Resources Atlas)
- Initial Windshield survey to visit all high and medium erosion risk sites
- Review of the DMS and previous culvert assessments
- Three follow-up site visit days to prioritize sites, take measurements, take photographs, and develop conceptual remediation measures
- Preparation of maps, cost estimates, and survey data in development of this document
- Stream crossing sizing by USGS Stream Stats for drainage area and Q25, Q50 and Q100 discharge numbers, field bankfull width data collection, and Headwater Depth Nomographs. Based on 2' structure burial depth to accommodate AOP.
- Stream crossing unit cost and construction materials estimates- Groton Road Foreman from suppliers

Road Infrastructure Capital Budget Summary- Town of Groton

Site Number	Site Name	Treatment Description	Town implemented or sub-contracted?	Total estimated project cost	Estimated Grant contribution (potential funding source)	Estimated Town contribution (cash or in-kind)
1	Minard Hill Road (lower)	Road embankment stabilization, floodplain restoration, and culvert header	Town	\$4,025	\$3,019 (BBR)	\$1,006
2	Ricker Mill Road	Drainage culvert installations, outlet apron, grass and stone-lined ditch	Town	\$9912	\$7,434 (BBR)	\$2,478
3	Great Road	Stone-lined ditching and turnouts	Town	\$10,240	\$7,680 (BBR)	\$2,560
4	Buzzy Road	Road embankment stabilization, stone-lined ditch and turnouts	Town	\$5,865	\$4,399 (BBR)	\$1,466
5	Glover Road	Road embankment stabilization with retaining wall and riprap, drainage culverts, stone-lined ditching and floodplain restoration	Town	\$18,010	\$13,508 (BBR)	\$4,502
6	Heath Road	Replacement of undersized double culverts	Sub-contracted	\$52,136	\$41,709 (TH Structures program)	\$10,427
7	Minard Hill Road (upper)	Replacement of undersized culvert	Sub-contracted	\$149,671	\$119,737 (TH Structures program)	\$29,934
8	Brock Road	Replacement of undersized culvert	Sub-contracted	\$44,933	\$35,947 (TH Structures program)	\$8,986
9	Harv Orr Road	Replacement of undersized culvert	Sub-contracted	\$41,468	\$10,000 (BBR) class 4 road*	\$31,468

Highest Priority Road Erosion Remediation Sites:

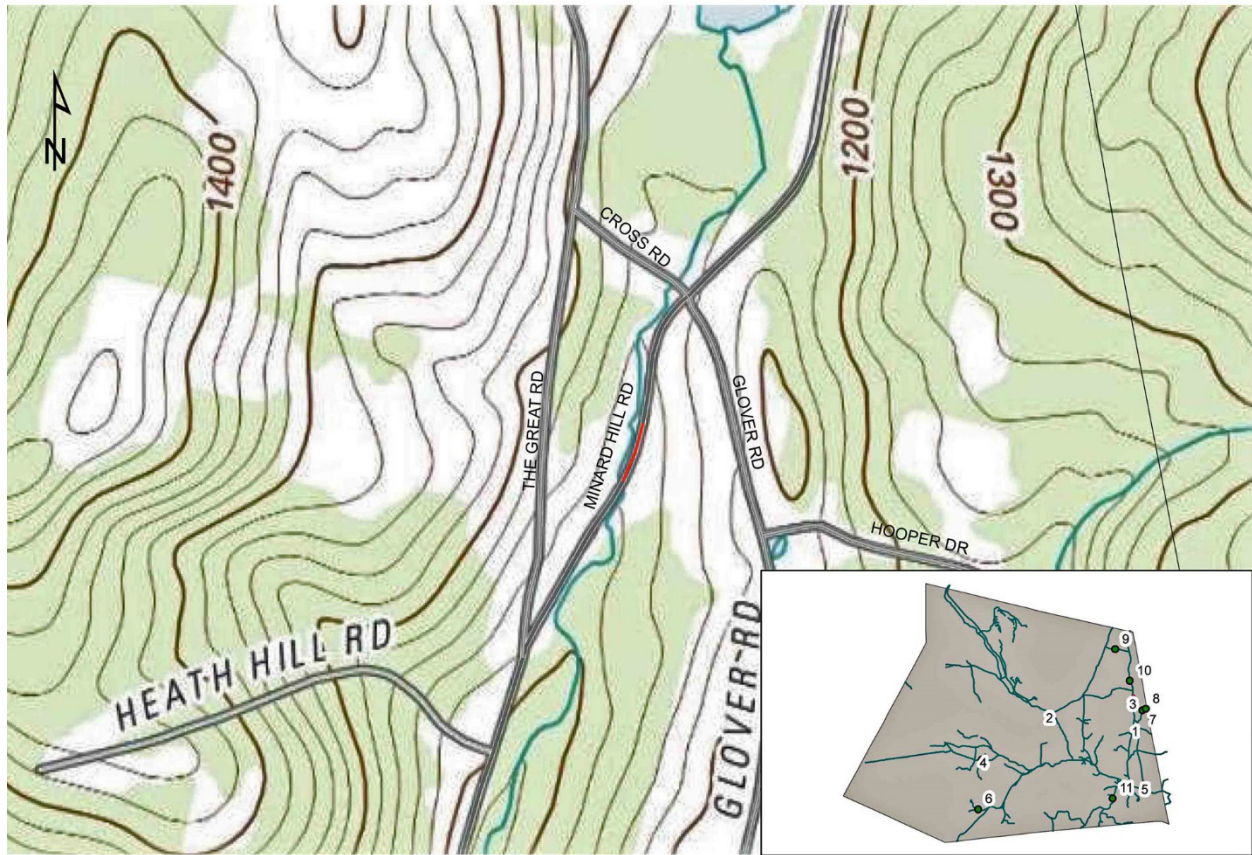
Road Erosion Remediation Sites	TH	Impacted Waterway
Minard Hill Road- lower	2	Tannery Brook
Ricker Mill Road	65	Ricker Pond
Great Road	5	North Branch Wells River trib
Buzzy Road	27	Heath Brook trib
Glover Road	13	Clark Hatch Brook

1. Minard Hill Road (Lower)

The problem- River-road conflicts have reoccurred at this site on numerous occasions resulting in damage to the town highway road embankment. The road bed is acting as a floodplain encroachment limiting full access to the remaining active floodplain, pinching the brook against the road embankment. A poorly aligned and undersized stream crossing, aggravates the erosion problems. The existing culvert header is beginning to fail and erode.



Site Location #1 Minard Hill (Lower)



The proposed treatment- Install 25 LF of road embankment riprap, replace 25 LF of failing culvert riprap, and partially restore the floodplain. The landowner should be approached to discontinue mowing up to the stream edge and to establish a woody riparian buffer. A longer term fix would be to replace this culvert with a bankfull plus crossing allowing for aquatic organism passage. (see riprap typical)

***Construction quantities and cost-estimates-** based on town crew equipment and labor for implementation

Materials/Equipment	Quantity	Cost per unit	Total cost
Type 4 riprap	75 CY	\$15/CY	\$1,125
Backhoe	16 hours	\$100/hour	\$1,600
Trucking	16 hours	\$75/hour	\$1,200
Seed and mulch	-	-	\$100
Total			\$4,025

Construction Notes:

- Construction Specification guidelines for culvert header and riprap- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998 (See Appendix for specific BMP specification)
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer.

2. Ricker Mill Road

The problem- Ricker Mill Road is a very steep road with inadequate road drainage treatments. This is resulting in significant sedimentation entering Ricker Pond at the downhill end of the road. There is a firewood processing business at the top of the road with frequent truck traffic. The paved road surface is in poor condition.

The proposed treatment- Install 200 LF of grass-lined drainage ditch, 460 LF of stone-lined ditch, a stone-lined turnout, culvert outlet apron/splash pad, and replace a driveway culvert.



Site Location #2 Ricker Mill Rd



*Construction quantities and cost-estimates- based on town crew equipment and labor for implementation

Materials/Equipment	Quantity	Cost per unit	Total Cost
Ditch stone- 8" minus	125 CY	\$12/CY	\$1,500
Splash pad stone- 8" minus	16 CY	\$12/CY	\$192
Culvert- 15"	60 LF	\$12/LF	\$720
Seed and mulch	-	-	\$500
Backhoe	40 hours	\$100/hour	\$4,000
Trucking	40 hours	\$75/hour	\$3,000
Total			\$9,912

Construction Notes:

- Construction Specification guidelines for culverts installation, grass and stone-lined ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998

- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.

3. Great Road

The problem- This section of Great Road is a steep with inadequate road drainage systems in place causing significant sediment to enter this tributary to the North Branch.



Site Location #3 Great Rd



The proposed treatment- Install 900 LF of stone-lined ditching on both the east and west sides of the road and two stone-lined turnouts. *There is buried wire at this site- Use Caution*

***Construction quantities and cost-estimates-** based on town crew equipment and labor for implementation

Materials/Equipment	Quantity	Cost per unit	Total Cost
Ditch stone- 8" minus	270 CY	\$12/CY	\$3,240
Backhoe	40 hours	\$100/hour	\$4,000
Trucking	40 hours	\$75/hour	\$3,000
Total			\$10,240

Construction Notes:

- Construction Specification guidelines for stone-lined ditches and turnouts- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and*

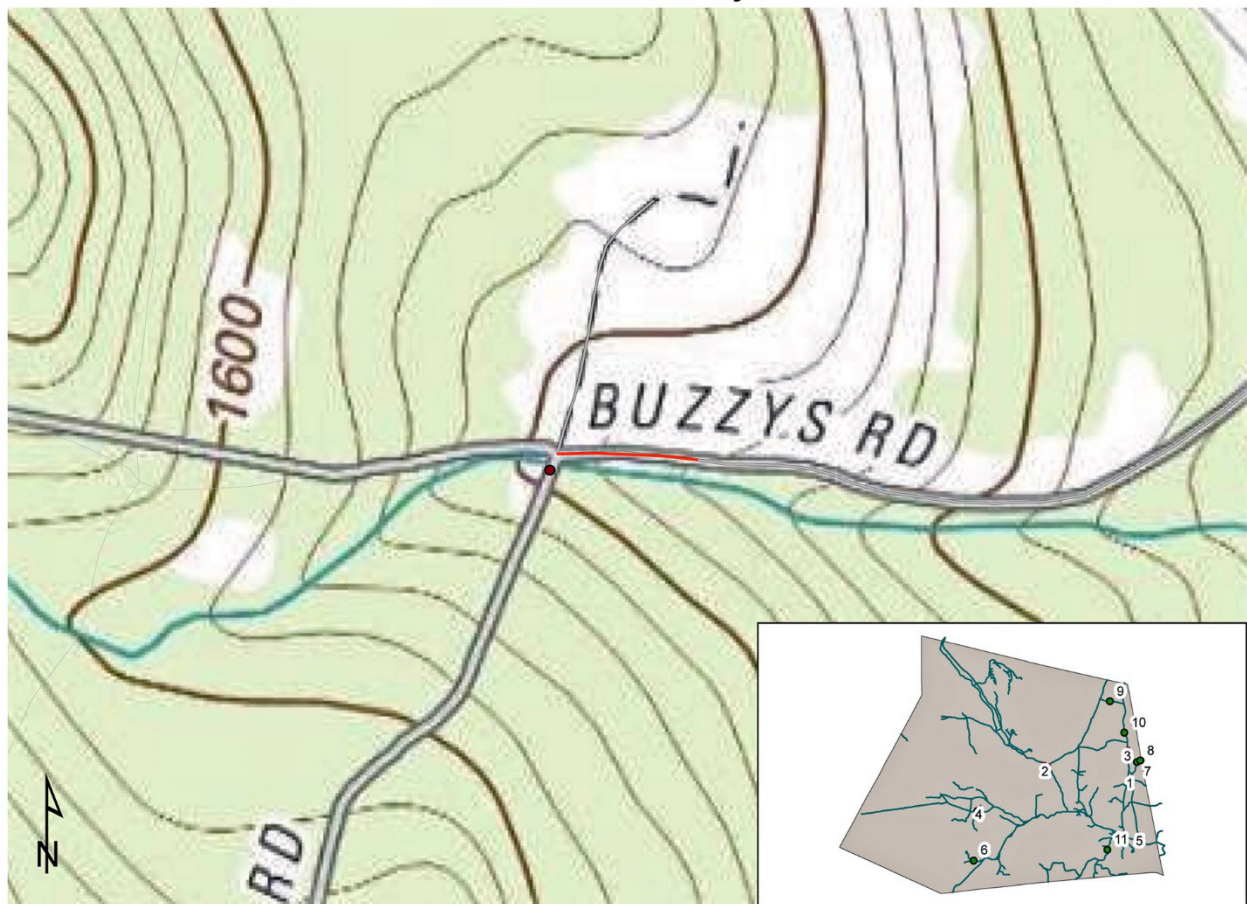
Specifications for Erosion Prevention and Sediment Control 2006 & the VTrans Hydraulic Manual 1998

- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.

4. Buzzy Road

The problem- The road embankment is encroaching on the stream floodplain causing road shoulder erosion. One of the existing turnouts is outletting sediment directly to the stream. The road drainage system needs to be upgraded.

Site Location #4 Buzzy Rd



The proposed treatment- armor 25 LF of the road shoulder with riprap, install 300 LF of stone-lined ditch, re-locate turnout so that it does not directly outlet to the stream.

***Construction quantities and cost-estimates-** based on town crew equipment and labor for implementation

Materials/Equipment	Quantities	Cost per unit	Total Cost
Riprap- Type 4 rock	35 CY	\$15/CY	\$525
8" minus	95 CY	\$12/CY	\$1,140
Backhoe	24 hours	\$100/hour	\$2,400
Trucking	24 hours	\$75/hour	\$1,800
Total			\$5,865

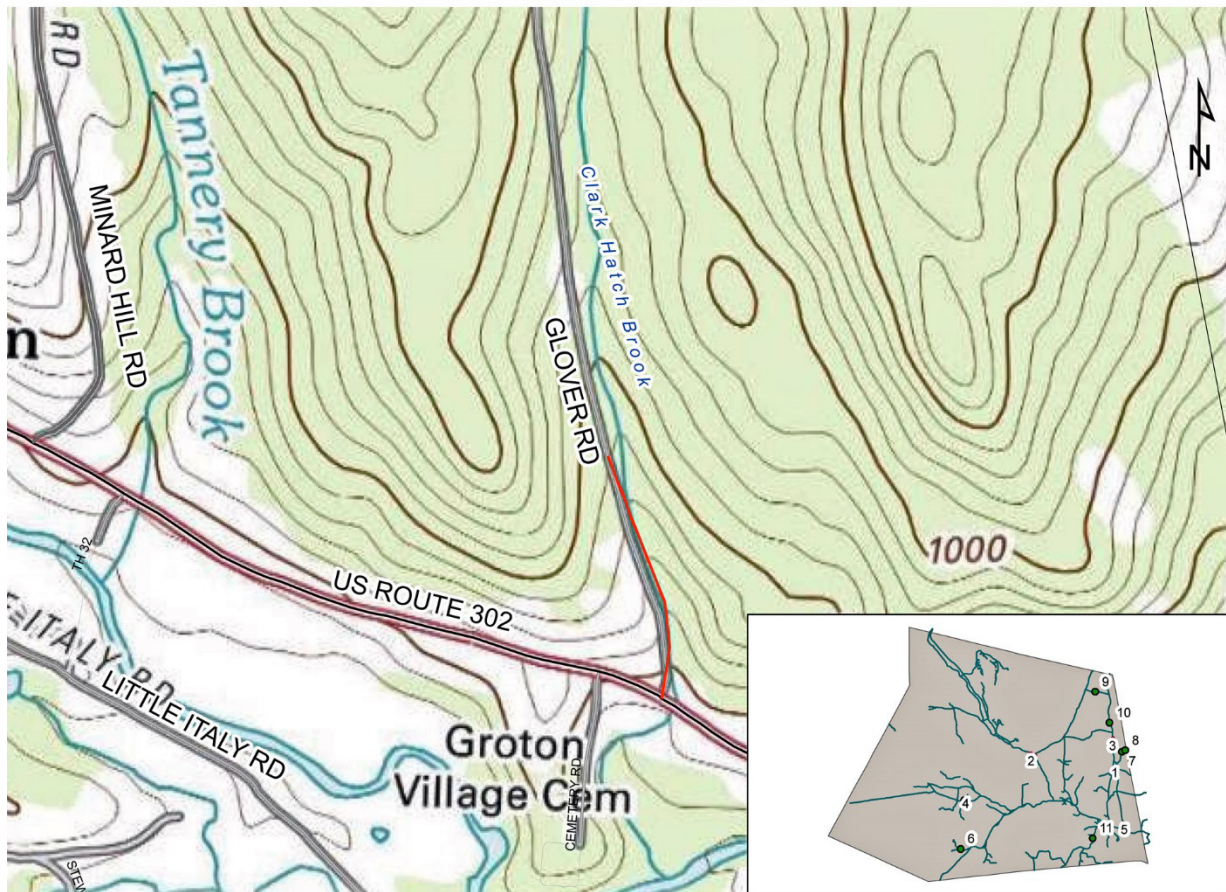
Construction Notes:

- Construction Specification guidelines for riprap, stone-lined ditches and turnout structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer

5. Glover Road

The problem- the Glover Road is acting as a significant floodplain encroachment and reducing the brook's access to its active floodplain. This river-road conflict has caused re-occurring road embankment failures and sedimentation to the waterway. Additionally, inadequate road drainage systems are causing road shoulder erosion.

Site Location #5 Glover Rd



The proposed treatment- Install 75 LF of road embankment riprap, install 50 LF of retaining wall, re-locate 150 LF of road as indicated to restore active stream floodplain area, re-grade and lower road shoulder on east side of road, install 625 LF of stone-lined ditch, and install 3 new driveway/road drainage culverts. (*Buried cable at site- Use Caution*)

***Construction quantities and cost-estimates-** based on town crew equipment and labor for implementation

Materials/Equipment	Quantities	Cost per unit	Total cost
Riprap- Type 4 stone	150 CY	\$15/CY	\$2,250
Retaining wall blocks (2'x2'x6')	40 waste concrete blocks	\$50/per block	\$2,000
Delivering and setting blocks	15 hours	\$100/hour	\$1,500
Ditch stone- 8" minus	160 CY	\$12/CY	\$1,920
15" corrugated black plastic culvert	20 LF	\$12/LF	\$240
18" corrugated black plastic culvert	40 LF	\$15/LF	\$600
Seed and mulch	-	-	\$500
Backhoe	40 hours	\$100/hour	4,000
Trucking	40 hours	\$75/hour	\$3,000
Excavator with hydraulic hammer	1 day and mobilization	\$2,000	\$2,000
Total			\$18,010

Construction Notes:

- Construction Specification guidelines for culverts installation and header, stone and grass-lined ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.

Highest Priority Stream Crossing Replacement Sites:

Stream Crossing Sites	TH number	Structure number	Impacted Waterway
Heath Road	37	e53181d8-01d3-4c92-9732-a1193ccada47	Heath Brook
Minard Hill Road-upper	2	Bridge 3	Tannery Brook
Brock Road	11	d6890b78-abca-4bfe-8bba-4a90aeb690f5	Tannery Brook
Harv Orr Road	6	f0d06e17-9108-43f7-9b94-30538592f9b0	North Branch
Great Road*	5	826a5c42-6e2b-4356-b4b7-3f9d325342ae	Trib to the North Branch

6. Heath Road Structures

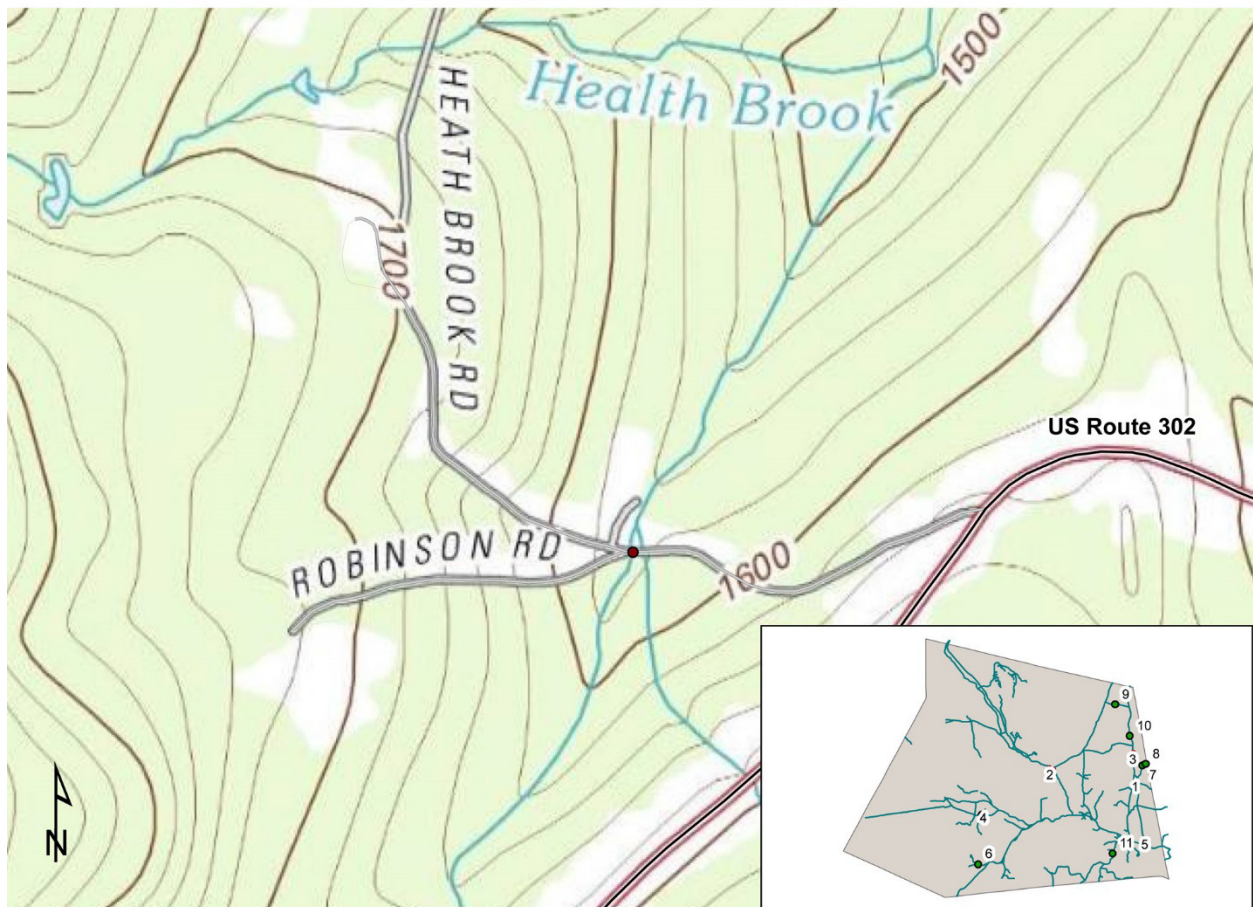
The problem- The bankfull measured on site is 12'. The existing two 4' round culverts are not large enough to handle flow, sediment and stream debris resulting in road erosion and failure. Heath Brook is joined by another unnamed tributary immediately upstream of this structure. Heath Road is a Class 3 gravel road. Top fill was measured at 7'. Drainage Area (DA) calculated at 1.69 sm.

The proposed treatment- includes the removal of double culverts and the installation of a 12' pipe arch 34' in length. The actual pipe arch size will be 12'-4" by 7'-9" buried approximately 2' to accommodate aquatic passage. The pipe will be covered by a minimum of 2' of fill. Riprap header should be installed.

Possible Funding Source: VTrans Structures Grant and BBR Category B Grant



Site Location #6 Heath Brook Rd



Materials/Equipment	Quantities	Cost per unit	Total Cost
12'-4" x 7'-9" pipe arch- 34' in length	1	\$347.25/ft.	\$11,807
Excavator*	120 hours	\$125/hour	\$15,000
Trucking	120 hours	\$85/hr.	\$10,200
Clean crushed gravel	90 CY	\$12/CY	\$1,080
Road sub-base and re-surfacing	130 CY	\$12/CY	\$1,560
Culvert bedding- ¾" stone	42 CY	\$12/CY	\$504
Culvert In-fill- skid steer walk behind (rental)	2 days	\$300/day	\$600
Culvert In-fill materials- Type 3	30 CY	\$15/CY	\$450
Inlet and outlet stabilization- Type 4	184 CY	\$15/CY	\$2,760
Compaction	-	-	\$500
Type 4 riprap for header	245 CY	\$15/CY	\$3,675
Bypass			\$3,000
Seed and mulch/erosion control	-	-	\$1,000
Total			\$52,136

Construction Notes:

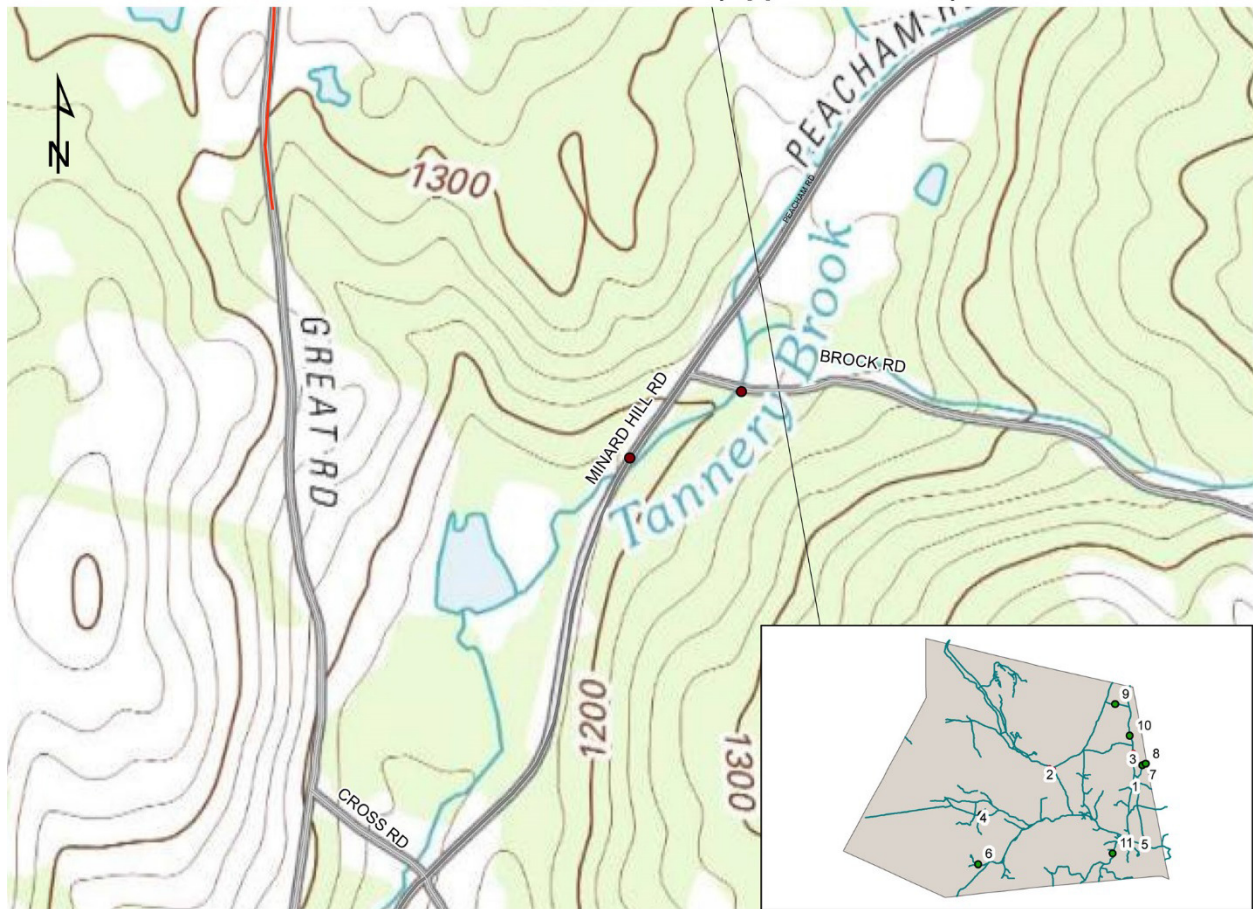
- Construction Specification guidelines for culverts, ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer

7. Minard Hill- Upper Structure

The problem- Bankfull was measured at 8' in the field on this reach of Tannery Brook. The existing structure is a 5' round culvert. This is a Class 2 paved highway. The culvert has been overtopped, eroding the paved surfaces. The current structure is poorly aligned, causing additional downstream bank and channel erosion. The existing structure does not provide aquatic passage. Top fill was measured at 7'. DA calculated at 0.91 sm.

The proposed treatment- includes the removal of the existing structure and replacement with an 8'x8' concrete box structure. The structure would be buried 2' to accommodate aquatic organism passage. Due to the steepness of slope, it would be difficult to realign the new structure and achieve aquatic organism passage. We recommend using the existing alignment and length for the new structure.

Site Location #7 Minard Hill Rd (Upper Structure)



Possible Funding Sources: VTrans Structures Grant, BBR Category B Grant, and USFWS

Materials/Equipment	Quantity	Cost per unit	Total Cost
8'x8' pre-cast concrete box 50' L with headers, retention baffles, and wing walls (delivered to site)	1	-	\$51,189*
Crane	-	-	\$4,000
Excavator* (1-2 machines)	225 hours	\$150/hr.	\$33,750
Trucking	120 hours	\$85/hour	\$9,600
Clean crushed gravel	100 CY	\$12/CY	\$1,200
Road sub-base	130 CY	\$12/CY	\$1,560
Culvert In-fill, skid steer	-	-	\$2,000
Culvert In-fill, material- Type 3	30 CY	\$15/CY	\$450

Inlet and outlet stabilization- Type 4	150 CY	\$15/CY	\$2,250
Culvert bedding- ¾" stone	56 CY	\$12/CY	\$672
Compaction	-	-	\$1,000
Rolling and paving	-	-	\$20,000
Guardrail work	-	-	\$6,000
Bypass	-	-	\$5,000
Seed and mulch/erosion control	-	-	\$1,000
Temporary bridge	-	-	\$10,000
Total			\$149,671

- *price includes headwalls, cutwalls, retention baffles and wingwalls
- Bypass prep: 2 days
- Excavate site/paving: 3 days
- Backfill site: 2 days
- Slopes and headers: 3 days

Construction Notes:

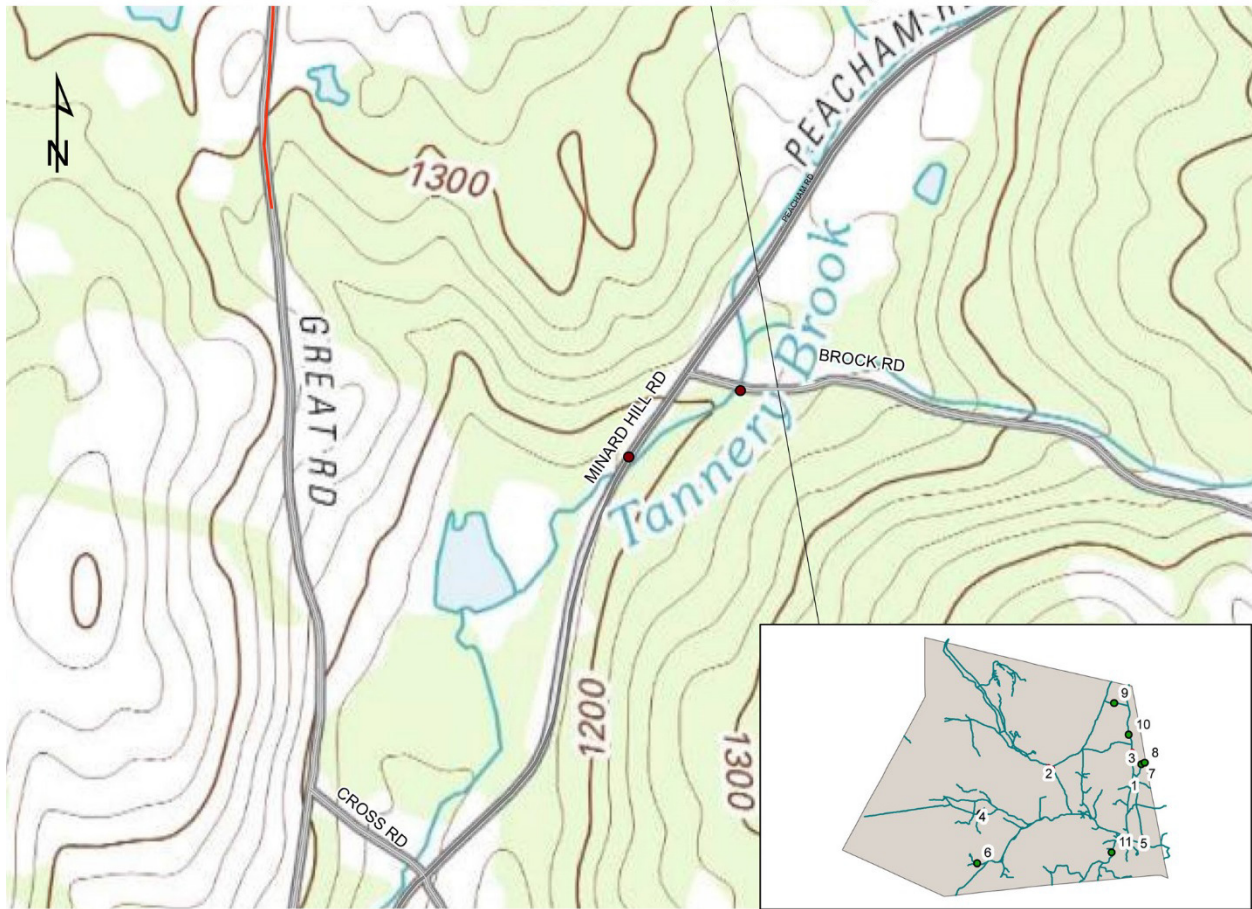
- Construction Specification guidelines for culverts, ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer

8. Brock Road Structure

The problem- bankfull was measured at 8' here in the field on Tannery Brook. The existing structure is a 4' round culvert, approximately 50% of bankfull. The culvert has been overtopped, causing road damage on several occasions. This is a Class 3 gravel road. This site is located immediately upstream of the Upper Minard Hill Road site (see above). Top fill was measured at 6' from culvert bottom to top of road. Could raise road height an additional foot to 7'*. DA calculated at 0.91 sm.

The proposed treatment- includes the removal of the existing undersized culvert and replacement with a 8'-2" x 5'-9" pipe arch buried 2' to accommodate AOP. A short term or interim treatment would be to add an additional 4' round culvert.

Site Location #8 Brock Rd (Structure)



Potential Funding Source: VTrans Structures Grant and BBR Category B grant



Materials/Equipment	Quantity	Cost per unit	Total Cost
8'-2"x5'-9" Pipe arch 24' L	1	\$252.56/ft.	\$6,062
Excavator	120 hours	\$125/hr.	\$15,000
Trucking	120 hours	\$85/hr.	\$10,200
Clean crushed gravel	50 CY		600
Road sub-base and re-surfacing	150 CY*		1,800
Header stone- Type 4	245 CY	\$15/CY	\$3,675
Compaction	-	-	\$500
Bypass	-	-	\$3,000
Culvert in-fill walk-behind skid steer	1 day	\$300/day	\$300
Culvert in-fill material- Type 3	14 CY	\$15/CY	\$210
Inlet and outlet stabilization- Type 4	150 CY	\$15/CY	\$2,250
Culvert bedding ¾" stone	28 CY	\$12/CY	\$336
Seed and mulch/erosion control	-	-	\$1,000
Total			\$44,933

Construction Notes:

- Construction Specification guidelines for culverts, ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998

- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer

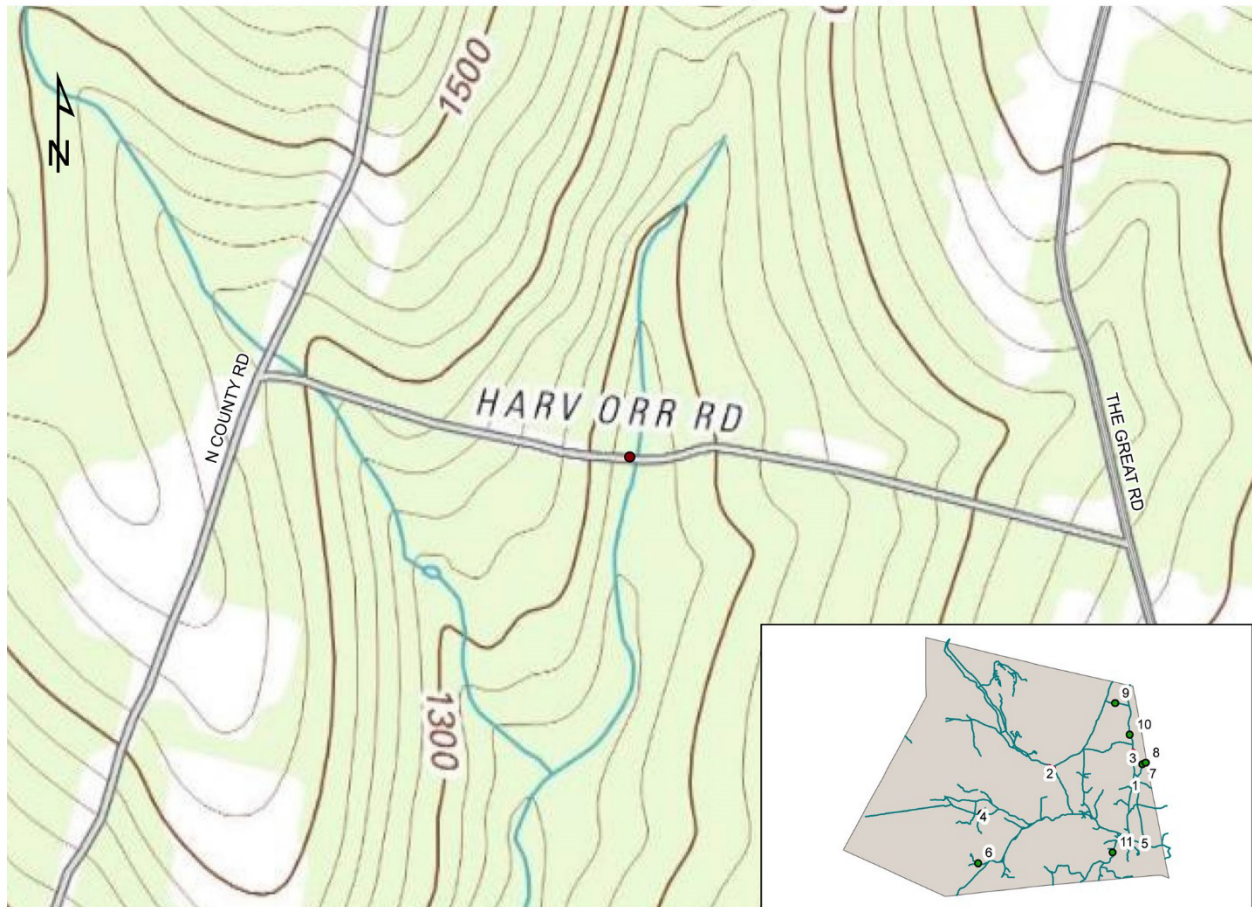
9. Harv Orr Road Structure

The problem- This section of Harv Orr Road is Class 4 gravel road and lightly traveled. The existing structure is a 3' round culvert with additional 2' culvert set at a higher elevation for flood events. Bankfull measured in the field is at 8'. Top fill was measured at 4.5'

The proposed treatment- includes the removal of the undersized structures and replacing them with a 8'-2" x 5'-9" pipe arch buried 2' to accommodate AOP. Because this is a Class 4 road, an alternative structure could include a Yard King pre-fabricated bridge set on concrete block or poured concrete abutments. A short term or interim solution could be to replace the 2' culvert with a second 4' round culvert.

Possible Funding Source: Not eligible for VTrans Structures grant because it is a Class 4 road. Eligible for BBR Category B grant but limited to \$10,000 max.

Site Location #9 Harv Orr Rd (Structure)



Materials/Equipment	Quantity	Cost per unit	Total Cost
8'-2"x5'-9" Pipe arch 20'L	1	\$252.56/ft.	\$5,052
Excavator	120 hours	\$125/hr.	\$15,000
Trucking	120 hours	\$85/hr.	\$10,200
Clean crushed gravel	110 CY	\$12/CY	\$1,320
Road sub-base and re-surfacing	150 CY	\$12/CY	\$1,800
Header stone- Type 4	150 CY	\$10/CY	\$1,500
Culvert in-fill walk behind skid steer	1 day	\$300/day	\$300
Culvert in-fill material- Type 3	14 CY	\$15/CY	\$210
Culvert bedding- ¾ stone	28 CY	\$12/CY	\$336
Inlet and outlet bed stabilization- Type 4	150 CY	\$15/CY	\$2,250
Compaction	-	-	\$500
Bypass	-	-	\$3,000
Total			\$41,468

Construction Notes:

- Construction Specification guidelines for culverts, ditches and outlet structures- See the *Vermont Better Back Roads Manual*, 2009, the *Vermont Standards and Specifications for Erosion Prevention and Sediment Control* 2006 & the *VTrans Hydraulic Manual* 1998
- Buried Cable/Utilities- Buried cable/utilities may be on site. Call dig safe 1-888-DIG-SAFE to locate buried utilizes prior to construction.
- Stabilize all disturbed areas with seed and mulch.
- Project may require DEC Stream Alteration Permit. Contact DEC regional Stream Alteration Engineer

The following structures are structures are medium priority structures-
(estimates were not prepared for these crossings)

10. Great Road Structure

The problem- this structure is a significant aquatic organism passage impediment, with a 3' outlet perch. Bankfull was measured at 9' in the field. The existing structure is a 6' round culvert.



Site Location #10 Great Rd (Structure)



The proposed treatment- replace existing structure and replace with a pipe arch buried to accommodate AOP. The channel bed downstream may have to be raised in order to achieve AOP passage.

Possible funding source: USFWS

11. Powder Spring Road Structure

The problem- this structure is located along a paved section of Powder Springs Road and is also the site of a town hydrant. Bankfull was measured at 12' at this site. The existing round culvert is 6'. Additionally, AOP is limited during some flow events and to some fish species due to the placed large rock downstream of the crossing. The rock was placed to create a pool for the hydrant. The existing structure has been overtopped and caused damage to the road embankment and pavement. The existing alignment aggravates the problem. The existing structure length is 45'

The proposed treatment- replace existing structure and install a 12' buried pipe arch. The new structure should be installed to accommodate AOP and be able to impound some water downstream for the hydrant. The new structure could be slightly re-aligned towards river right. The new alignment could add 5-15' in length, compared to current structure, depending on new location. Removing and replacing pavement, would add to the project cost.



Site Location #11 Powder Spring Rd (Structure)



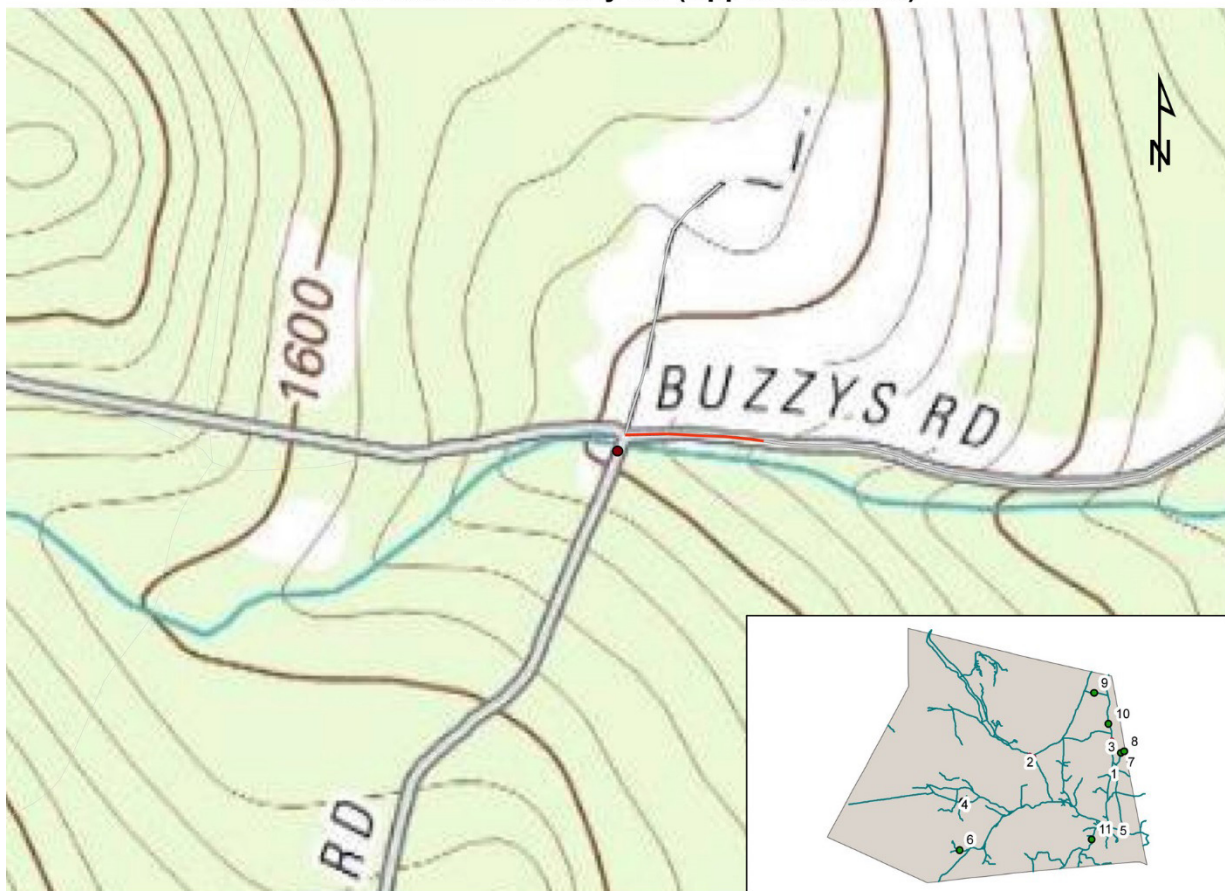
Possible funding sources: VTrans Structure Grant, BBR Category B Grant

12. Buzzy Road (upper)

The problem- an undersized stream crossing plugs and is outflanked by the stream taking out the road. This causes significant amounts of sediment to enter the tributary to Heath Brook



Site Location #12 Buzzy Rd (Upper/Structure)



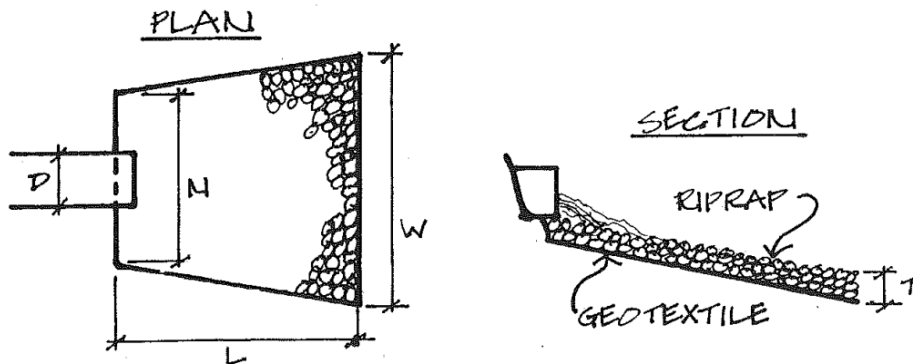
The proposed treatment- would be to replace this undersized structure with a bankfull width AOP friendly structure. In addition, a lowering of the road approach on river left would allow the brook to access its floodplain.

Appendices-

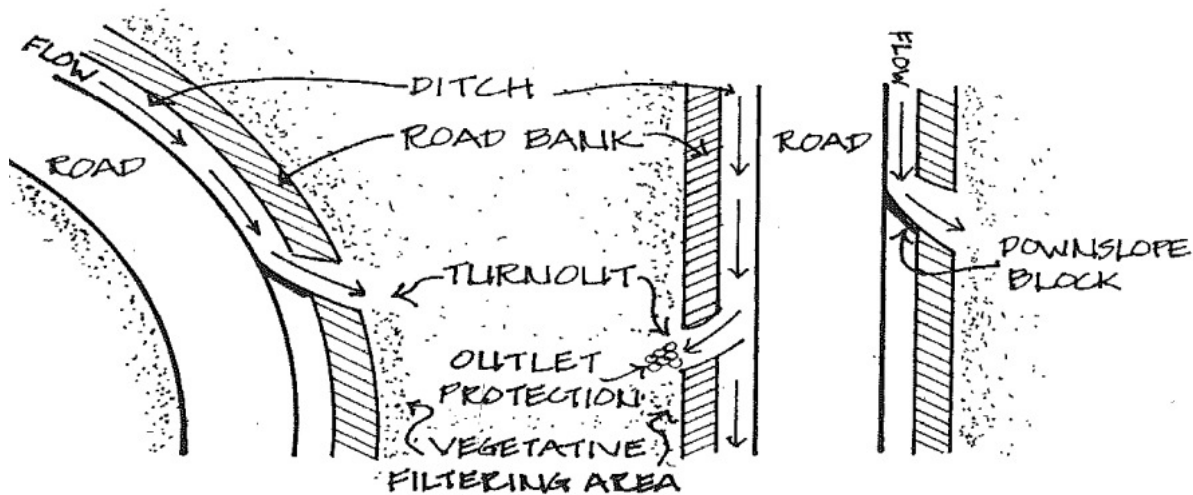
Road Best Management Specifications (Better Backroads Manual,)

Rock Apron Specifications					
Culvert Diameter (D)	Riprap Size	T (in.)	N (ft.)	W (ft.)	L (ft.)
18 inches	(3-12 inch)	18	4.5	14.5	10.0
24 inches	(3-12 inch)	18	6.0	20.0	14.0

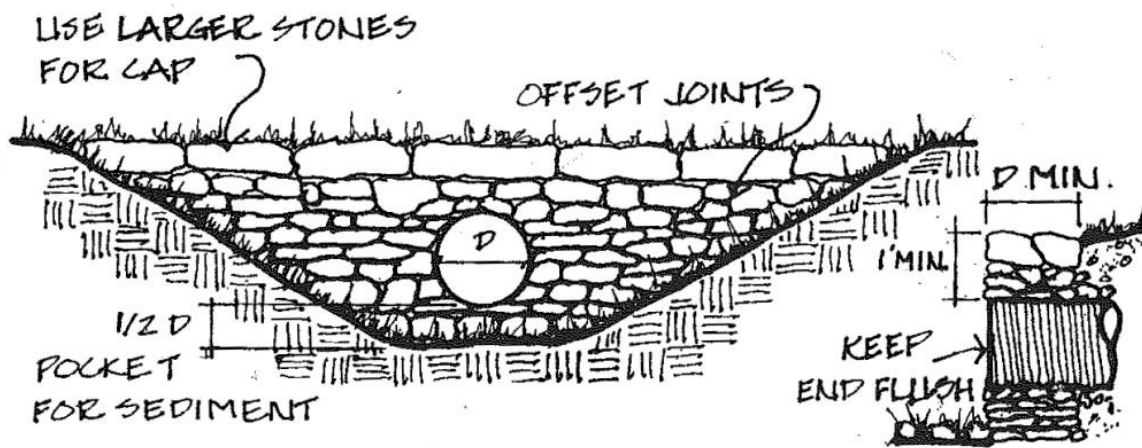
D= diameter of culvert
 T= depth of stone in apron
 N= width of apron near culvert
 W= width at downhill end of apron
 L= length of apron



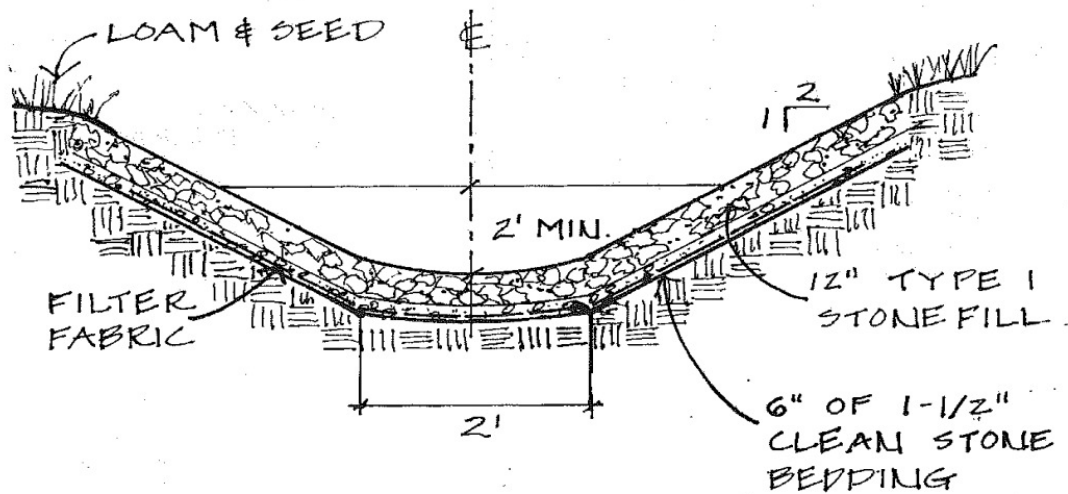
ROCK APRON



TURNOUTS



HEADER



STONE LINED DITCH

Rock Riprap Streambank Stabilization

