



# Understanding Water Quality Impacts of Vermont's Back Roads: a research summary for policy makers

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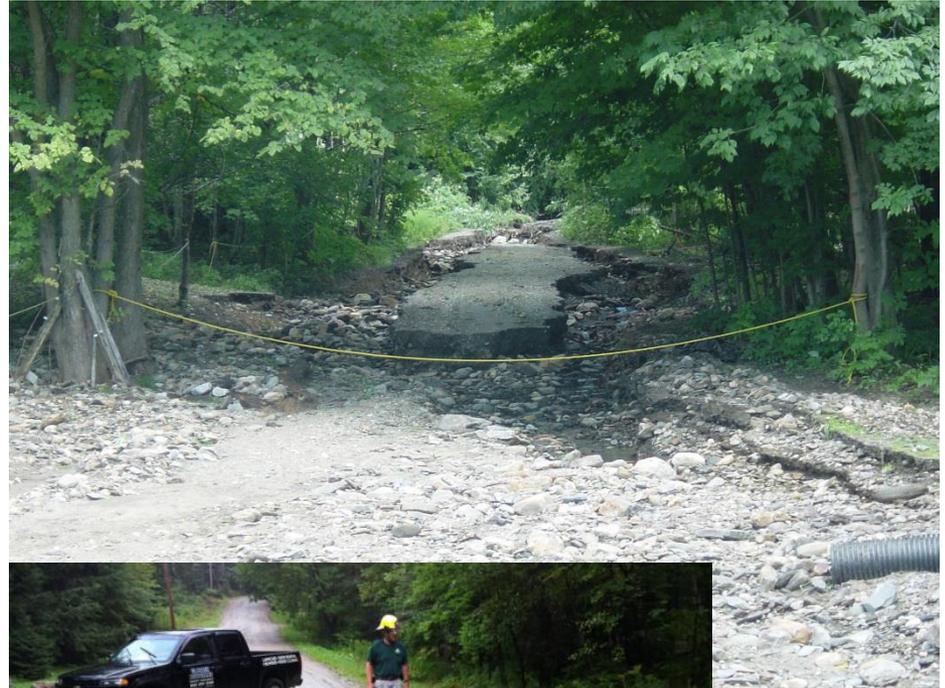
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Presentation to the Vermont House  
Transportation Committee

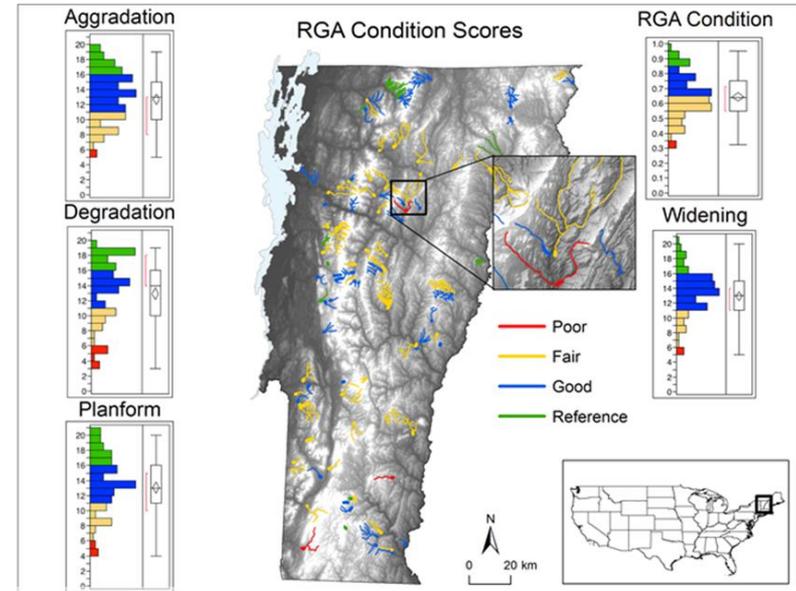
January 30, 2015

# Context: Lake Champlain TMDL

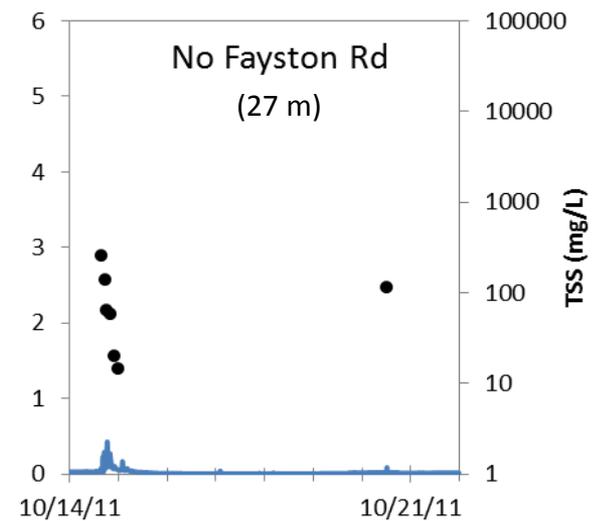
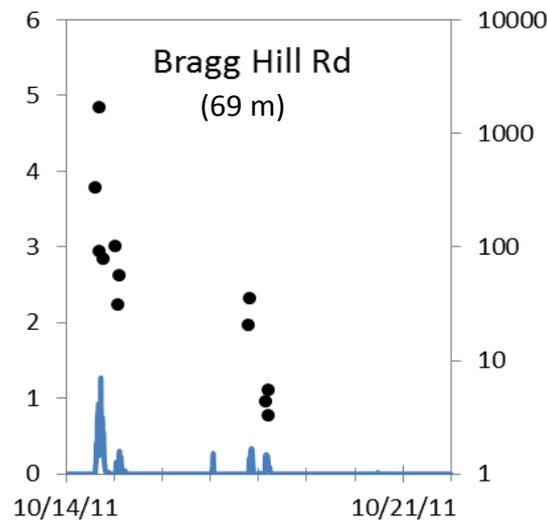
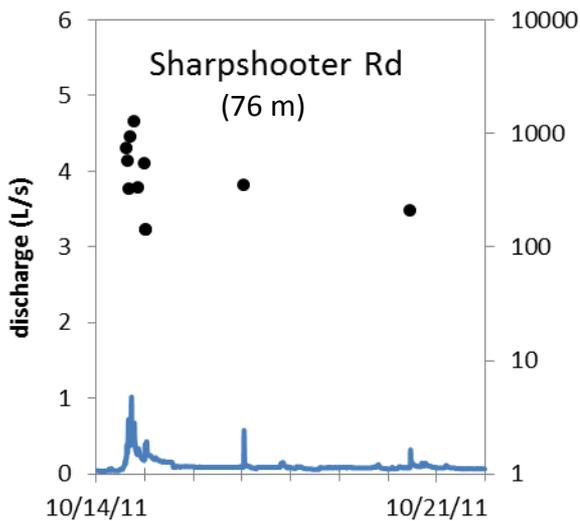
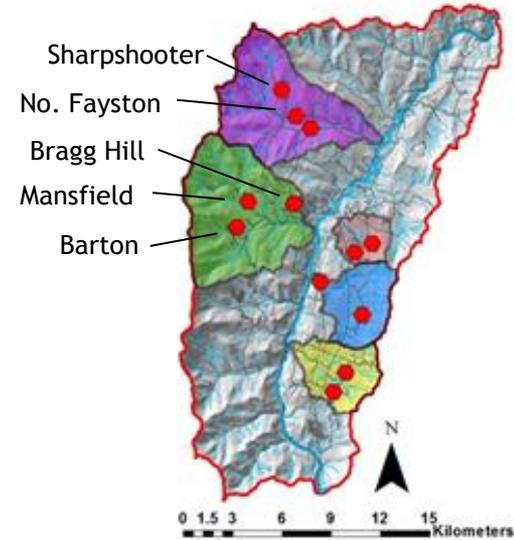
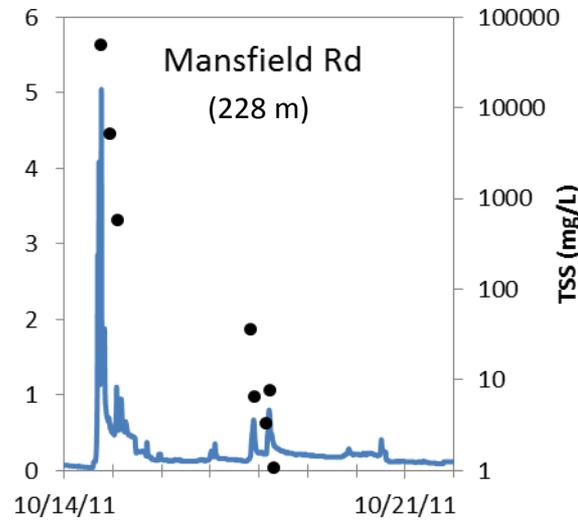
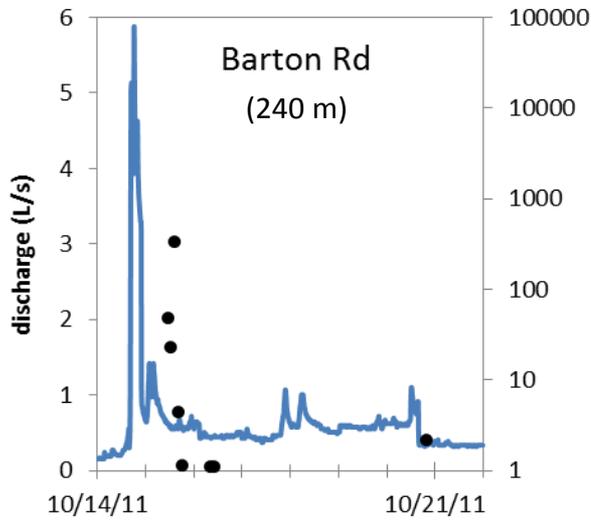




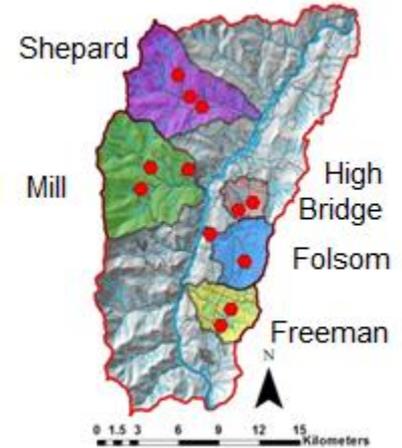
# Research approach



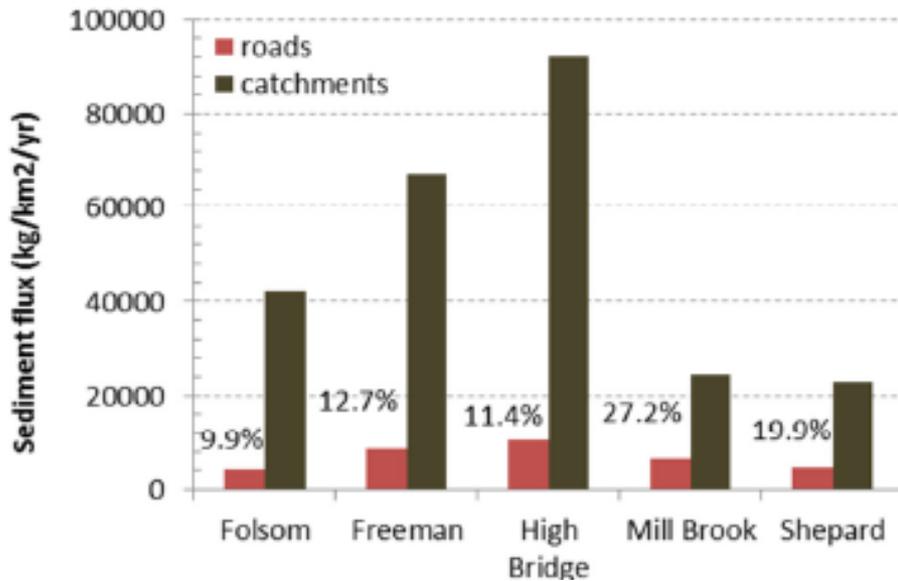
# Runoff & sediment production



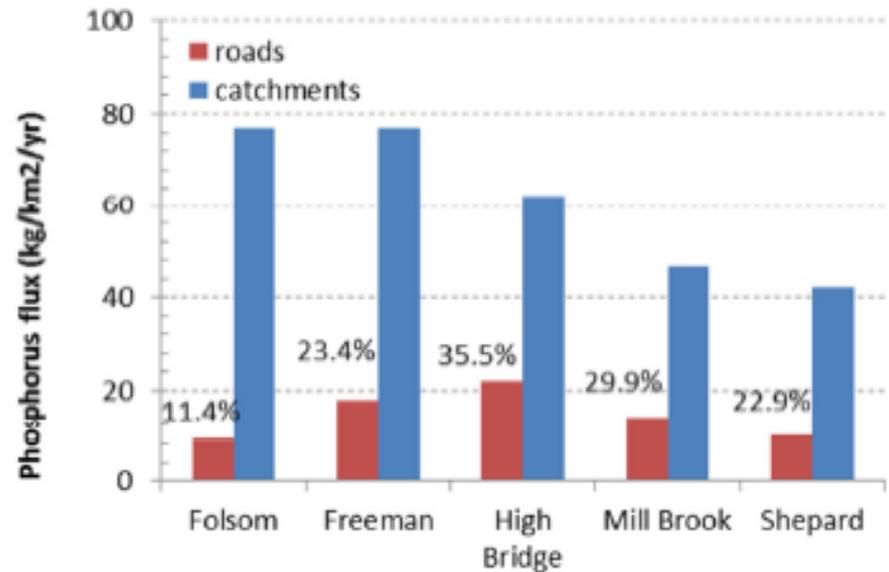
# Back road contributions to sediment and phosphorus in streams



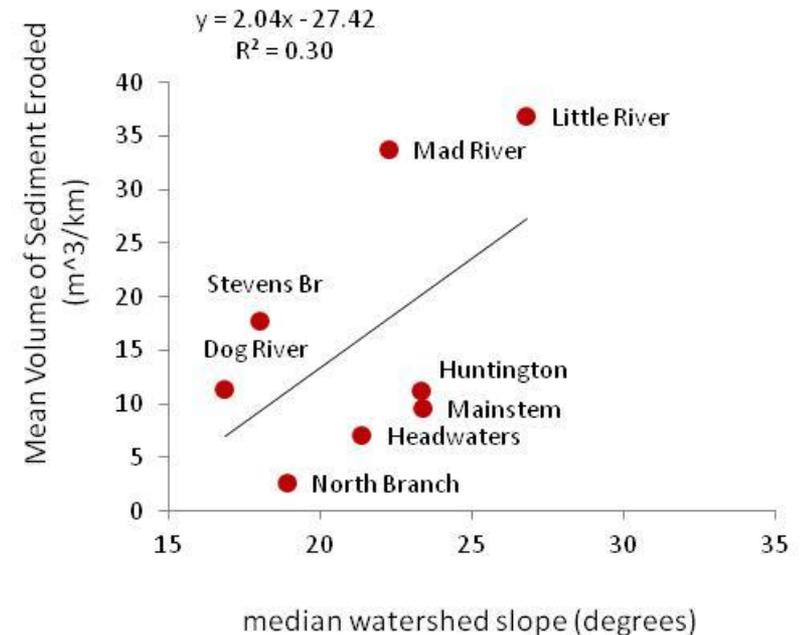
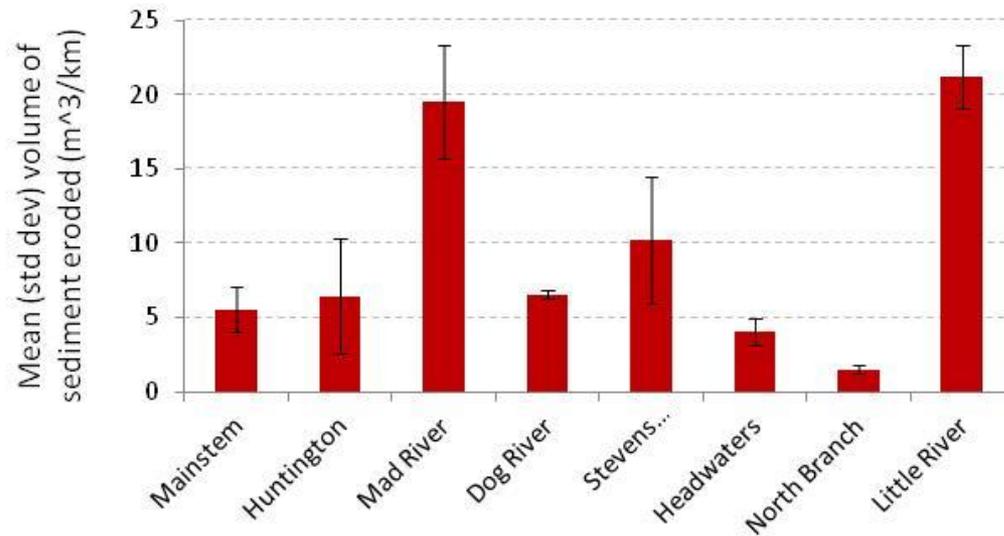
Suspended Sediment



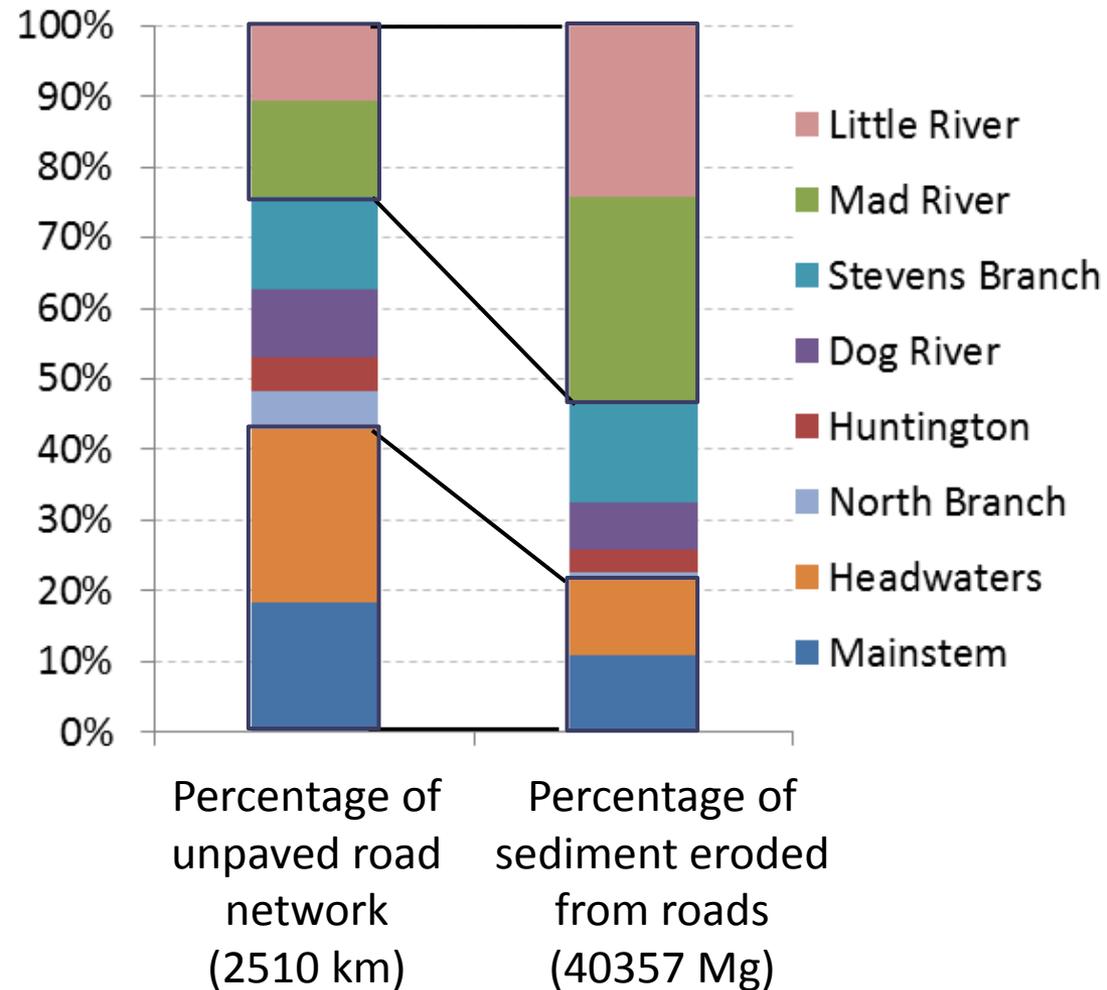
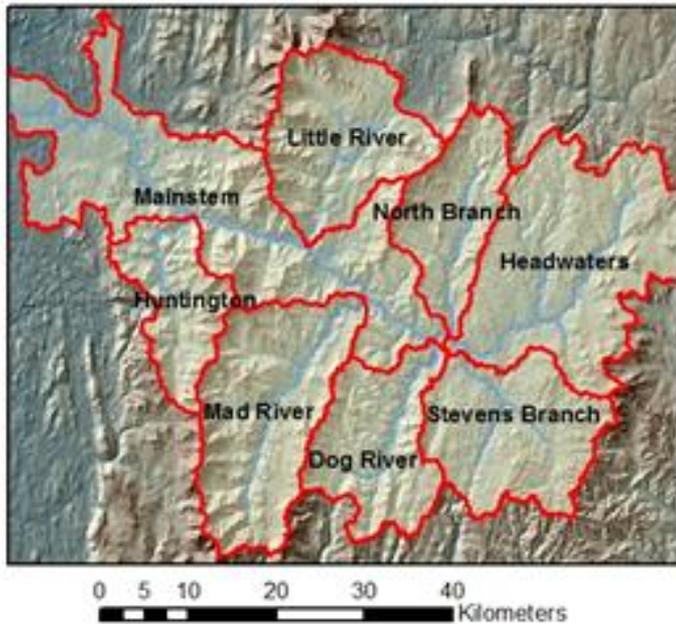
Total Phosphorus



# Erosion on Vermont's back roads



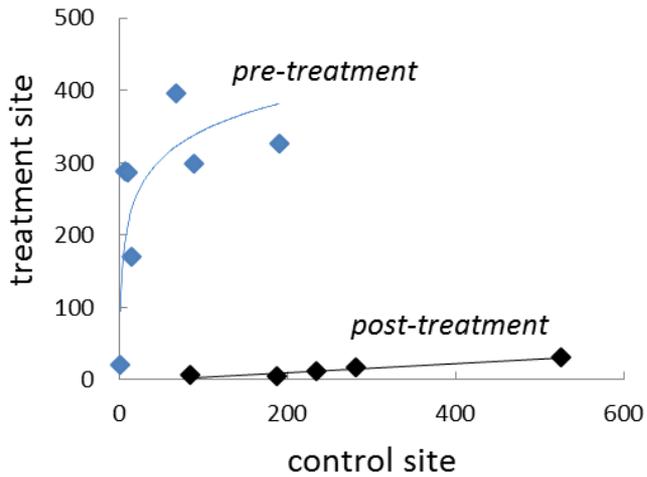
# Identifying “hot spots” of erosion



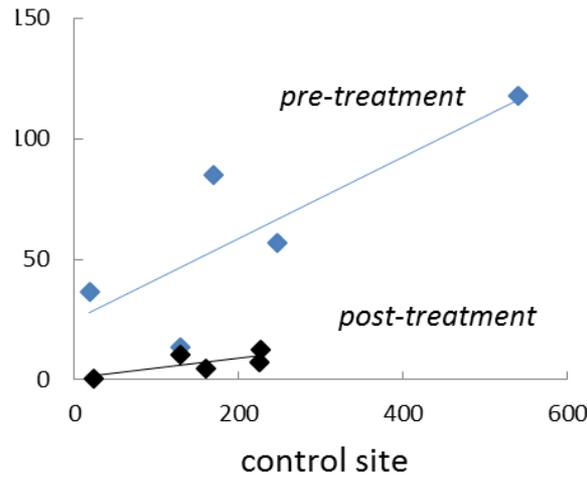
# BMP effectiveness



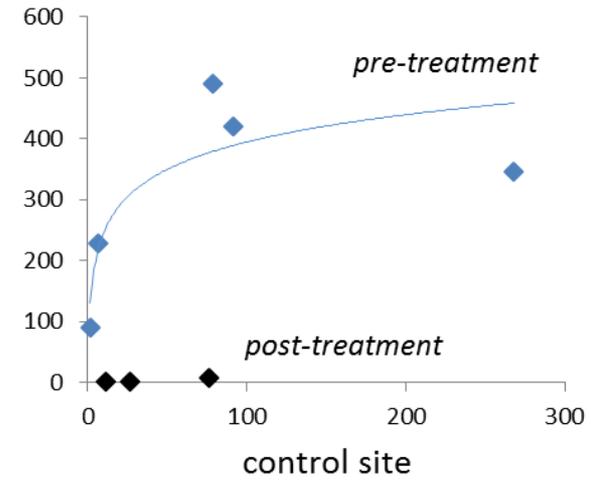
**Randell**



**Kew Vasseur**

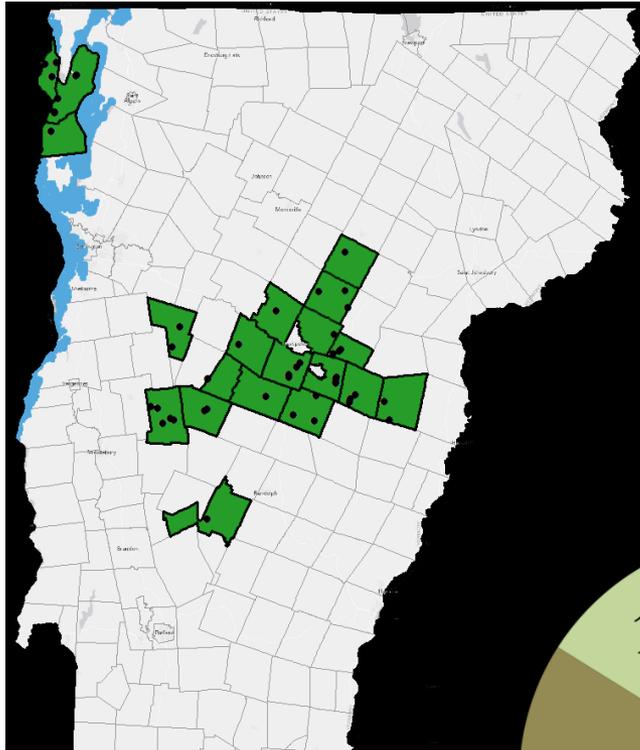


**Ski Valley**

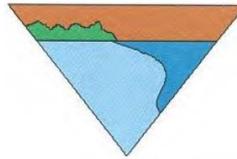


Sediment dry mass (kg)

# BMP longevity



Vermont Better Backroads Manual  
Clean Water You Can Afford



intact



compromised



failed

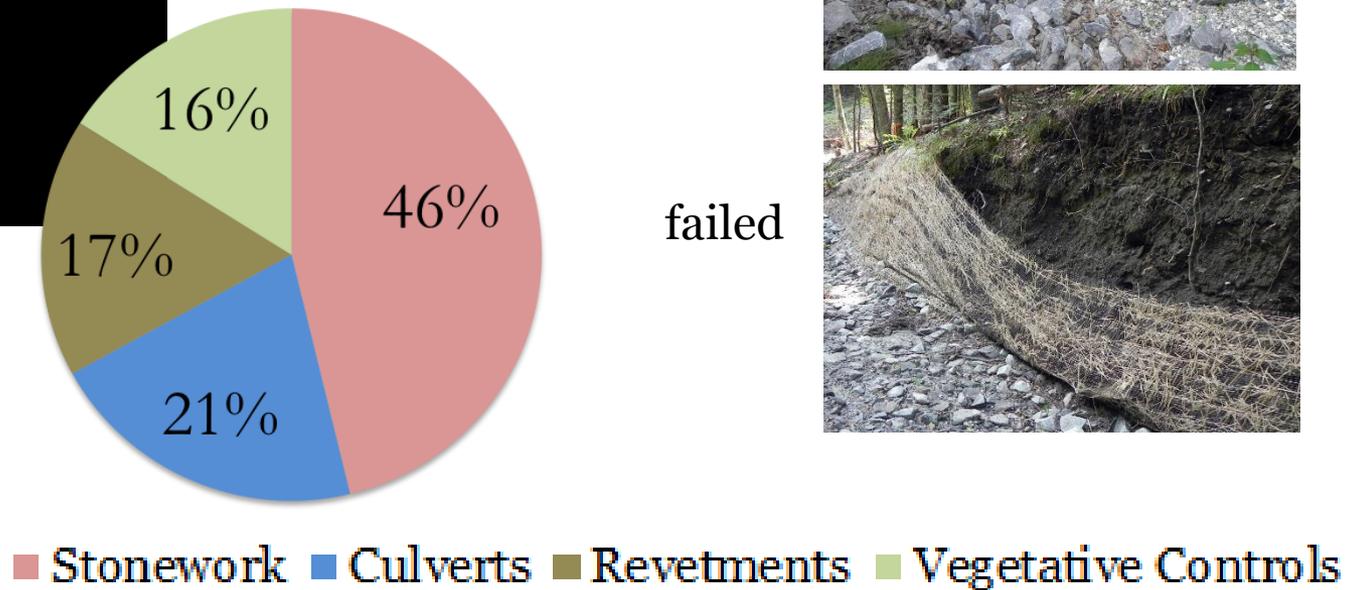


## Field Visits

46 Sites

106 BMPs

Age 1-8 years

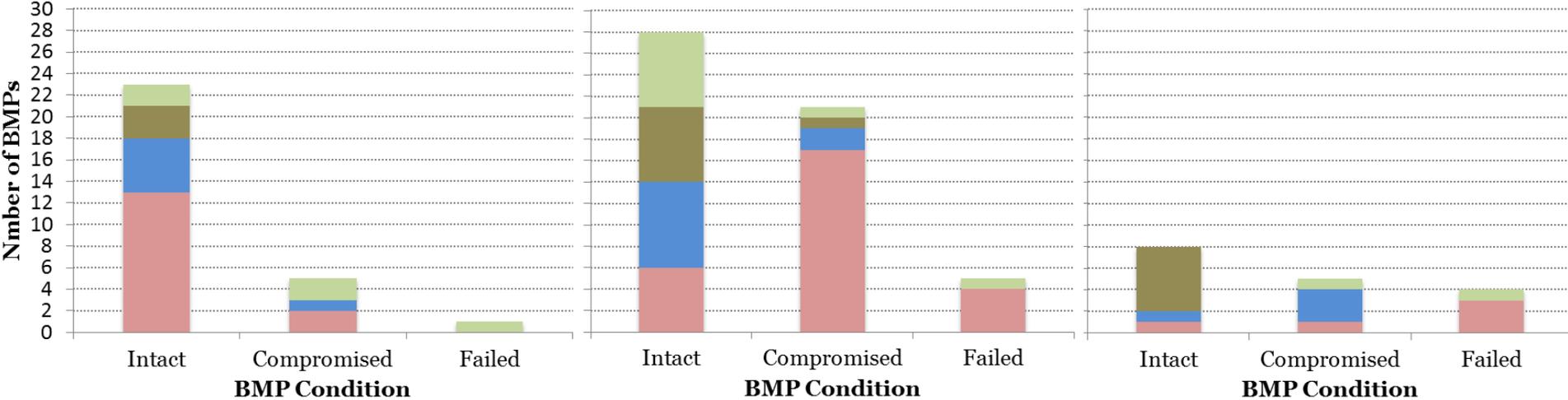


# BMP persistence with time

**1-2 Years**  
29 BMPs at 11 Sites

**3-5 Years**  
54 BMPs at 20 Sites

**6-8 Years**  
17 BMPs at 12 Sites



■ Stonework ■ Culverts ■ Revetments ■ Vegetative Controls

# BMP effectiveness with flood exposure



## Flood Resilience in the Lake Champlain Basin and Upper Richelieu River

A comprehensive review of the 2011 flooding impacts on a watershed level to inform flood resilience policies and management strategies in the Lake Champlain Basin

20  
13

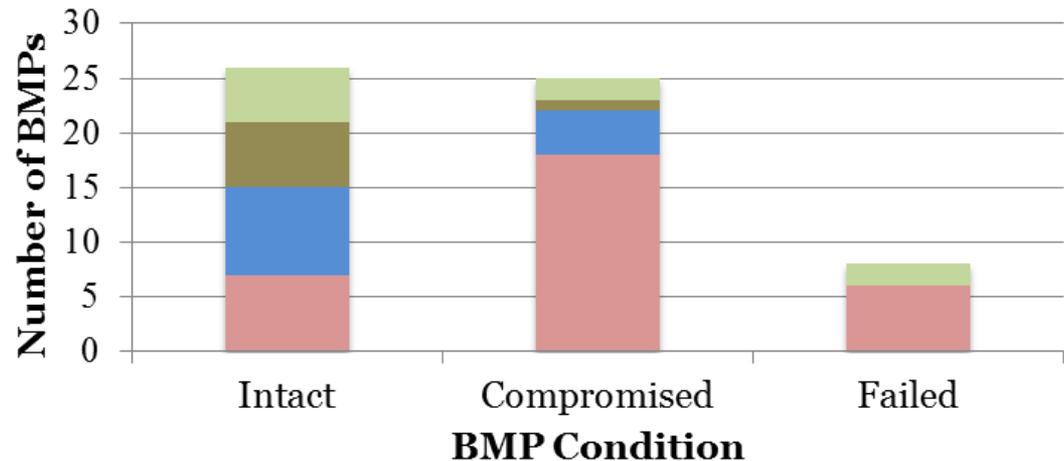
Learning from the Past, Preparing for the Future



## Exposed to flood events

59 BMPs at 23 Sites

Average Age 4.8 years, SD 1.6



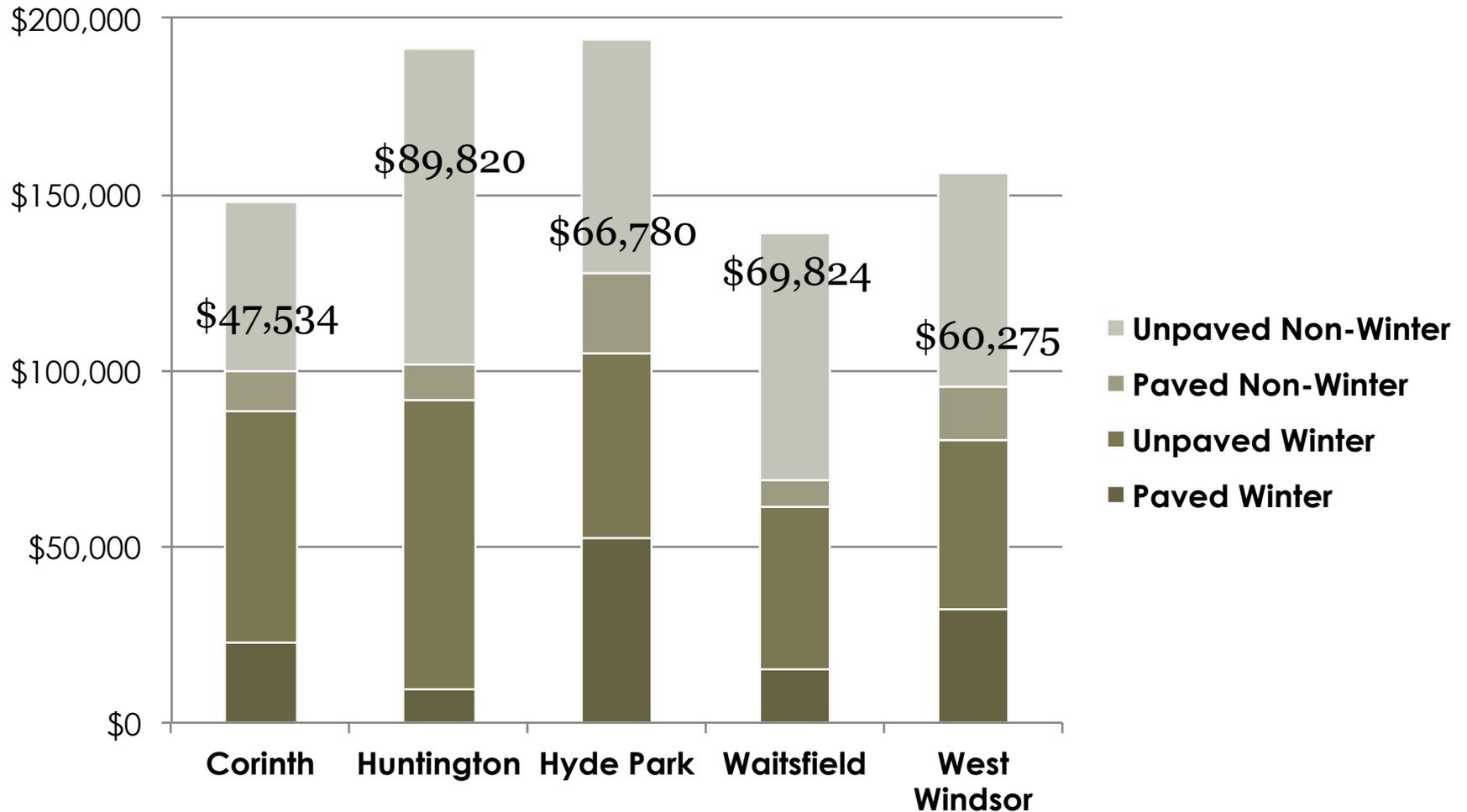
■ Stonework ■ Culverts ■ Revetments ■ Vegetative Controls

# Road budget assessment

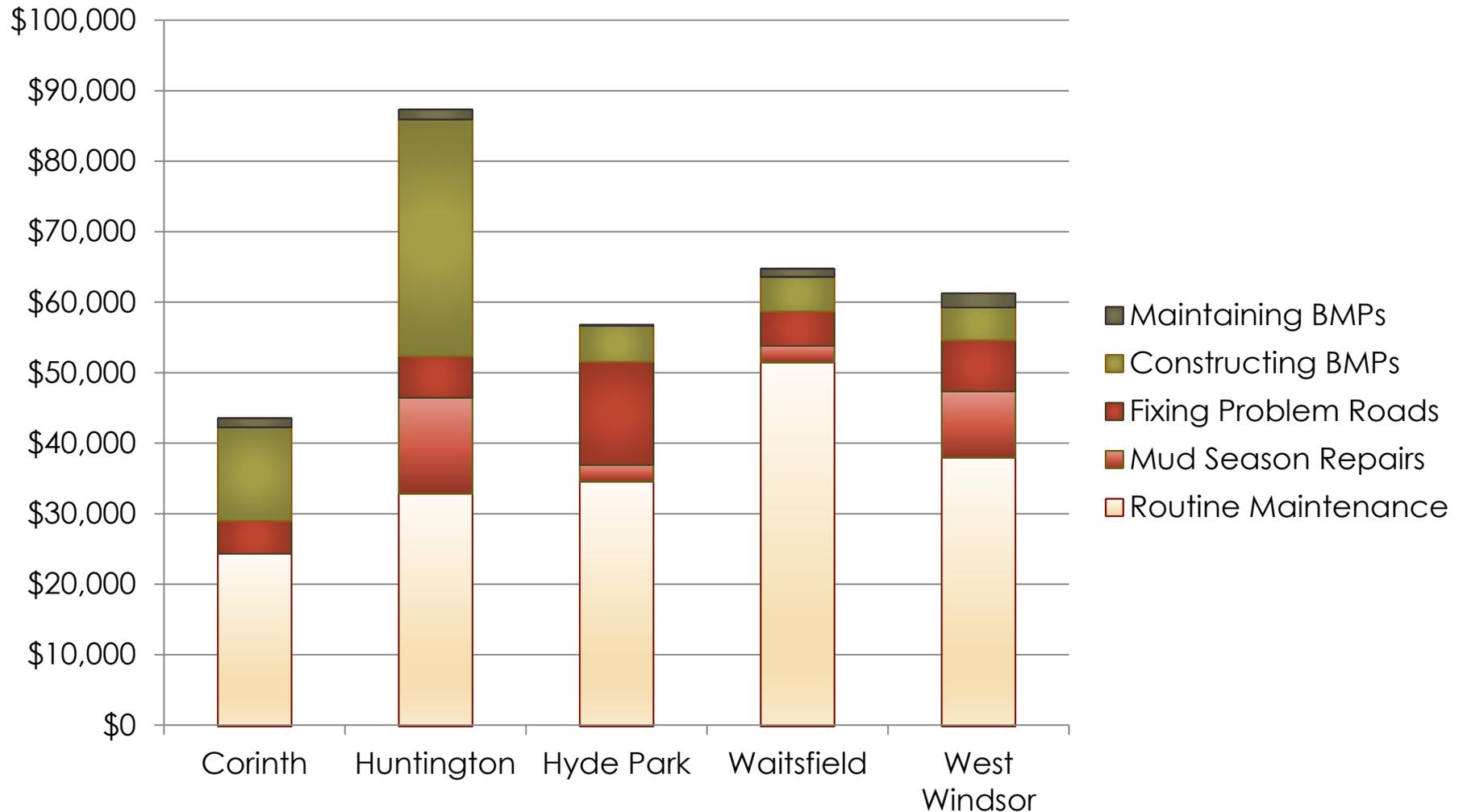
	<b>Corinth</b>	<b>Huntington</b>	<b>Hyde Park</b>	<b>Waitsfield</b>	<b>West Windsor</b>
Total Road Miles	93.74	43.96	63.45	29.67	51.28
% Unpaved	77	75	61	75	85
Population*	1,367	1,938	2,954	1,719	1,099
Road Budget (Year)	\$1,076,891 (FY 2014)	\$867,717 (FY 2013)	\$677,707 (FY 2014)	\$431,615 (CY 2013)	\$876,088 (CY 2013)
Budget \$/mile	\$11,488	\$19,739	\$10,680	\$14,547	\$17,084
Road crew Employees	3 FT 1 PT	4 FT	4 FT 1 PT	3 FT	3 FT 1 PT

\* Data from Vermont 2010 Census of Population and Housing

# Annual road crew salary

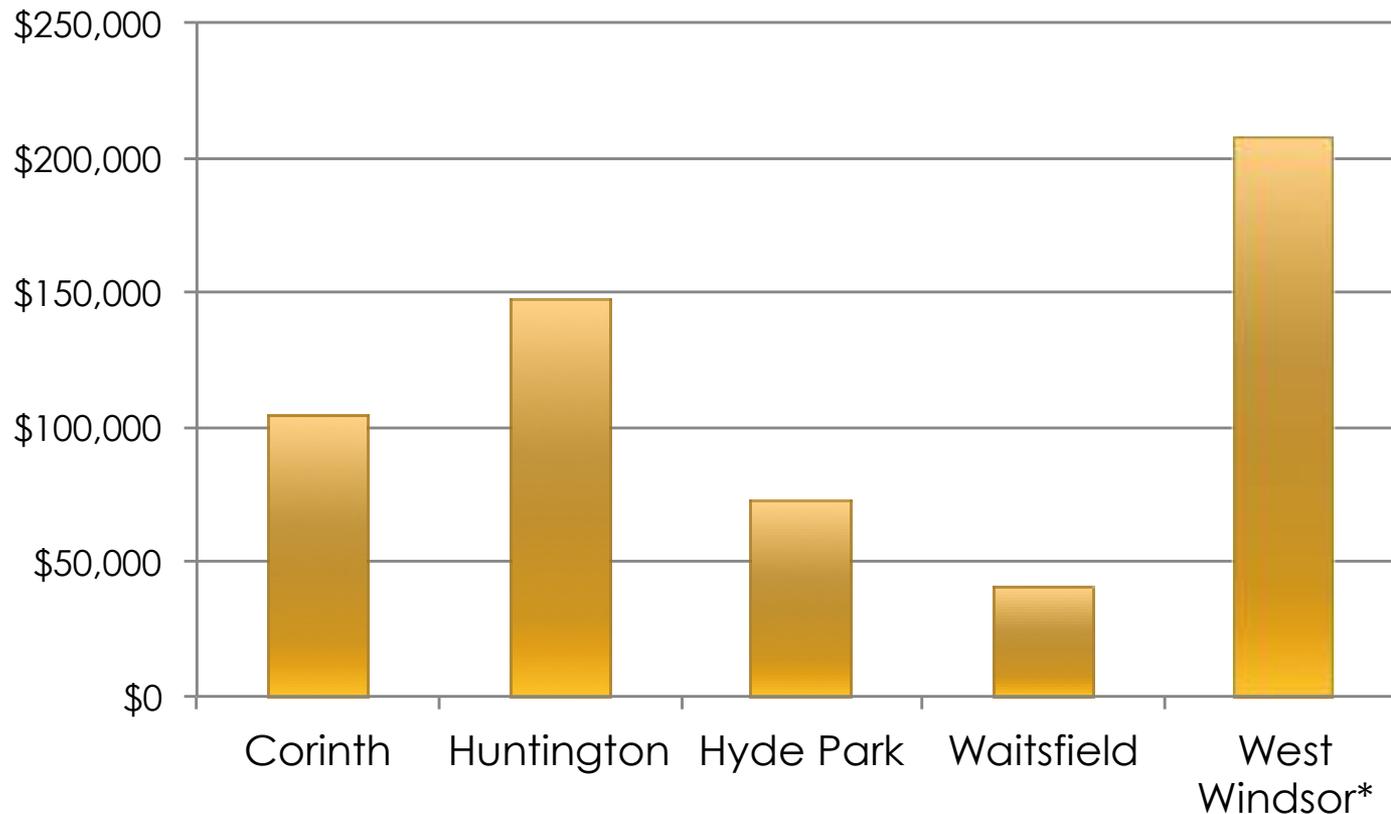


# Distribution of road crew salary by non-winter unpaved road maintenance tasks



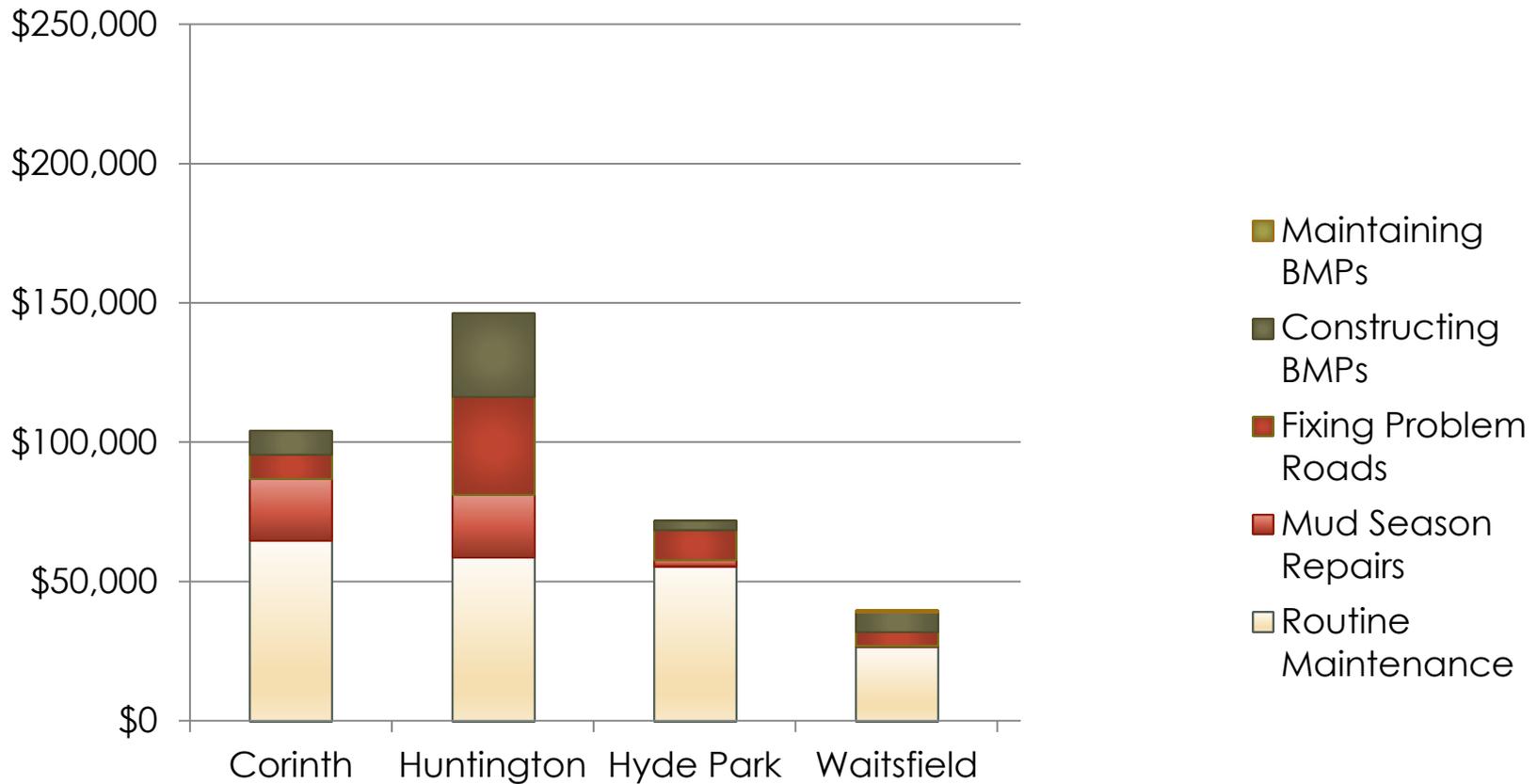
# Annual materials costs

## Non-Winter Unpaved Road Maintenance

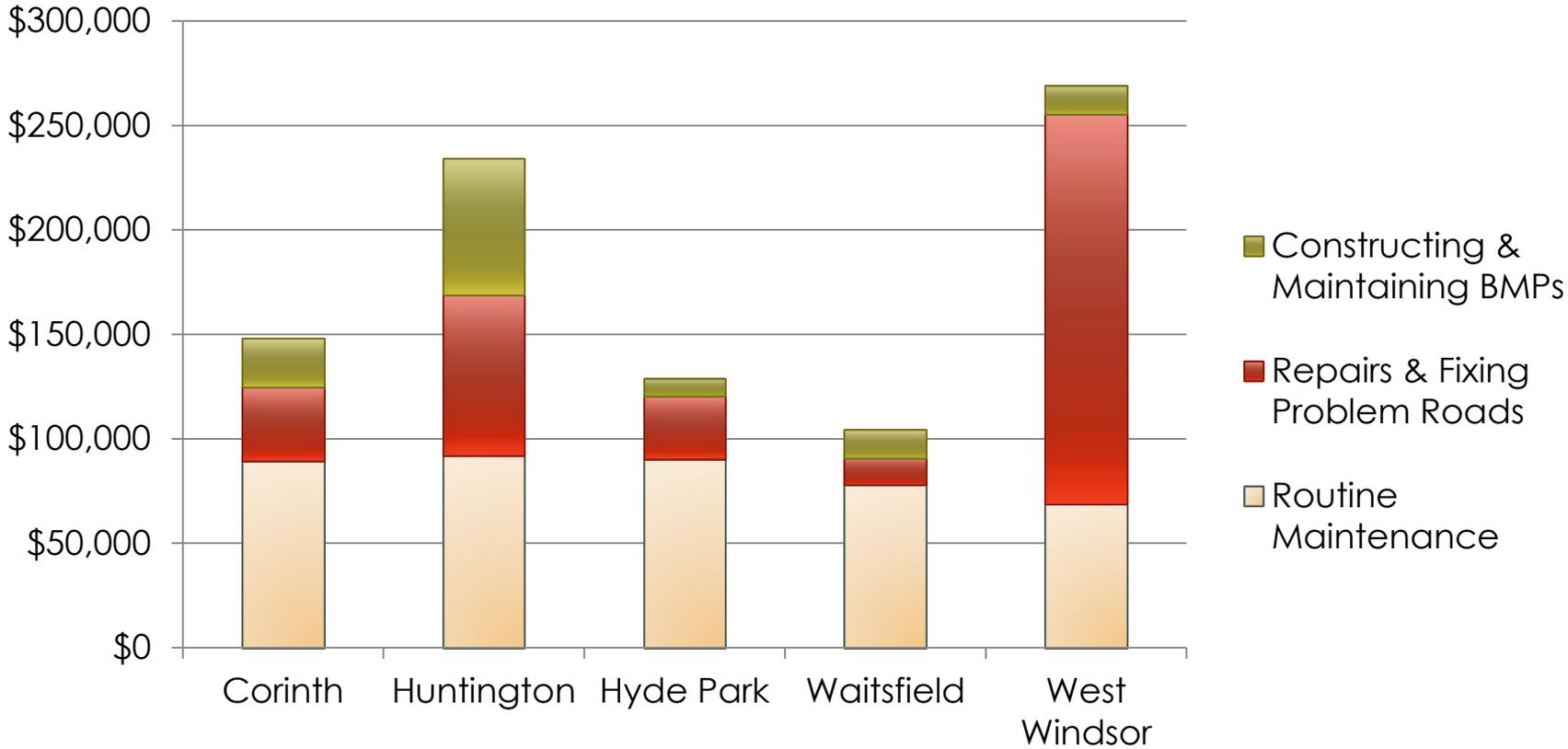


\* West Windsor materials total includes \$55,686.81 of itemized equipment rental, materials and trucking as a needed after a 2013 flood event

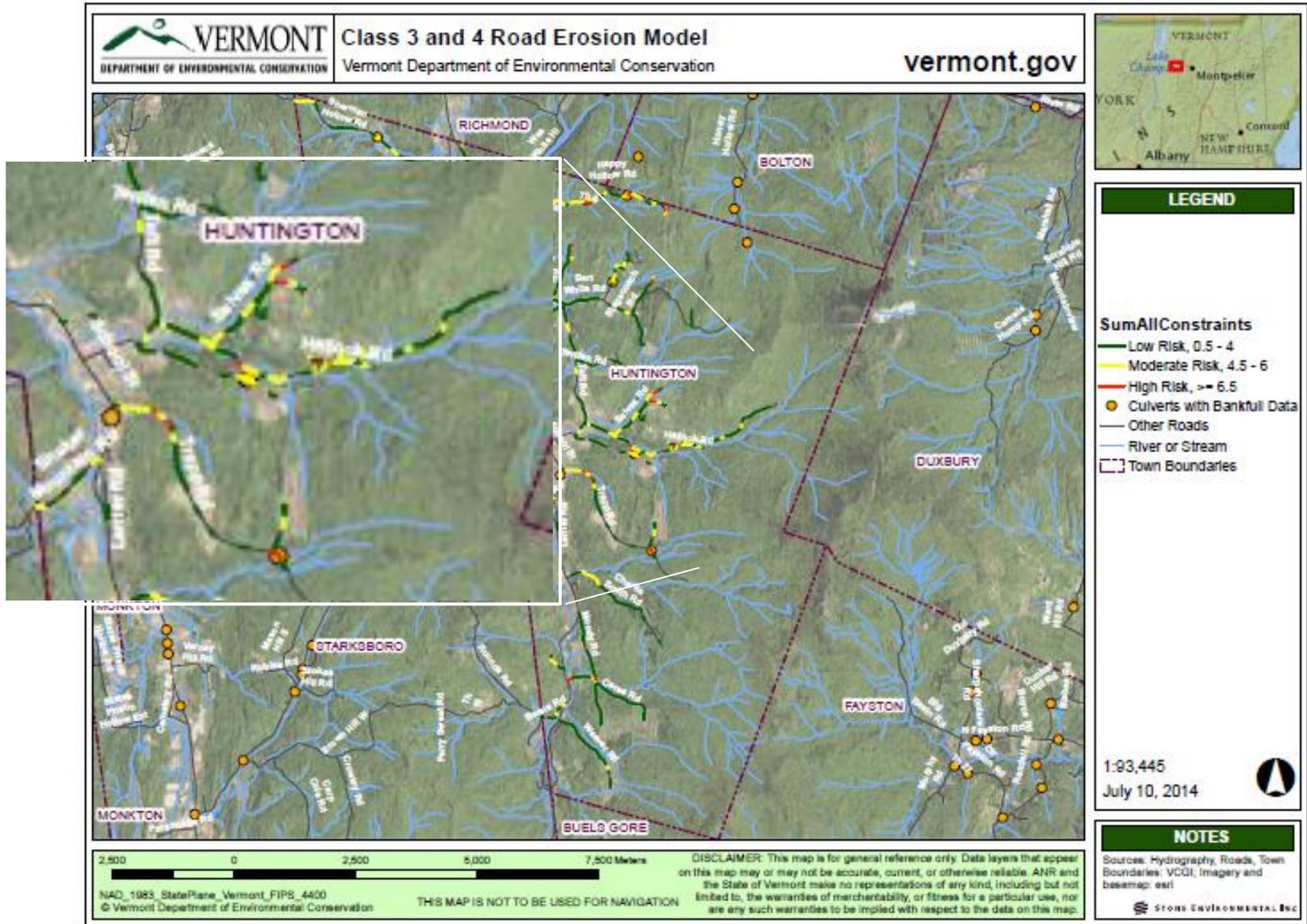
# Distribution of materials costs by non-winter unpaved road maintenance tasks



# Total salary and materials costs unpaved non-winter road work



# Prioritization of back road treatments



# “Ground truthing” prioritization

	Stone Environmental Ranking			
		High	Medium	Low
Field Ranking	High	8	8	8
	Medium	5	5	2
	Low	3	10	7
	No Priority*	10	5	10

A “No Priority” ranking was assigned if the road is:

- Paved
- No longer has an erosion-related problem
- A class 4 road or private driveway not maintained by the town

- 20 of the 56 assessed roads that towns must maintain earned matching ranks
- Class 4 roads and driveways pose risks to water quality

# Estimated need & treatment costs

	Corinth	Huntington	Hyde Park	Waitsfield	West Windsor
<b>Estimated mileage</b>					
High priority	2.02	1.34	1.47	1.23	2.59
Medium priority	13.71	6.40	5.13	7.13	9.93
Low priority	57.61	22.76	32.48	18.83	38.21
<b>Cost of treatment (@ \$4000/100 feet)</b>					
High priority	\$425,675	282,816	311,452	260,529	546,174
Medium priority	\$2,895,892	1,351,951	1,083,773	1,505,657	2,096,981
<b>Treatment cost over 8 years</b>					
High	\$53,209	35,352	38,932	32,566	68,272
Medium	\$361,987	168,994	135,472	188,207	262,123



# Summary

- Vermont's back roads have meaningful effects on water quality
- Storm damage and on-going repairs strain local budgets
- “Problem” or “high priority” sites represent small fraction of the network
- BMPs reduce water quality impacts and last over time
- Benefits to be achieved by moving from reactive (fixing problems) to pro-active (BMP-based) approach
- Broader investment (capital and training) needed to address downstream WQ benefits and build resilience

# Acknowledgements

## Collaborators:

- Don Ross, Dept of Plant & Soil Science, UVM
- Donna Rizzo, Environmental Engineering, UVM
- Leslie Morrissey, Rubenstein School, UVM

## Students and technicians:

G Clark, J Garton, K Garvey, L Hall, S Hamshaw, A Larson, A Morton, H Schmid, A Pechenick, C Webster, R Zeyzus

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- U.S. Geological Survey (NIWR)
- Vermont NSF EPSCoR RACC project (EPS 1101317)