Town of Vershire
Road Erosion Inventory Report

Taylor Valley Road. *Photo taken by TRORC staff.*

Prepared by:

Two Rivers-Ottauquechee
REGIONAL COMMISSION

128 King Farm Road
Woodstock, VT 05091

Inventory and report funded by the Vermont Agency of Transportation 2017 Better Roads Program.

Table of Contents

Introduction
Background
Methodology
Town Report
Conclusion

Appendices

Maps	Appendix A
Diagrams	Appendix B
High Priority Sites	Appendix C

Introduction

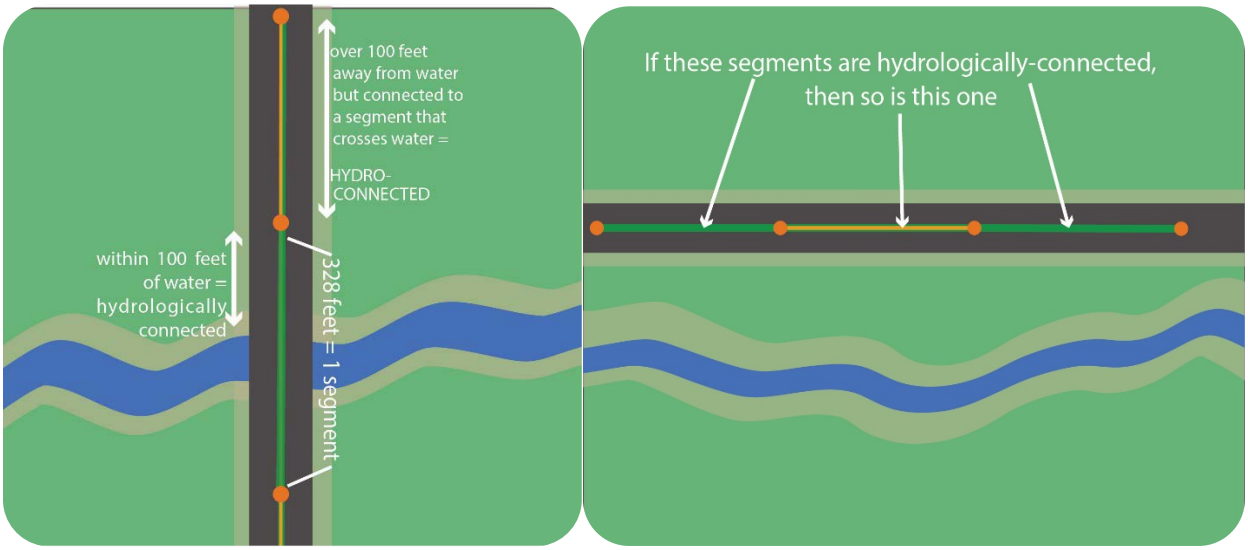
In the summer 2017, the Two Rivers-Ottauquechee Regional Commission (TRORC) conducted a road erosion inventory (REI) to evaluate hydrologically connected segments in the town of Vershire. This report highlights the road sites with the most significant hydrological impact due to erosion within the municipality.

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.

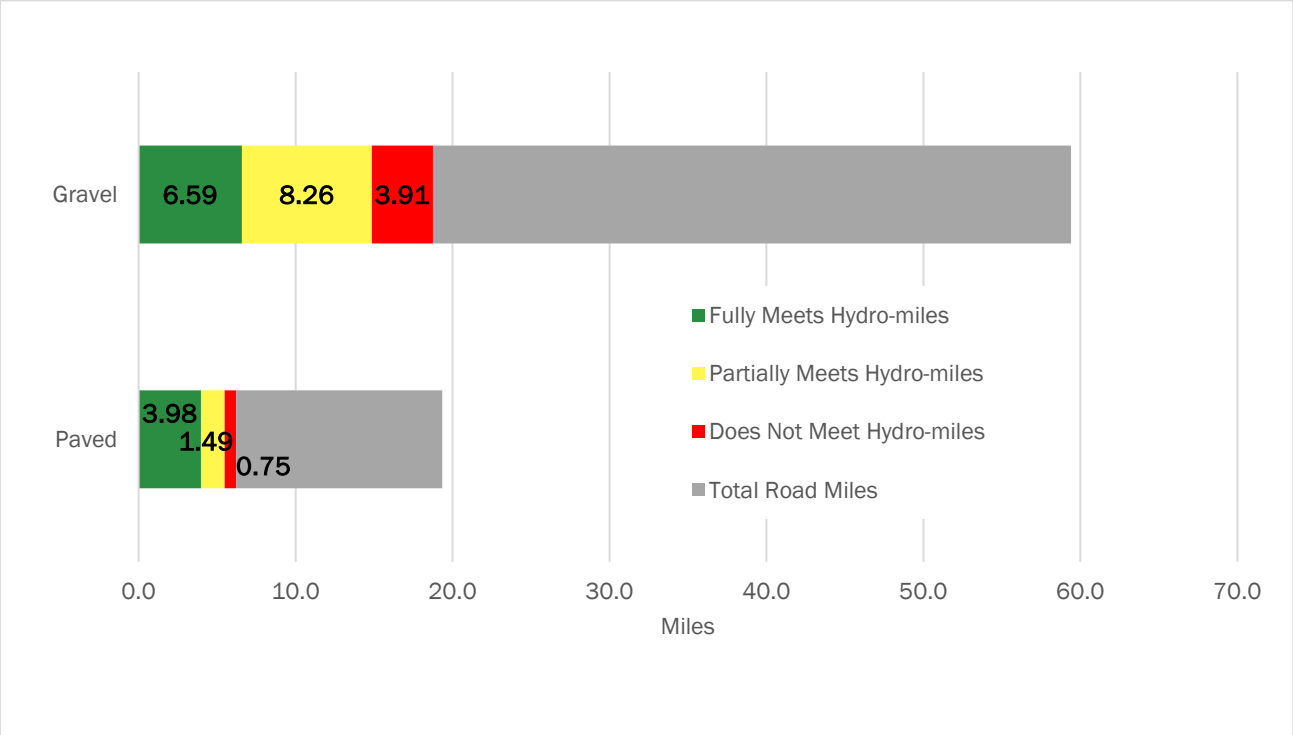
Town Report

Context

The town of Vershire is almost 37 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. Tributaries of the Ompompanoosuc River run through Vershire. This combined with steep roads creates extra challenges and emphasizes the importance of proper road drainage installation and maintenance.

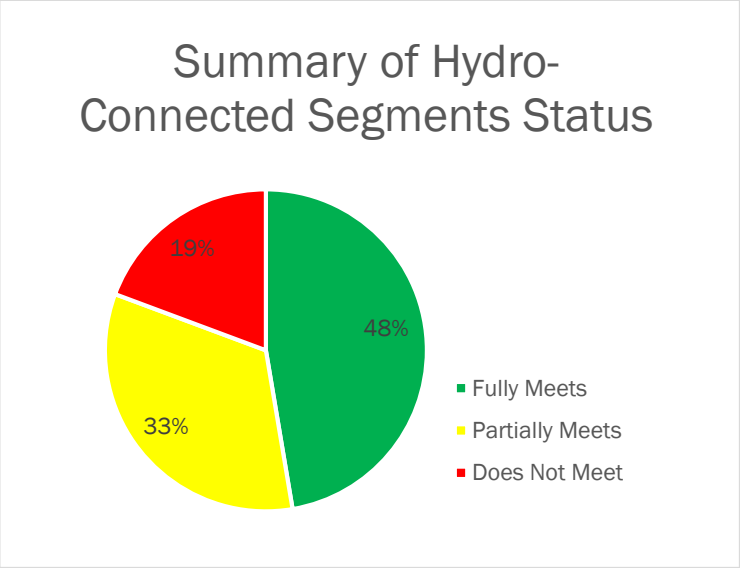
Current Condition

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



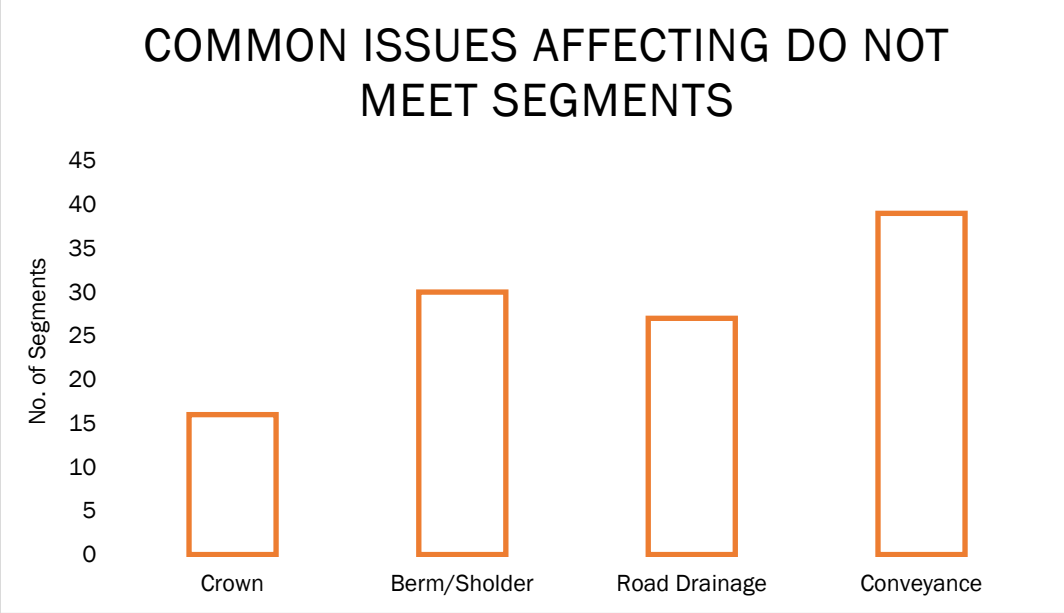
Appendix A depicts the town with detailed results of the inventory.
The following provides a brief summary:

- There are 570 hydrologically-connected road segments in Vershire, or 34 miles.
- Of these, 52% do not fully meet standards; which roughly equals 15.1 miles of road eroding into the streams.



Fourteen (14) 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.
The three main issues in the high priority segments are:

- Poor Drainage (64% have erosion present)
- Poor Berm or Shoulder (50% Do Not Meet)
- Poor Crown (86% Do Not Fully Meet)



It is useful to note that of all hydrologically-connected roads, the average road grade is: **6.32%.** This indicates the need for proper drainage practices, including stabilization through vegetation or stone-lining, 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

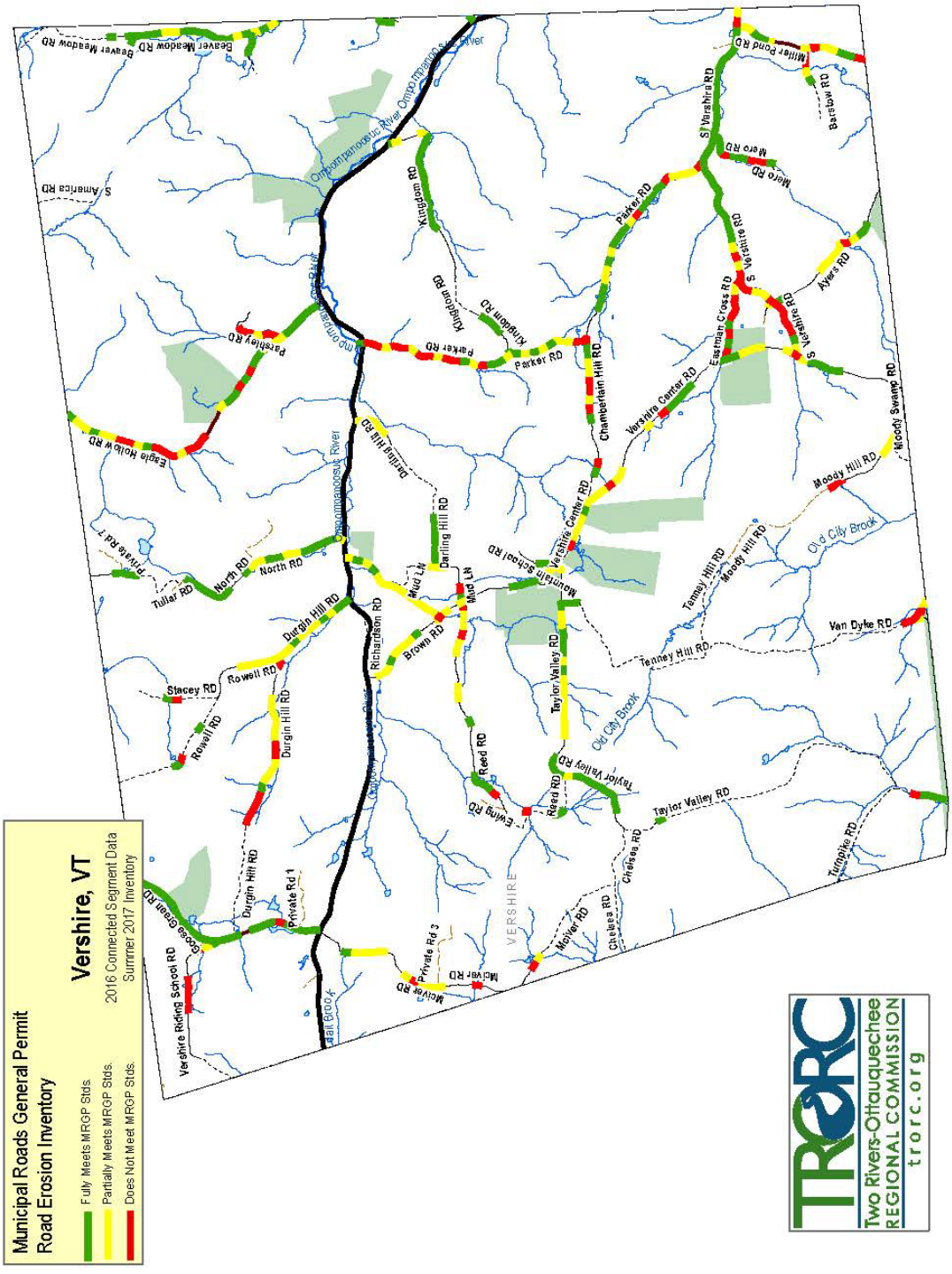


Figure 1- Depicts the Town with all hydro-connected segments and their scores, as well as the breakdown of how many segments Fully Meet, Partially Meet, and Do Not Meet.

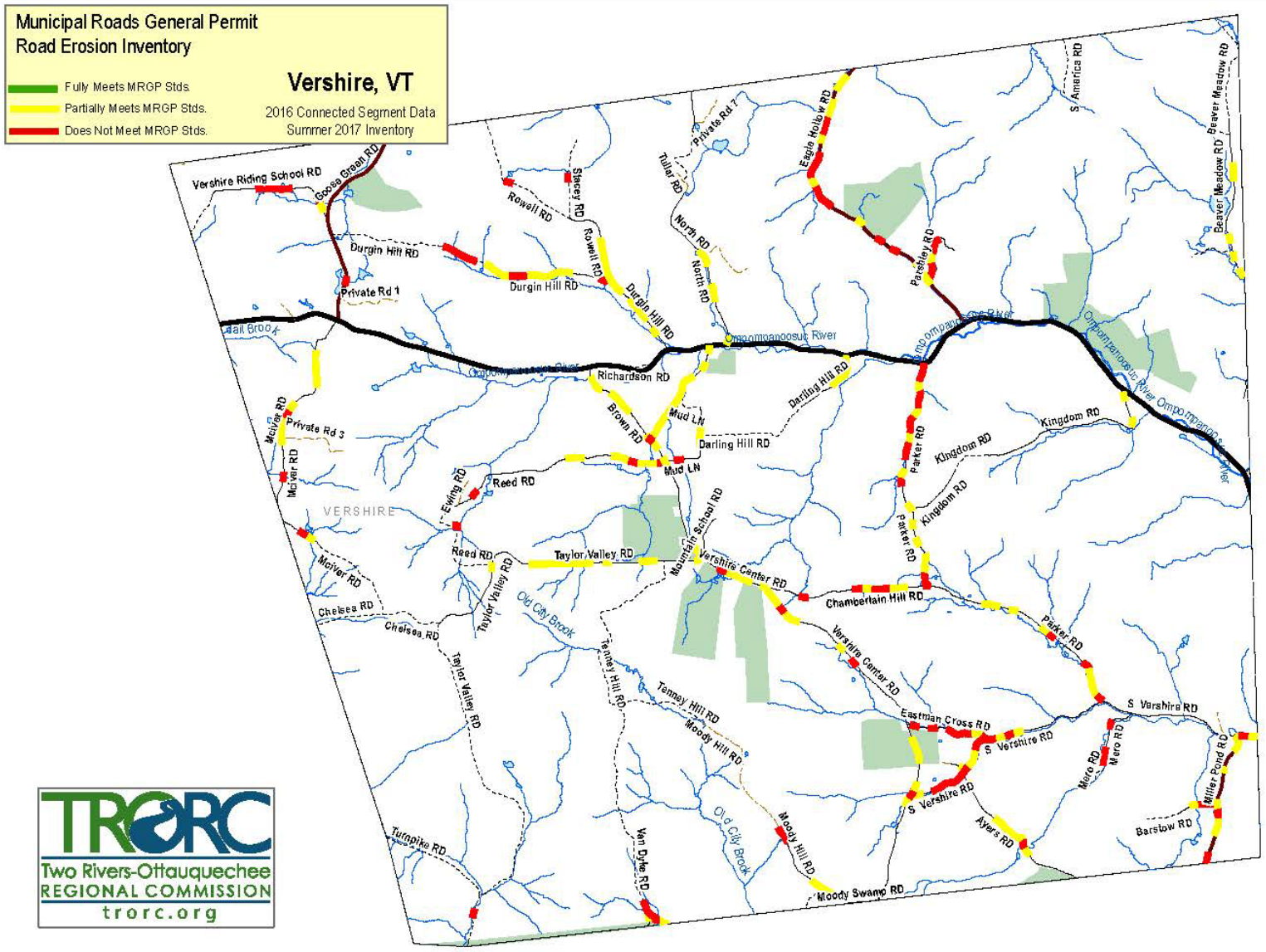


Figure 2- Displays the segments with a score of Partially Meet and Does Not Meet.

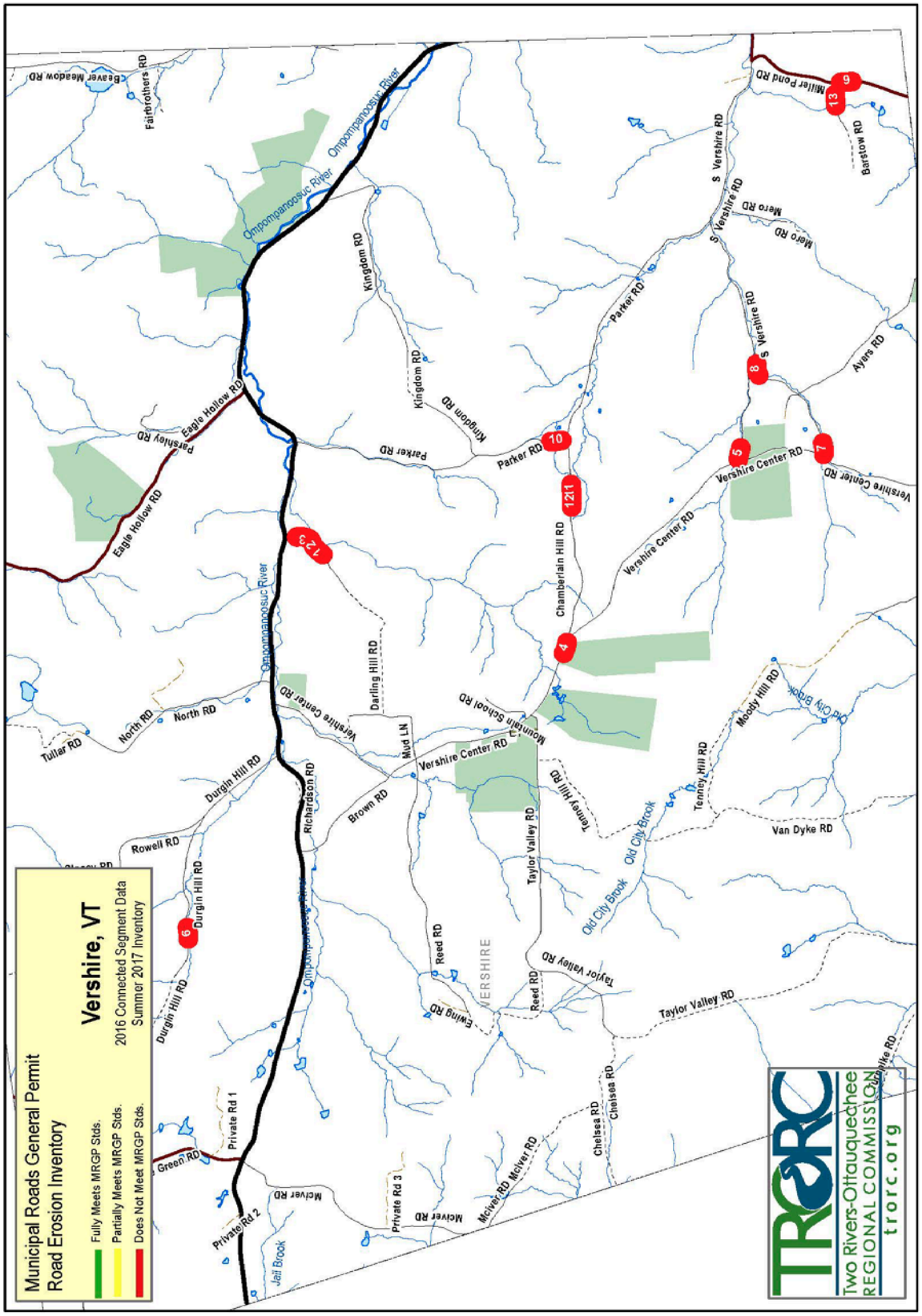
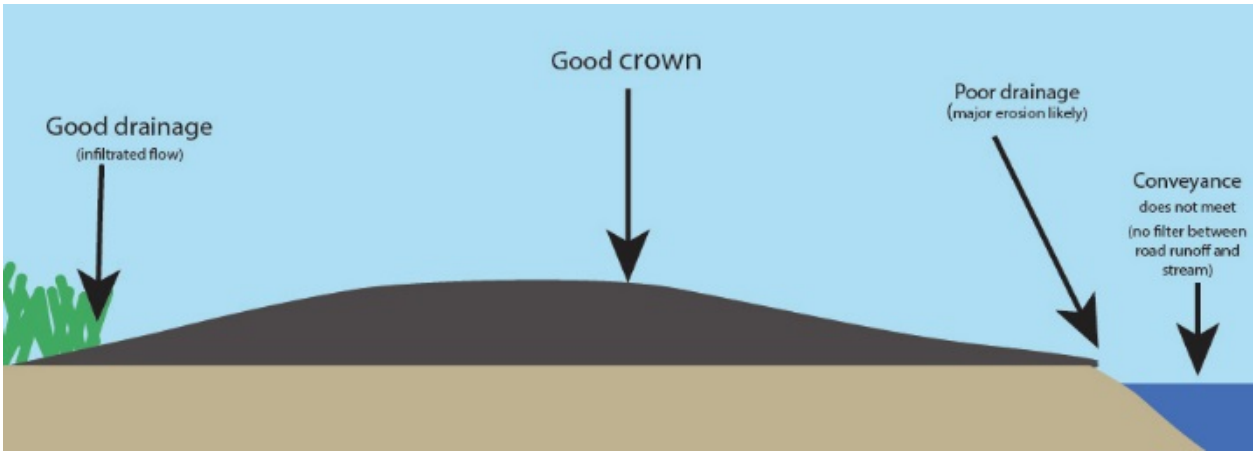
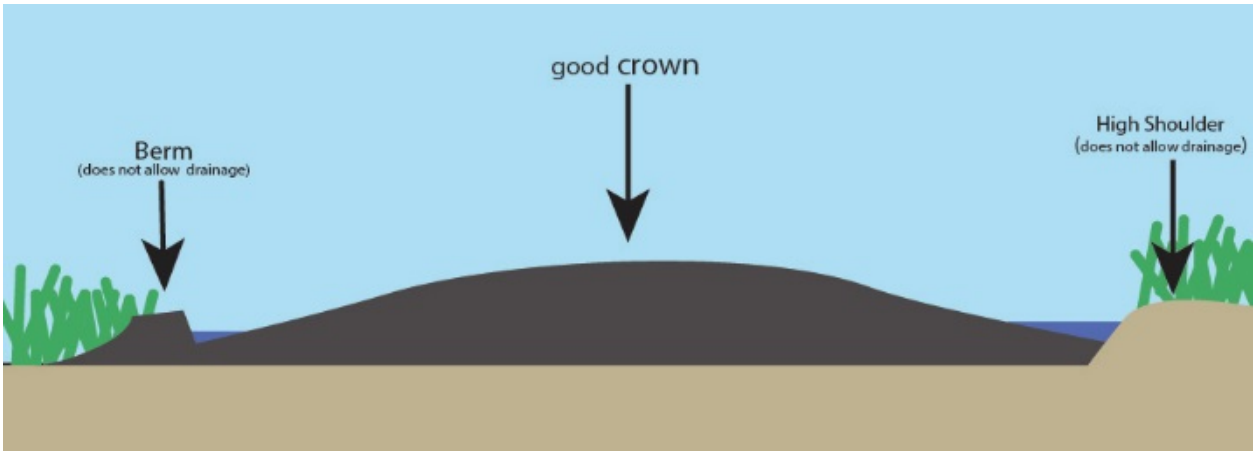


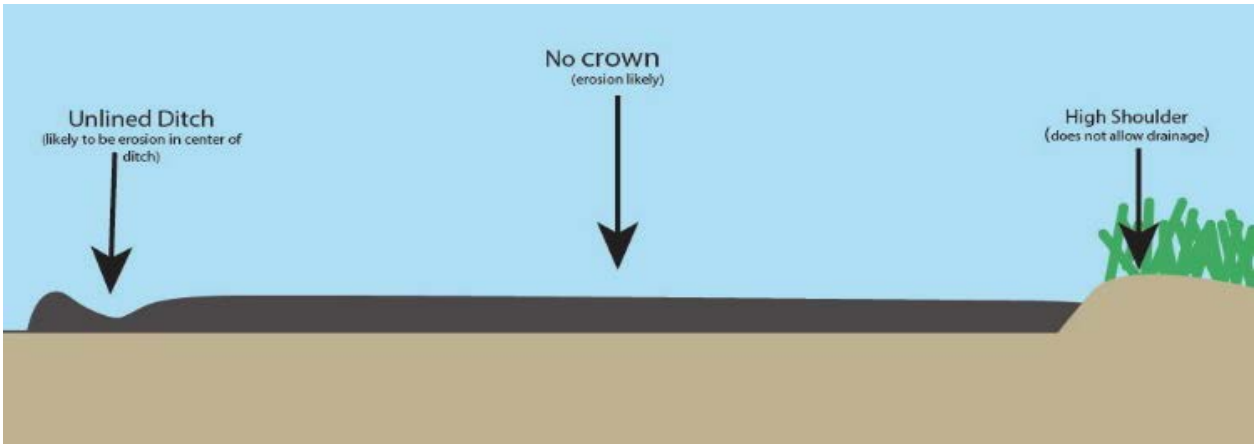
Figure 3- Displays high priority segments within the Town.

Appendix B

Table 1 Terminology Illustrated

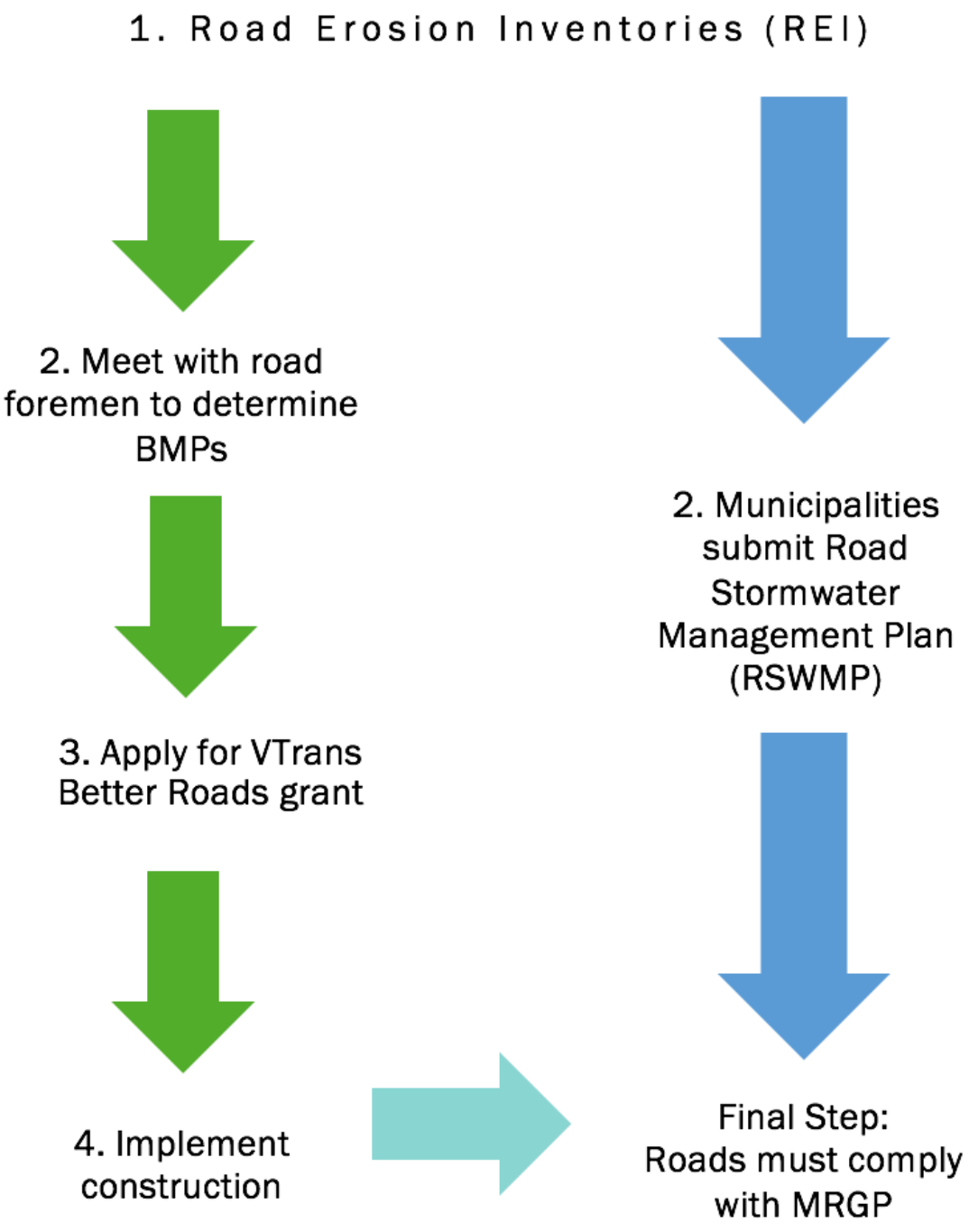






Images created by TRORC staff

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 Darling Hill Road.....Sites 1-3

Project 2 Vershire Center Road and Chamberlain Hill Road Intersection.....Site 4

Project 3 Eastman Cross.....Site 5

Project 4 Durgin Hill Road.....Site 6

Project 5 South Vershire Road I.....Site 7

Project 6 South Vershire Road II.....Site 8

Project 7 Miller Pond Road.....Site 9

Project 8 Parker Road.....Site 10

Project 9 Chamberlain Hill Road.....Sites 11-12

Project 10 Barstow Road.....Site 13

Project 1 Darling Hill Road

Best Management Practices:

- Replace culverts

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Darling Hill Rd 30990	Gravel	17.03%	1

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets	Rill	90% - 100% (590’ – 656’ OK) Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328’ – 589’ OK) Partially Meets	Rill	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Does Not Meet

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Darling Hill Rd 30991	Gravel	13.17%	2

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets	Rill	90% - 100% (590’ – 656’ OK) Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
90% - 100% (590’ – 656’ OK) Fully Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Does Not Meet

Notes: Recently maintained, need stones in ditches

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Darling Hill Rd 30992	Gravel	9.06%	3

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets	Rill	90% - 100% (590’ – 656’ OK) Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328’ – 589’ OK) Partially Meets	Rill	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Does Not Meet

Notes: Need stones in ditches

Project 2 Vershire Center Road and Chamberlain Hill Road Intersection

Culvert Project:

- Upsize existing 15" x 35ft to 24" x 40 ft
- Riprap header and outlet

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Vershire Center Rd 191160	Gravel	1.23%	4

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164' – 294' OK) Partially Meets		50% - 89% (164' – 294' OK) Partially Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (164' – 294' OK) Partially Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Does Not Meet

Project 3 Eastman Cross Road

Best Management Practices:

- Grass-line ditch to first culvert
- Challenging on ditching with brook right on the other side of the road

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Eastman Cross Rd 94530	Gravel	6.25%	5

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
0% - 49% (0' – 163' OK) Does Not Meet		50% - 89% (328' – 589' OK) Partially Meets	Rill
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328' – 589' OK) Partially Meets		One or more areas does not meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Fully Meets

Notes: Seems just graded but no crown

Project 4 Durgin Hill Road

Best Management Practices:

- Replace exciting 15” culvert near top of the road to 24”

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Durgin Hill Rd 91874	Gravel	16.44%	6

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets	Rill	0% - 49% (0’ – 327’ OK) Does Not Meet	Gully
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
0% - 49% (0’ – 327’ OK) Does Not Meet	Gully	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Does Not Meet

Notes: Stone lined ditch needed

Project 5 South Vershire Road I

Best Management Practices:

- Add a cross culvert from 35 mph speed limit sign to mailbox
- Improve ditching

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
S Vershire Rd 162728	Gravel	6.33%	7

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
90% - 100% (295' – 328' OK) Fully Meets		90% - 100% (590' – 656' OK) Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328' – 589' OK) Partially Meets	Rill	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	None Present

Project 6 South Vershire Road II

Best Management Practices:

- Needs ditching from driveway on right to intersection with Vershire Center Road

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
S Vershire Rd 147880	Gravel	12.24%	8

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
90% - 100% (295' – 328' OK) Fully Meets		90% - 100% (590' – 656' OK) Fully Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
0% - 49% (0' – 327' OK) Does Not Meet	Gully	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	Partially Meets

Project 7 Miller Pond Road

Best Management Practices:

- Needs ditching

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Miller Pond Rd 133925	Gravel	2.45%	9

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
90% - 100% (295’ – 328’ OK) Fully Meets		0% - 49% (0’ – 327’ OK) Does Not Meet	Gully
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
90% - 100% (590’ – 656’ OK) Fully Meets		All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
Fully Meets	Fully Meets

Project 8 Parker Road

Best Management Practices:

- Ditching work needed

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Parker Rd 147706	Gravel	10.35%	10

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets	Rill	50% - 89% (328’ – 589’ OK) Partially Meets	Rill
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328’ – 589’ OK) Partially Meets		One or more areas does not meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	Fully Meets

Project 9 Chamberlain Hill Road

Best Management Practices:

- Needs improved ditching and excavator for work
- Wetland on the right, high banks and banks slumping into roadway (had stone-lined ditch but got full and removed)
- Take out berm to widen road but outside ROW

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Chamberlain Hill Rd 20296	Gravel	10.29%	11

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164' – 294' OK) Partially Meets	Rill	50% - 89% (328' – 589' OK) Partially Meets	Gully
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328' – 589' OK) Partially Meets	Rill	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	None Present

Notes: Looks recently graded but big shoulder berm

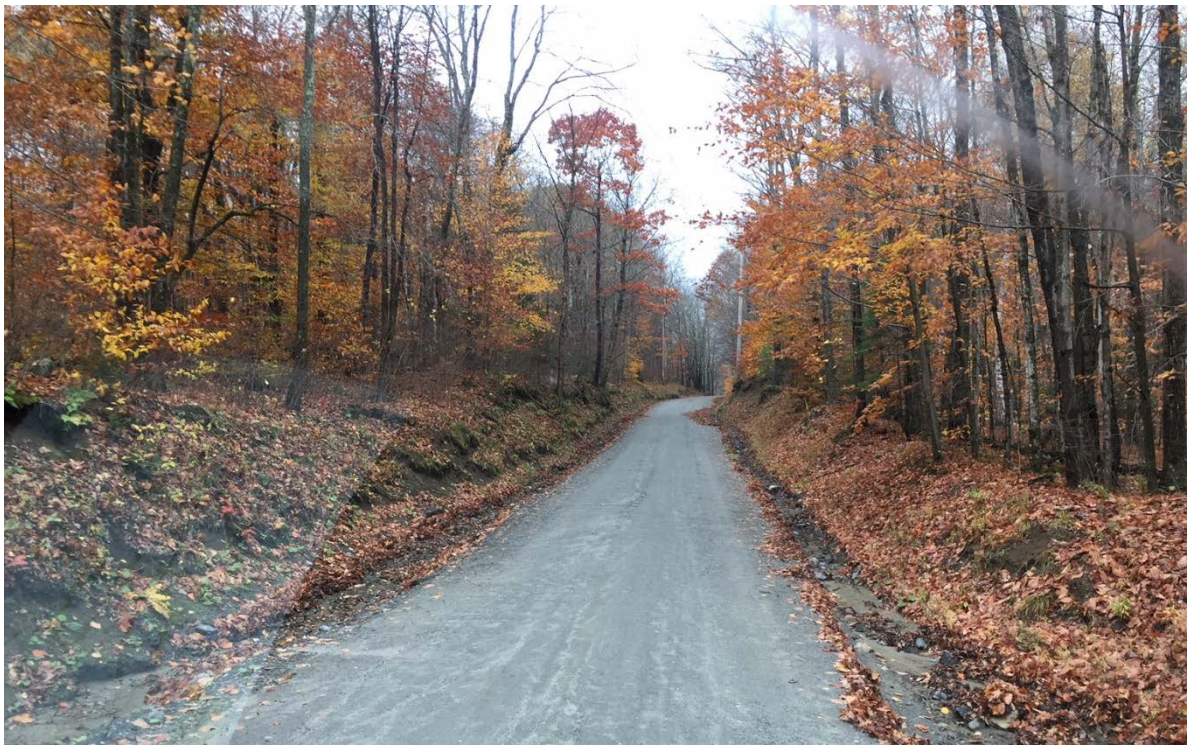
SPEED
30

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Chamberlain Hill Rd 20297	Gravel	15.3%	12

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164’ – 294’ OK) Partially Meets		50% - 89% (328’ – 589’ OK) Partially Meets	
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
50% - 89% (328’ – 589’ OK) Partially Meets	Rill	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	None Present



Project 10 Barstow Road

Best Management Practices:

- Restricted ditching because of high banks and historic stone wall

Road Segment Name & Segment ID Number:	Road Type:	Average Road Grade:	Site Number:
Barstow Rd 4900	Gravel	12.43%	13

Overall Segment Score: Does Not Meet

1. ROADWAY CROWN/TRAVEL LANE:	Erosion Type:	2. GRADER BERM/WINDROW:	Erosion Type:
50% - 89% (164' – 294' OK) Partially Meets	Rill	0% - 49% (0' – 327' OK) Does Not Meet	Rill
3. ROAD DRAINAGE:	**Erosion Type:**	**4. CONVEYANCE AREA/TURNOUT:**	**Erosion Type:**
0% - 49% (0' – 327' OK) Does Not Meet	Gully	All areas meet standard	

5. DRIVEWAY CULVERT:	6. DRAINAGE CULVERT:
None Present	None Present