

Town of Bridgewater Road Erosion Inventory Report



Chateauguay Road. Photo taken by TRORC staff.

Prepared by:

TRORC
Two Rivers-Ottawaquechee
REGIONAL COMMISSION

128 King Farm Road
Woodstock, VT 05091

Inventory and report funded by the Vermont Agency of Transportation 2016 Better Roads Program.

Table of Contents

Introduction
Background
Methodology
Town Report
Conclusion

Appendices

Maps Appendix A
Diagrams Appendix B

Introduction

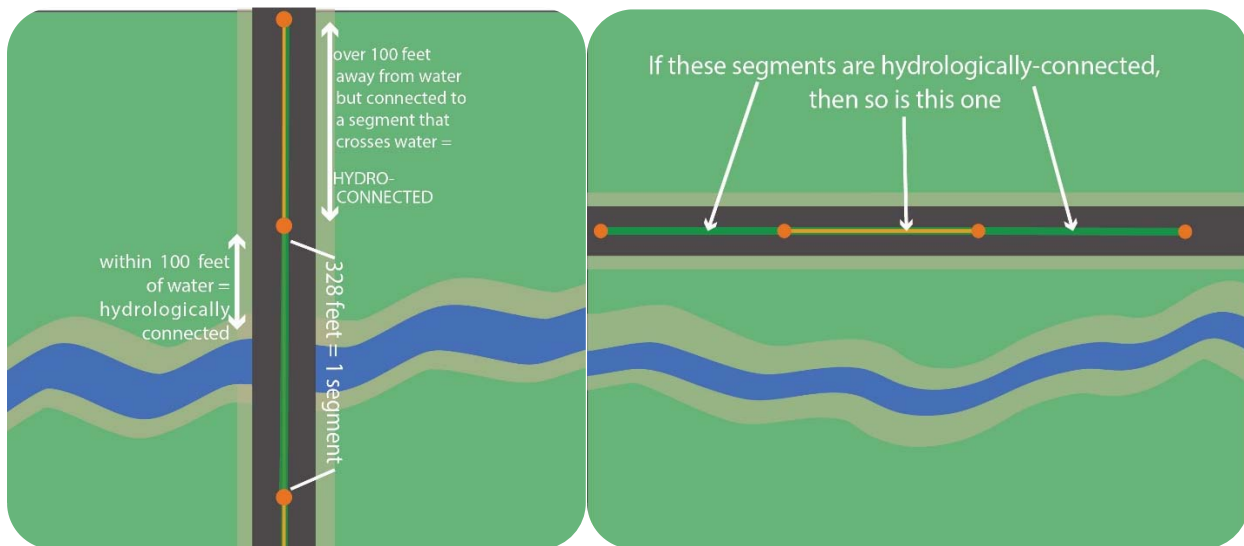
In the spring of 2017, the Two Rivers-Ottauquechee Regional Commission (TRORC) conducted a road erosion inventory (REI) to evaluate hydrologically connected segments in the town of Bridgewater. This report highlights the road sites with the most significant hydrological impact due to erosion within the municipality.

Hydrologically-connected road segments are one or more of the following:

- Within 100' or within river corridor layer to water resources (perennial and intermittent streams, wetlands, lakes and ponds)
- Road segments that bisect a water resource
- Adjacent segments to bisected connected segments if 8% or greater slope
- Road segments that bisect 24" or greater culverts
- Non-connected segments that were bordered on either side by a connected segment
- Stormwater infrastructure mapping

*There may be additional factors when assessing urban areas

The following diagrams depict the criteria for *hydrologically-connected road segment*:



Images created by TRORC staff

Background

Problem Definition

Many roads in Vermont traverse waterways since these are the lowest and flattest parts of the topography. Erosion, exacerbated by unpaved roads, has adverse effects on nearby bodies of water. During rain events road sediment is deposited directly into the water resources. Water resources are defined as perennial and intermittent streams, wetlands, lakes, and ponds. Road sediment in water resources causes a wide spectrum of ecological

problems including increased algae blooms and decreased levels of dissolved oxygen, both of which negatively impact fish habitat and the ecosystem as a whole.

Response

Solutions are taking shape in the form of state permits and grants. Grants will support proper construction and maintenance of road drainage and surfaces, while the permit will set a standard with criteria that must be met. The goal is to minimize road erosion caused by storm runoff and ensure that any sediment that does erode is sufficiently diverted and filtered before reaching the watershed.

Implementation

Instrumental to both grant funding and permit compliance is the Road Erosion Inventory (REI), and Evaluation. The purpose of the inventory is to identify locations that result in problematic road erosion. These are the places that require continuous attention by town road crews to maintain quality or restore problems. Since sediment only reaches the watershed if the road is close to open water (rivers, streams, lakes, ponds, wetlands), only hydrologically-connected road segments were assessed.

The Department of Environmental Conservation (DEC) provides GIS data of these hydrologically-connected road segments for each municipality. The inventory reflects the criteria set out by DEC's drafted Municipal Roads General Permit (MRGP), which is based on the Better Roads Manual provided by the Vermont Agency of Transportation (VTrans).

The MRGP draft indicates that:

1. By July 2018— Municipalities apply for MRGP coverage and pay fees. (Starting in 2018, municipalities will be required to submit MRGP compliance updates every six months.)
2. By fall of 2020— Municipalities are required to submit a Road Stormwater Management Plan (RSWMP), which includes road erosion inventories and the implementation plans and schedules.
3. By December 31, 2037— All hydrologically-connected segments are expected to meet MRGP standards.

The MRGP is required by the Vermont Clean Water Act (Act 64), and the Lake Champlain Phase I TMDL; the permit will be finalized by December 31, 2017. While funding from DEC might be available through the Ecosystem Restoration grant program, towns currently apply for funding through VTrans Better Roads grants. Better Roads is funded with state funds that could include appropriations through the Transportation Bill, the Clean Water Fund and the Capital Bill as well as federal funding VTrans receives from the Federal Highway Administration.

Methodology

- The DEC determined all hydrologically-connected municipal roads (paved, gravel, and class 4) based on proximity to water.
- The hydrologically-connected roads were divided into approximately 300 foot segments and given an identification number.

- Each segment was assessed and given a score of Fully Meets, Partially Meets, or Does Not Meet for the crown, berm, drainage, conveyance, drainage culverts and driveway culverts in the right-of-way. An overall score was given to each segment.
 - Fully Meets (FM) indicates that all individual scores fully met.
 - Partially Meets (PM) designates one or two partially meet individual scores.
 - Does Not Meet (DNM) stipulates three or more partially meets individual scores or one or more does not meet individual score.
 - Class 4 roads are evaluated based on gully erosion. If gully erosion is present, the overall segment does not meet. If gully erosion is absent, the overall segment fully meets.

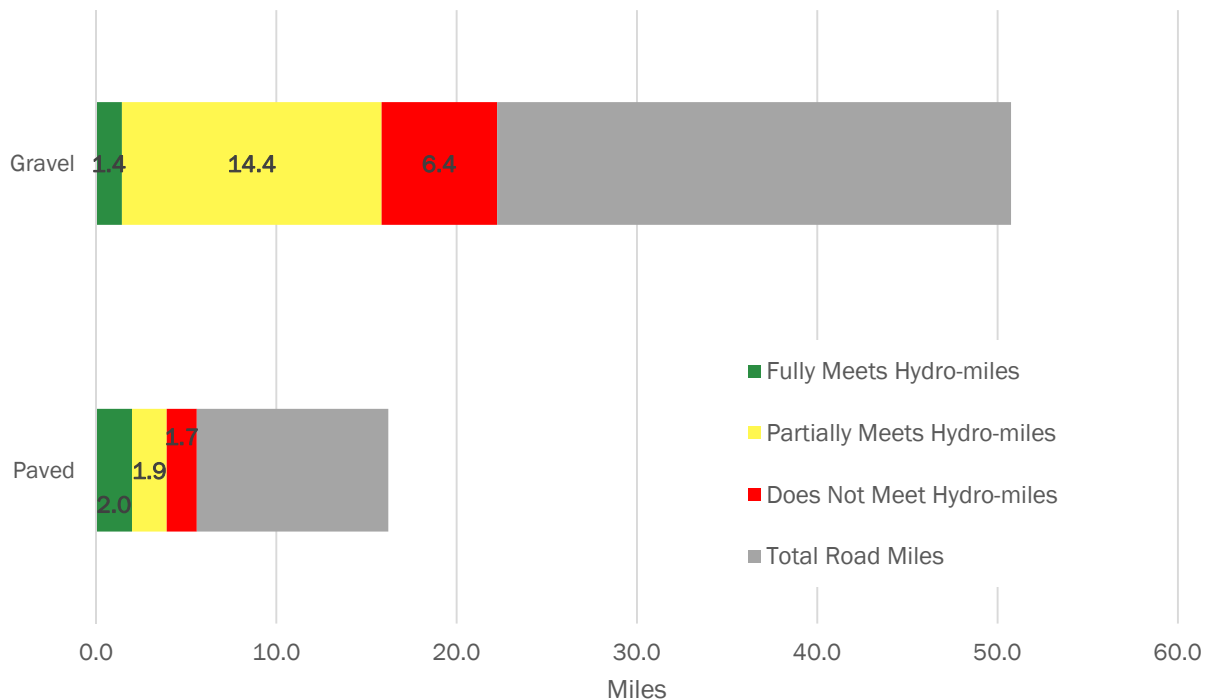
Town Report

Context

The town of Bridgewater is almost 50 square miles of mountains and rivers. The majority of the roads run along rivers and cross them many times. Roads typically are flanked by a steep grade to one side and a river or creek on the other. This combined with steep roads creates extra challenges and emphasizes the importance of proper road drainage installation and maintenance.

Current Condition

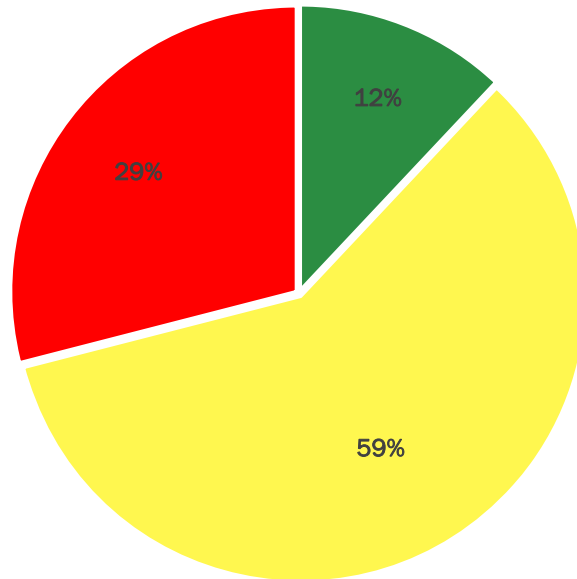
This bar chart depicts the scoring breakdown by road type for hydrologically-connected road miles within the town's total road miles.



Appendix A depicts the town with detailed results of the inventory. The following provides a brief summary:

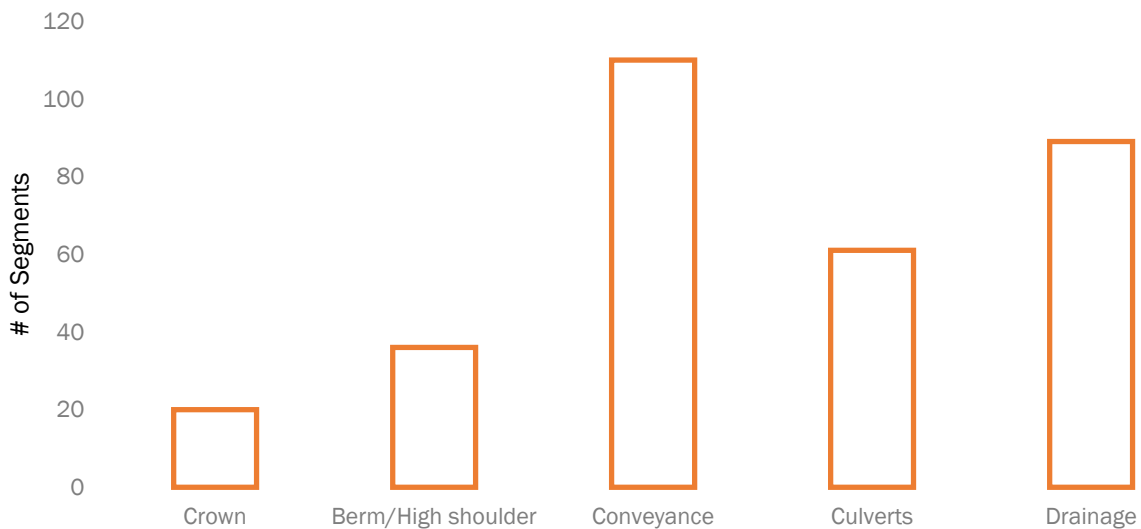
- There are 450 hydrologically-connected road segments in Bridgewater, or 26.9 miles (not including class 4 roads).
- Of these, 88% do not fully meet standards; which equal 23.7 miles of road eroding into the streams.

Summary of Hydro-Connected Segments Status



Twenty-five (25) segments have been identified as **High Priority**. High Priority indicates an overall score of Does Not Meet with a slope of 10% or greater. These are the segments which the town will focus on addressing in future grants. They are also a good example of issues facing the road network as a whole as other segments are likely to deteriorate in similar ways.

COMMON ISSUES AFFECTING SEGMENTS THAT DO NOT FULLY MEET



The three main issues in the high priority segments are:

- Poor Conveyance (100% Do Not Meet)
- Poor Drainage (88% have erosion present)
- Culverts (80% Do Not Meet)

It is useful to note that of all hydrologically-connected roads, the average road grade is quite high at: **8.94%**. This indicates a great need for stone-lined ditches and well-stabilized conveyance areas, as both of these are impacted by the faster flow of water that runs down steep grades.

Common causes for these issues are as follows:

- Inadequate infiltration and diversion practices
- Unstable banks separating roads from rivers
- Unstable ditches or no ditches at all where they are needed
- Lack of culvert headwalls, or culverts that are poorly placed, undersized, or in disrepair

Interventions

Very High Priority Road Segments are on slopes >10% that do not meet standards. These must be brought to MRGP standards by 12/31/2025.

For these the following practices must be implemented:

- >10%: Stone-line ditch with 12" minus stone
- 18" drainage culvert minimum
- 15" drive culvert

For all other segments, best practices for drainage are as follows:

- 0-5%: Grass-lined ditch
- 5-8%:
 - Stone-lined ditch with 6"-8" minus stone
 - Grass-lined ditch with stone check dam
 - Grass-lined ditch AND 2+ cross culverts
- 8-10%: Stone-line ditch with 6-8" minus stone

Conclusion

The results of the field inventory illustrate the importance of the MRGP. While the placement of roads in proximity to water poses a threat, adequate road maintenance practices will greatly diminish the rate of unfiltered runoff reaching our valuable natural resources.

TRORC and your road foremen will coordinate site visits to identify best management practices (BMPs) for remediation. Implementation plans to bring segments to MRGP compliance standards will include measures like grass and stone-lined drainage ditches, stone check-dams, sheet flow infiltration, ditches and turnouts disconnected from surface waters, road crowning, upgrading culverts, installing outlet stabilization headwalls, and stabilizing exposed soil. A detailed financial plan will be submitted to the VTrans Better Roads program.

Appendix A

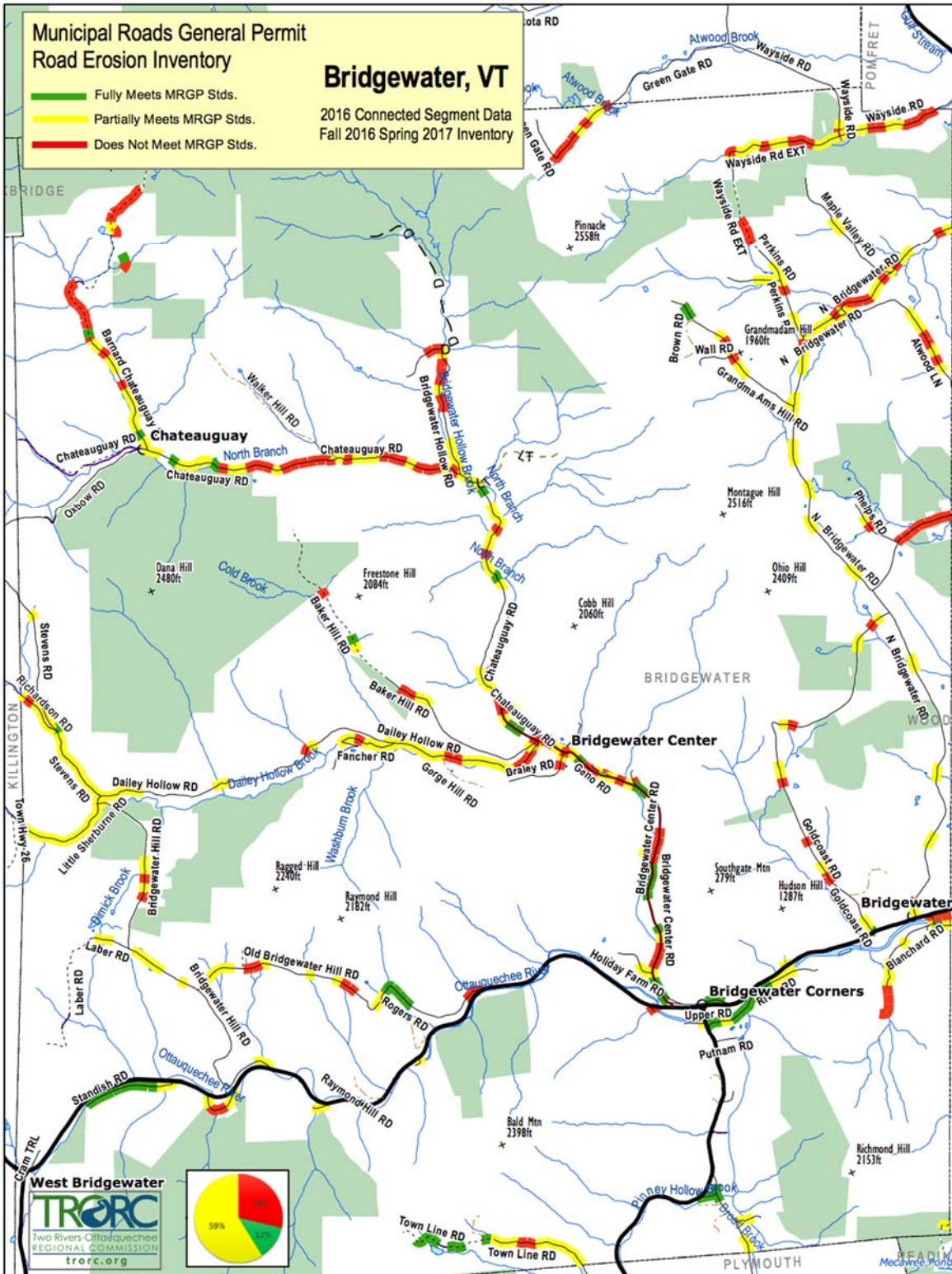


Figure 1- Depicts the Town with all hydro-connected segments and their scores, as well as the breakdown of how many segments Fully Meet, Partially Meet, and Do Not Meet.

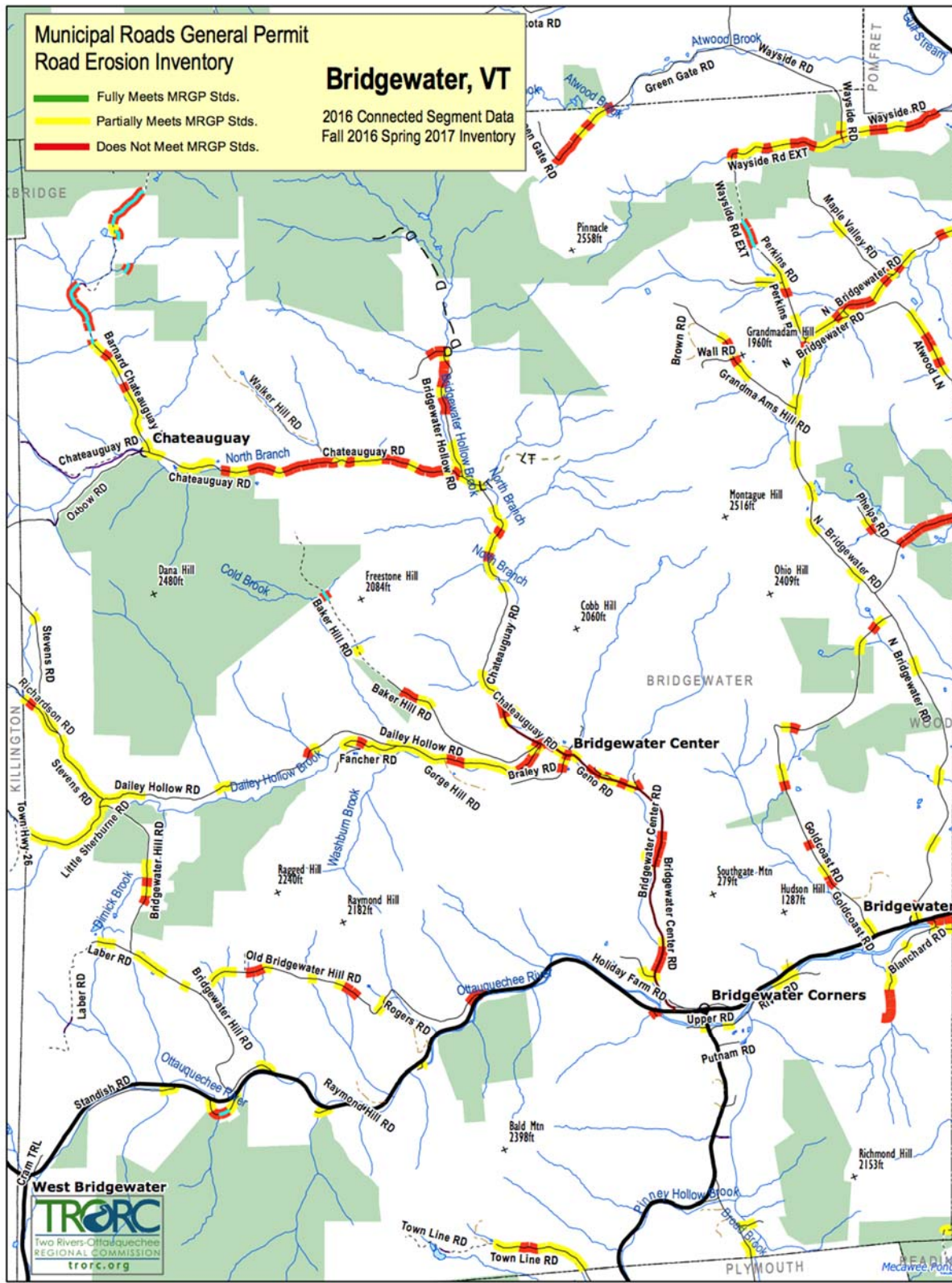


Figure 2- Displays the segments with a score of Partially Meet and Does Not Meet.

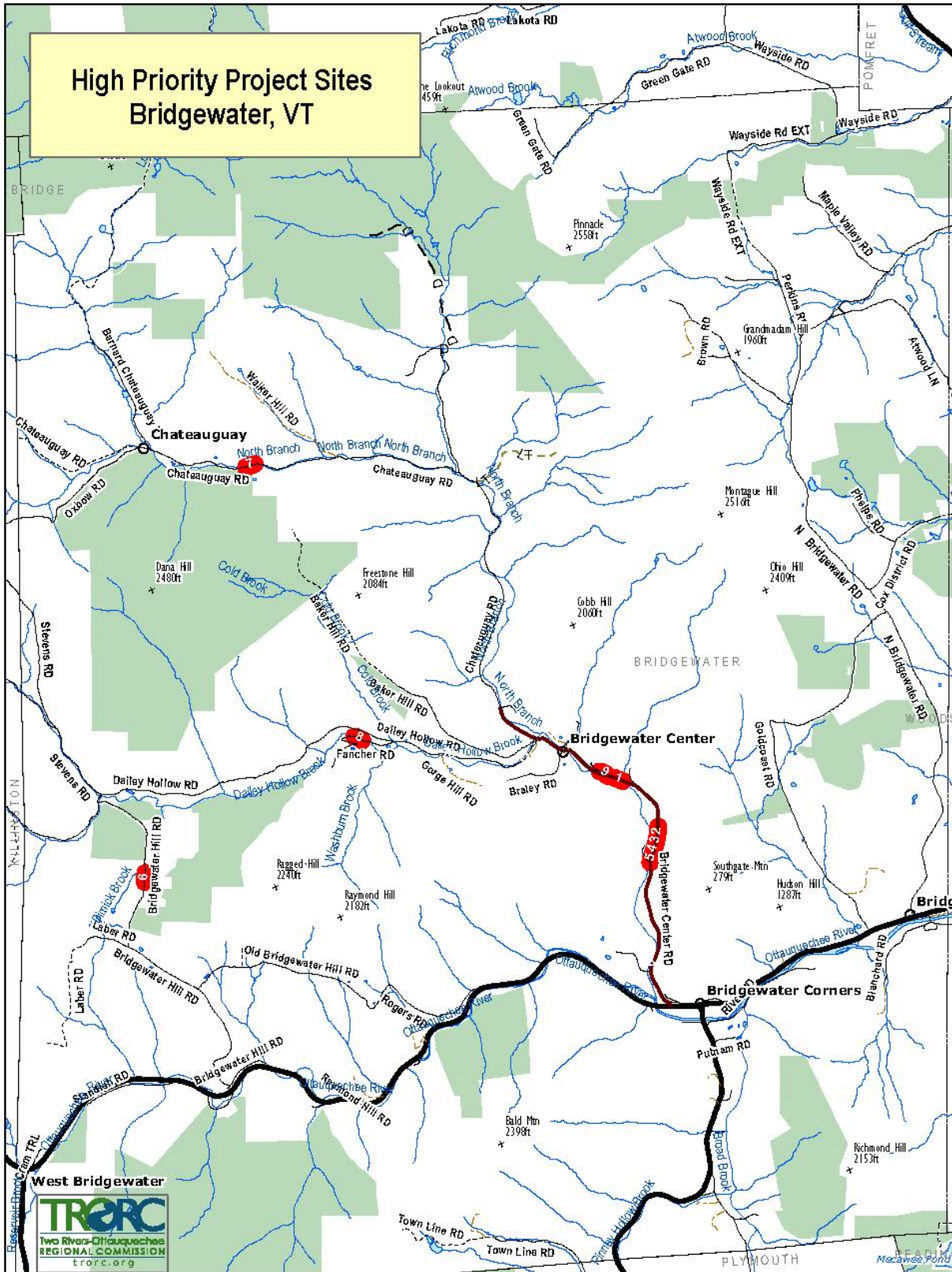
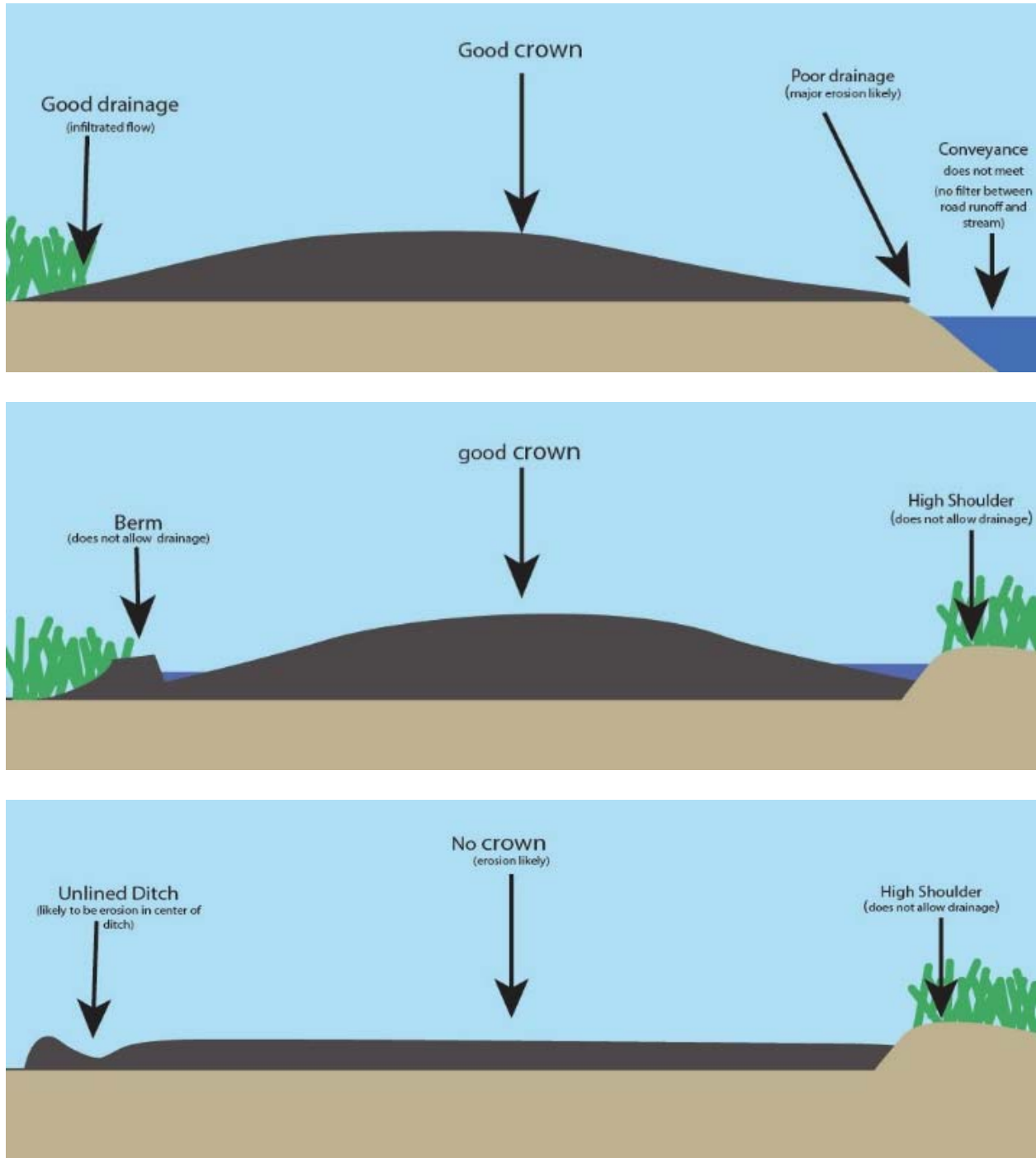


Figure 3- Displays high priority segments within the Town.

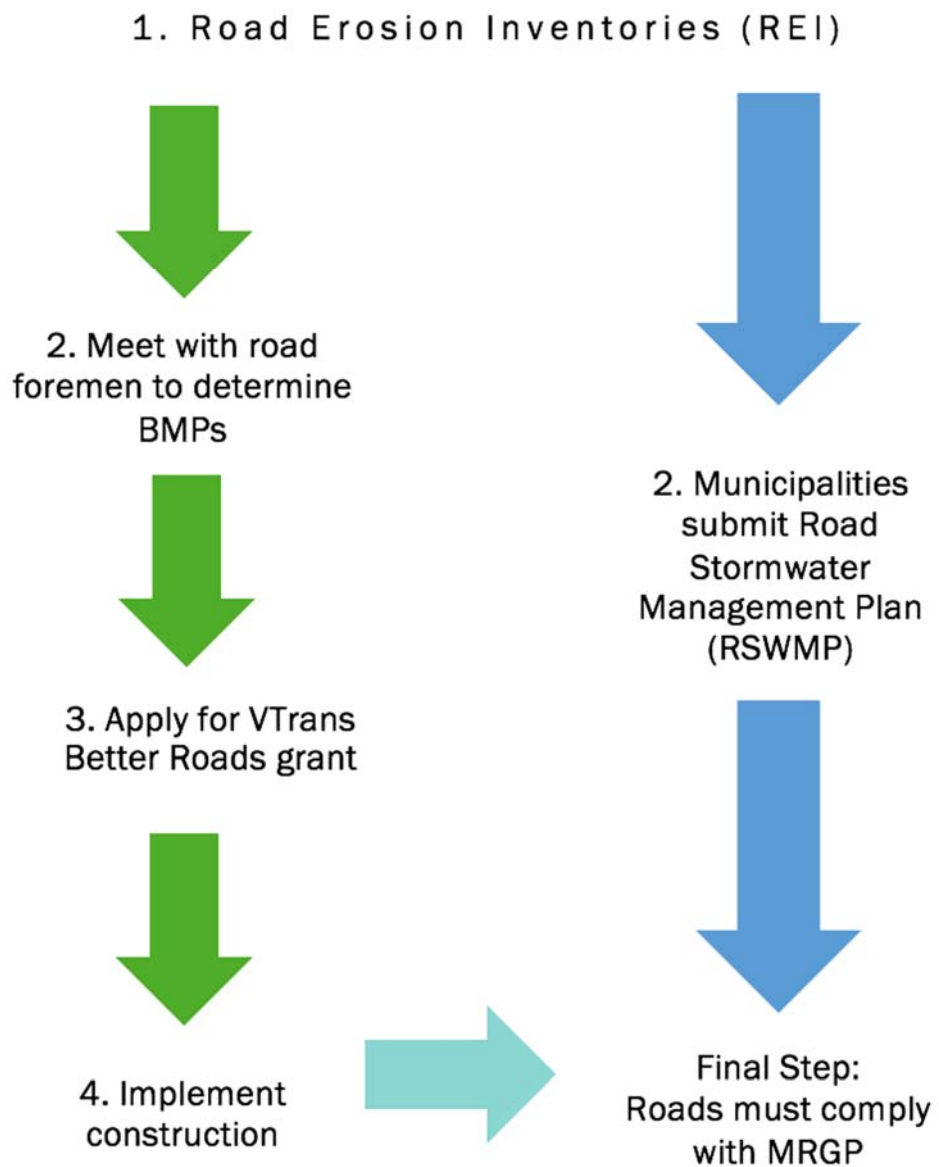
Appendix B

Table 1 Terminology Illustrated



Images created by TRORC staff

Figure 1 Permit and Grant Process



Flow chart created by TRORC Staff

Appendix C

Road Inventory and Evaluation Form for High Priority Project Sites

Project 1 Bridgewater Center Road.....	Sites 1-4
Project 2 Chateauguay Road.....	Site 5
Project 3 Bridgewater Hill Road.....	Site 6
Project 4 Fancher Road.....	Site 7
Project 5 Geno Road and Bridgewater Center Road.....	Sites 8-9

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Ctr Rd 5745	Paved	1

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Partially Meets	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Partially Meets	Yes	1 bad outlet

Notes: Culvert perched too long. Knotweed along roadside

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Ctr Rd 5753	Paved	2

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Does Not Meet	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	3 bad outlets, 3 gully sites

Notes: Erosion at all culvert inlets



Culvert outlet. *Photo taken by TRORC staff.*

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Ctr Rd 5754	Paved	3

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Does Not Meet	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	1 bad outlets, 1 gully site

Notes: Large abutment and rip rap. One stream-road conflict.



Culvert outlet. *Photo taken by TRORC staff.*

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Ctr Rd 5755	Paved	4

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Does Not Meet	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	2 bad outlets, 2 gully sites

Notes: Significant erosion at culvert inlets. One stream-road conflict.



Culvert outlet. Photo taken by TRORC staff.

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Ctr Rd 5756	Paved	5

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Partially Meets	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	1 bad outlet, 1 gully site

Notes: Ditches eroding. Stabilize!



Culvert outlet. Photo taken by TRORC staff.

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Bridgewater Hill Rd 12724	Gravel	6

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Does Not Meet
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Fully Meets	Does Not Meet

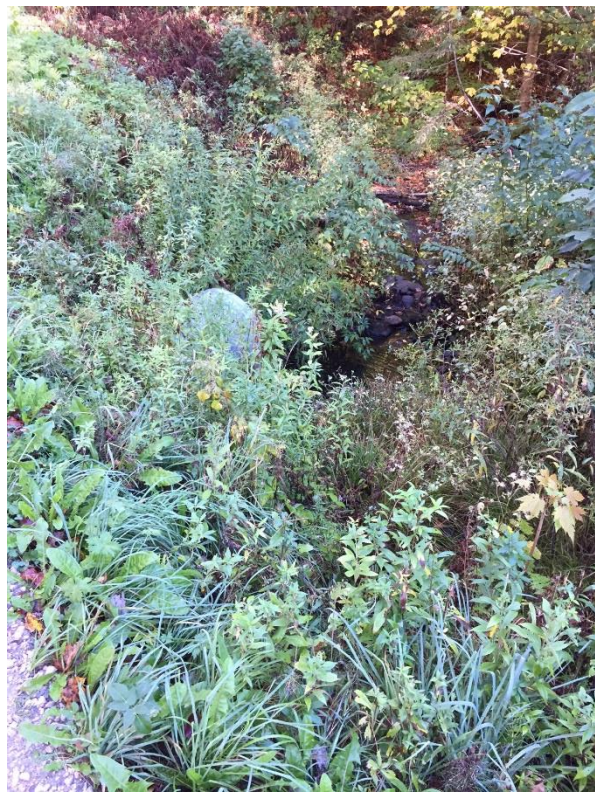
5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Partially Meets	No	1 stream culvert

Notes: Conyeances bad. Perched.

Pictures of stone header and outlet



Culvert inlet. *Photo taken by TRORC staff.*



Culvert outlet. *Photo taken by TRORC staff.*

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Chateauguay Rd 21317	Gravel	7

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Partially Meets	Partially Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Partially Meets	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	1 gully erosion, 2 bad outlets

Notes: Whole segment next to stream. One stream-road conflict.



Culvert 1 inlet. Photo taken by TRORC staff.



Culvert 1 outlet. Photo taken by TRORC staff.



Culvert 2 inlet. *Photo taken by TRORC staff.*



Culvert 2 outlet I. *Photo taken by TRORC*



Culvert 2 outlet II. *Photo taken by TRORC staff.*



Culvert 3 outlet I. *Photo taken by TRORC staff.*



Culvert 3 outlet II. *Photo taken by TRORC staff.*

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Fancher Rd 96368	Gravel	8

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Fully Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Fully Meets	Does Not Meet

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Does Not Meet	Yes	2 Gully erosion, 2 bad outlets

Notes: Both culverts need work. One way too long perched. Two stream-road conflicts.



Culvert 1 inlet. Photo taken by TRORC staff.



Culvert 1 outlet. Photo taken by TRORC staff.



Culvert 2 inlet. Photo taken by
TRORC staff.



Culvert 2 outlet. Photo taken by
TRORC staff.

Road Segment Name & Segment ID Number:	Road Type:	Map Identification Number:
Geno Rd 101821	Gravel	9

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	2. GRADER BERM/WINDROW:
Fully Meets	Partially Meets
3. ROAD DRAINAGE:	4. CONVEYANCE AREA/TURNOUT:
Partially Meets	Partially Meets

5. DRIVEWAY CULVERT:	5. DRAINAGE CULVERT:	Erosion Present	Type of Erosion
Fully Meets	Fully Meets	No	

Notes: Ditches eroding and runoff in roadway.



Geno Road. Photo taken by TRORC staff.