

Transportation Resilience Planning Tool

Infrastructure Vulnerability, Criticality, and Risk



CVRPC | September 22, 2020



Fitzgerald Environmental Associates, LLC.
Applied Watershed Science & Ecology



Agenda

- Transportation Resiliency Planning Tool Review
- Vulnerability
- Local Road Importance
- Criticality
- Risk
- Website Review
- Next Steps

Definitions

Vulnerability: The extent that a transportation asset is exposed to a threat from inundation, erosion, or deposition.

Probability: The likelihood that a threat will damage a transportation asset, as linked to storms of different sizes.

Criticality: **How important is the transportation asset that dictates the consequence of the disruption to mobility due to damage? How close is it to essential facilities?**

Risk: The combination of the probability of vulnerability and criticality.

Project Overview

VULNERABILITY

- Watershed and River Corridor Analysis
- 10-year, 50-year, and 100-year floods
- Road, Bridges, and Culverts
- Failure Mode

CRITICALITY

- State and Local Roads
- Novel Consideration of Vulnerability
- 1,000 Simulations of Network Disruption
- Failures and Delays

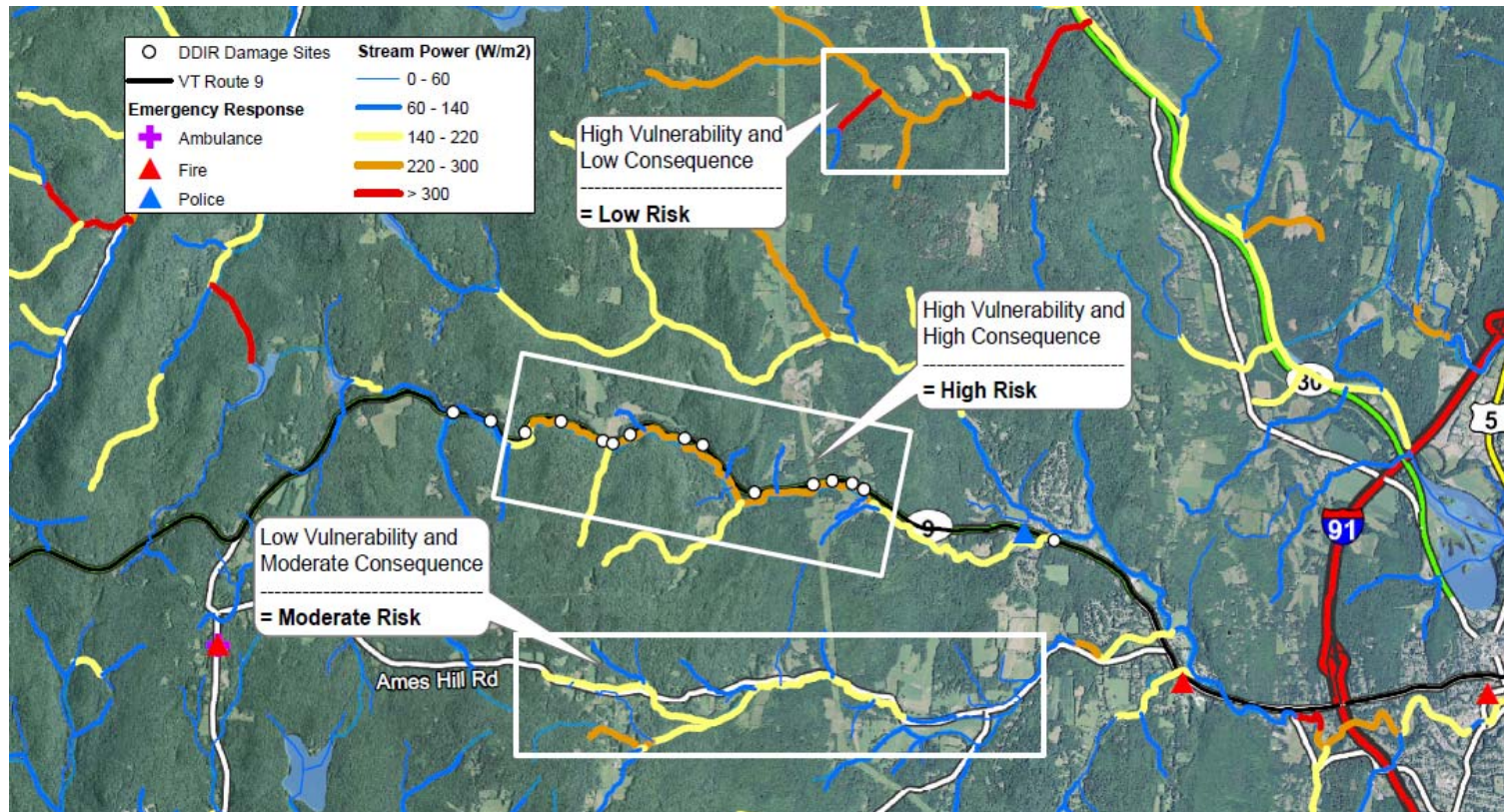
RISK

Mitigation

- Resiliency App
- VTrans Prioritization Updates
- Watershed Resiliency Plans
- Project Guide Book

Goals

1. Develop flood risk identification methods and tools.
2. Systematically identify high risk road segments and crossing structures.
3. Incorporate vulnerability and risk into planning process.

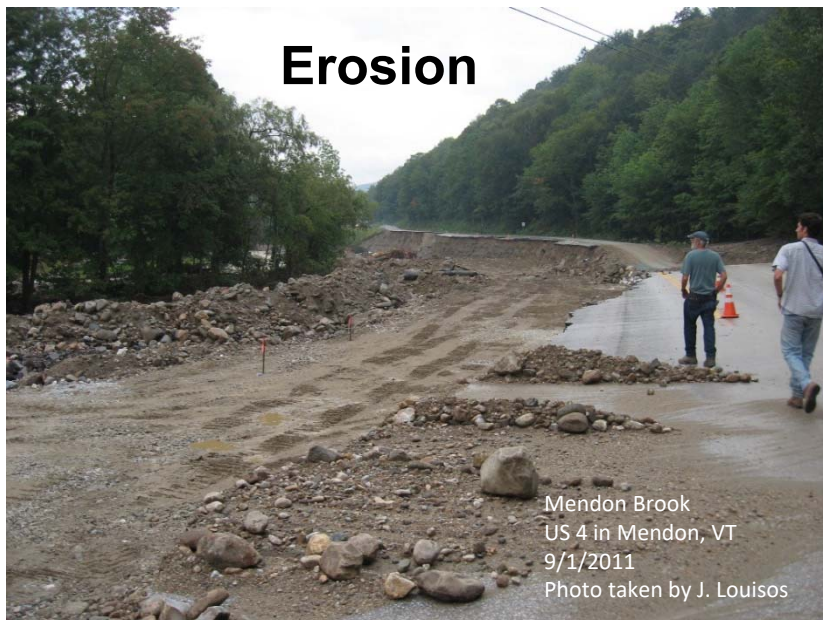


Vulnerability Processes

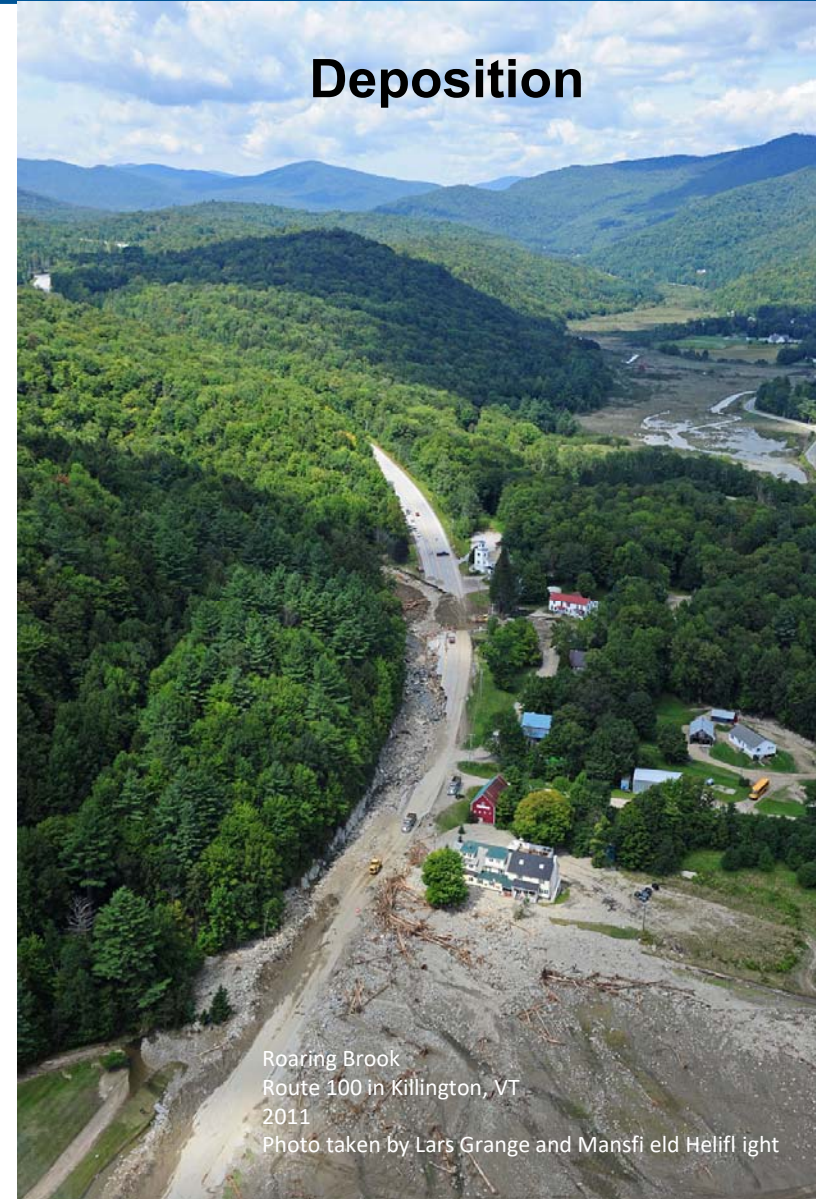
Inundation



Erosion

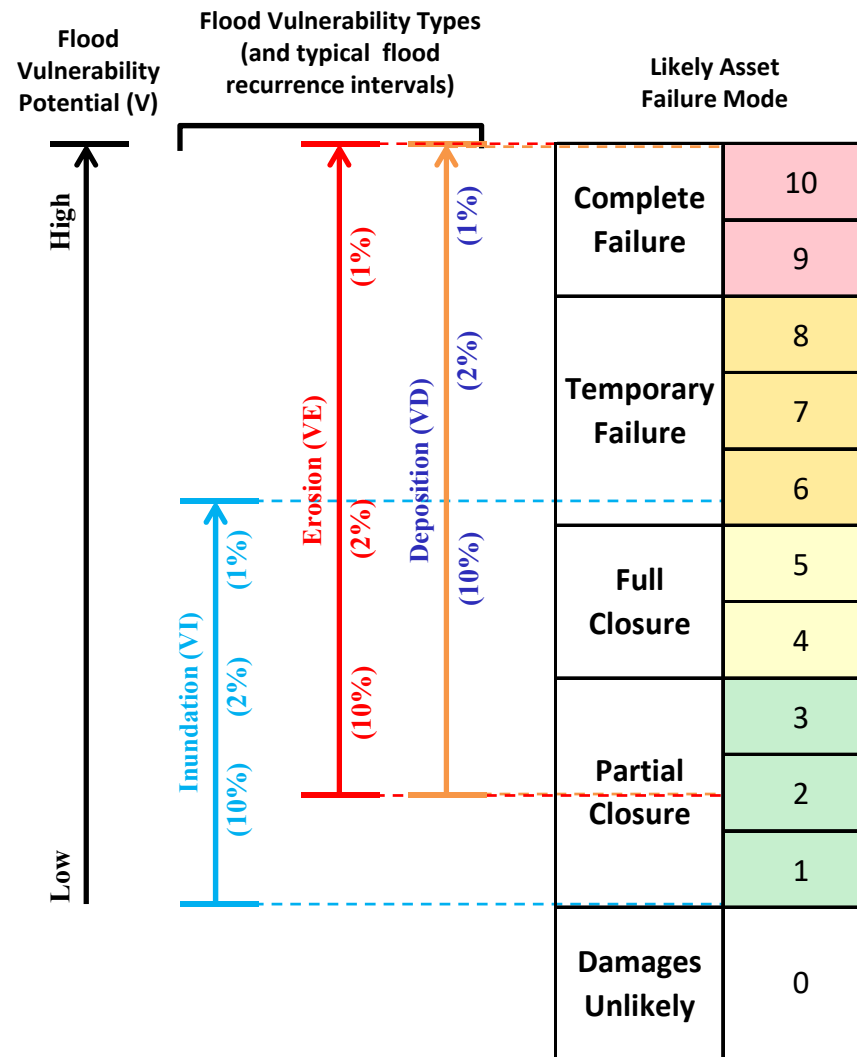


Deposition

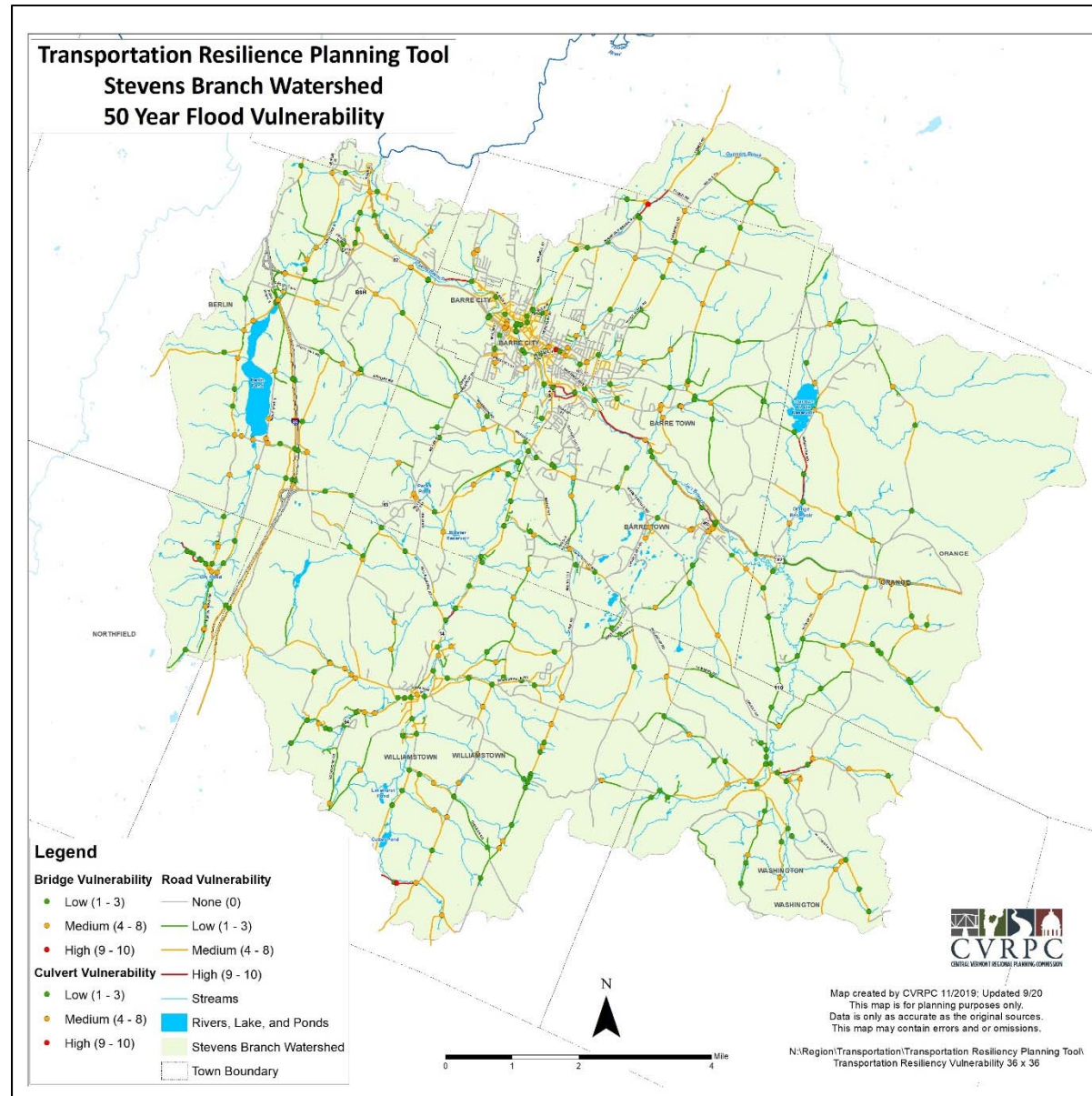


Vulnerability

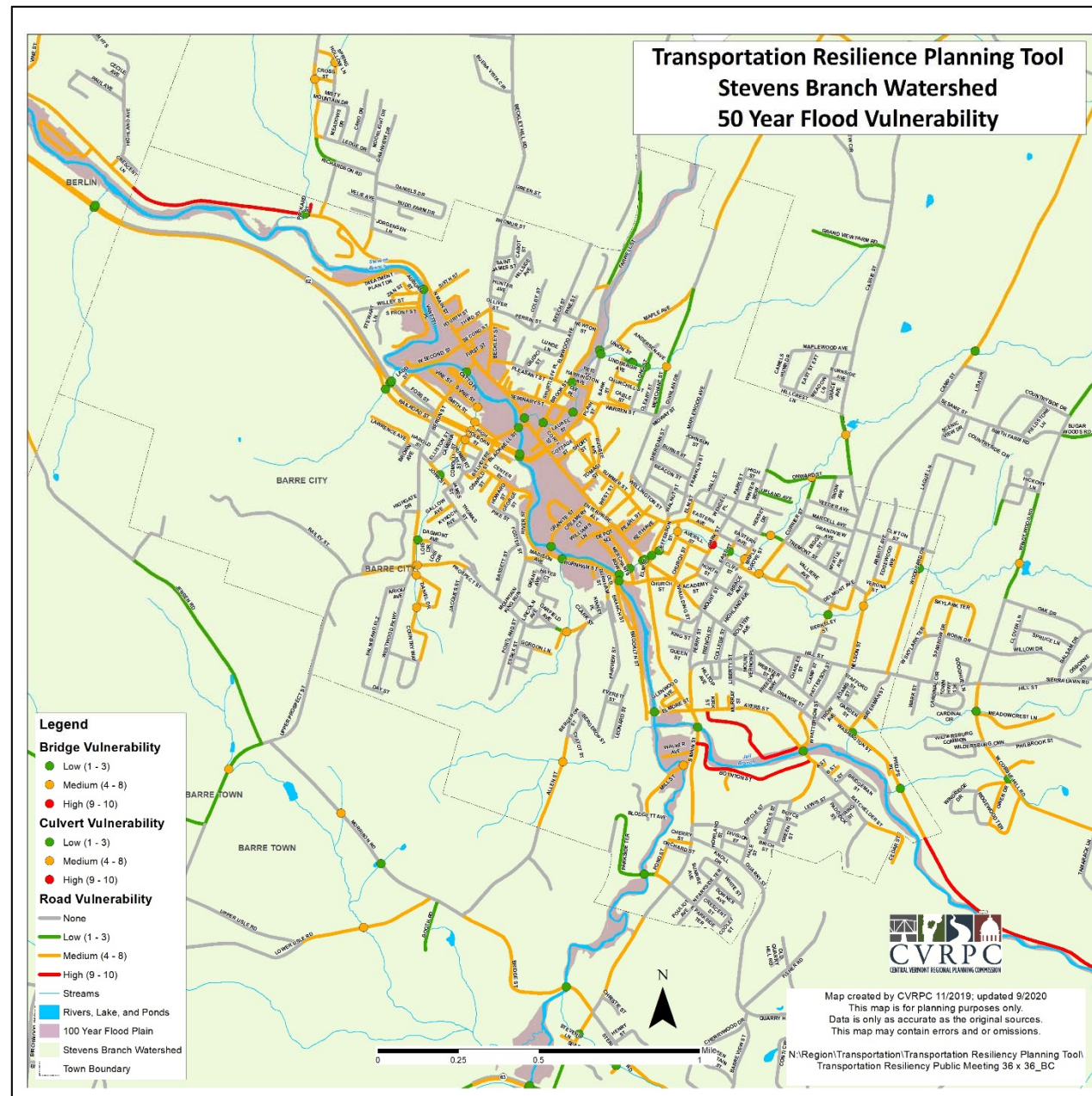
- Vulnerability estimated at road embankments, bridges, and culverts.
- Assigned maximum from inundation, erosion, and deposition.



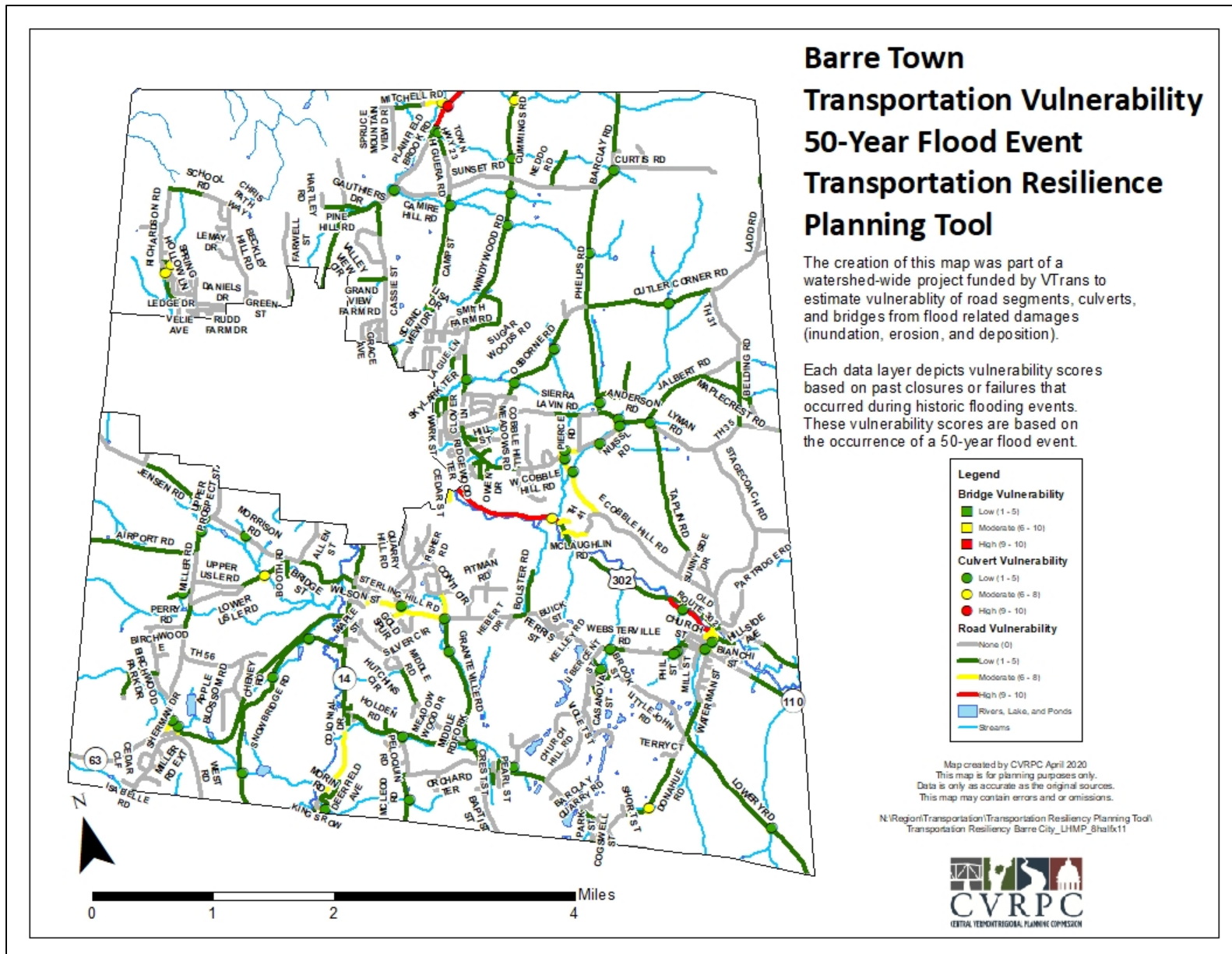
Vulnerability – Combined 50-Year Flood



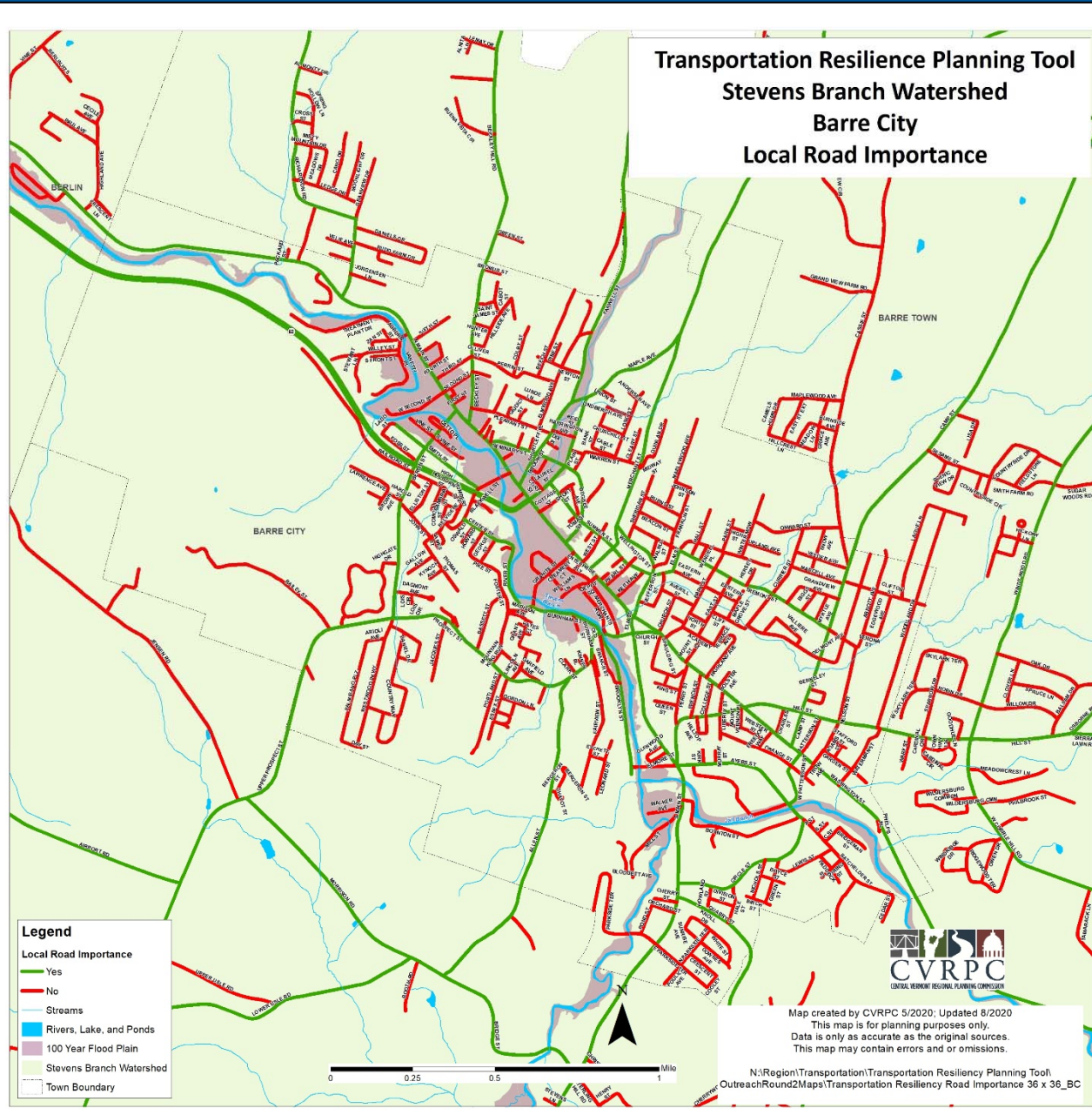
Vulnerability – Barre City Combined 50-Year Flood



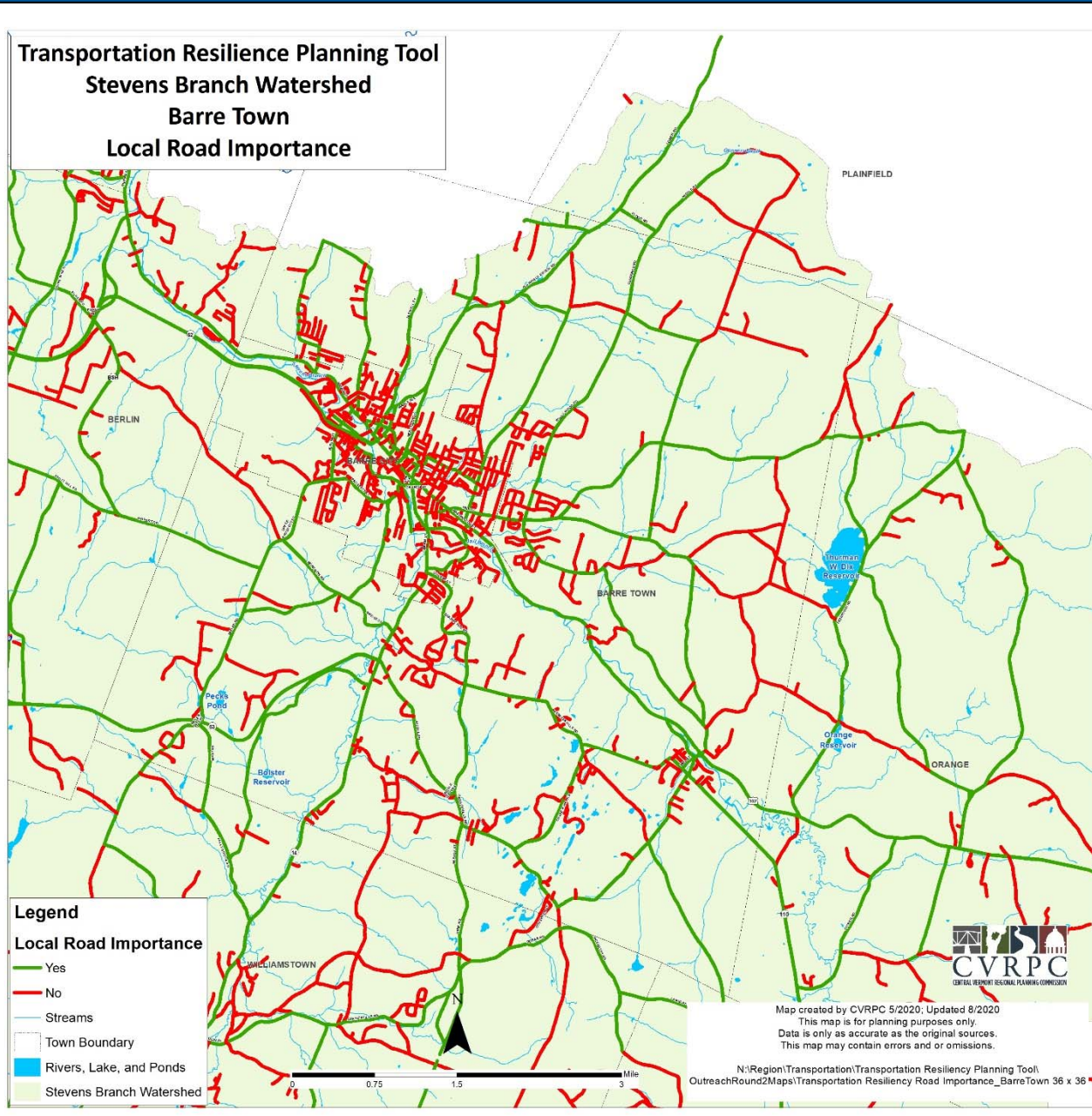
Vulnerability – LHMPs



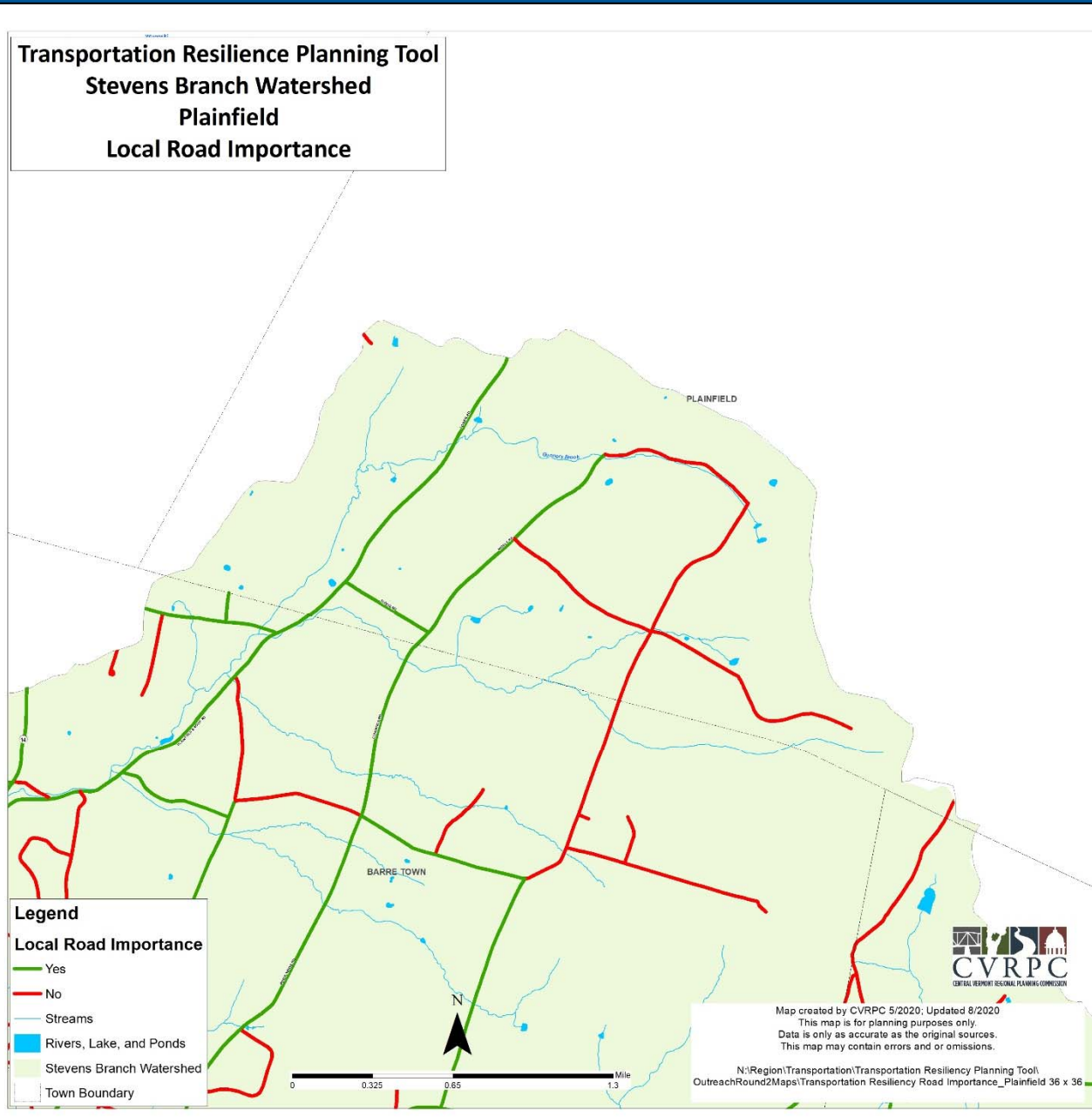
Local Road Importance – Barre City



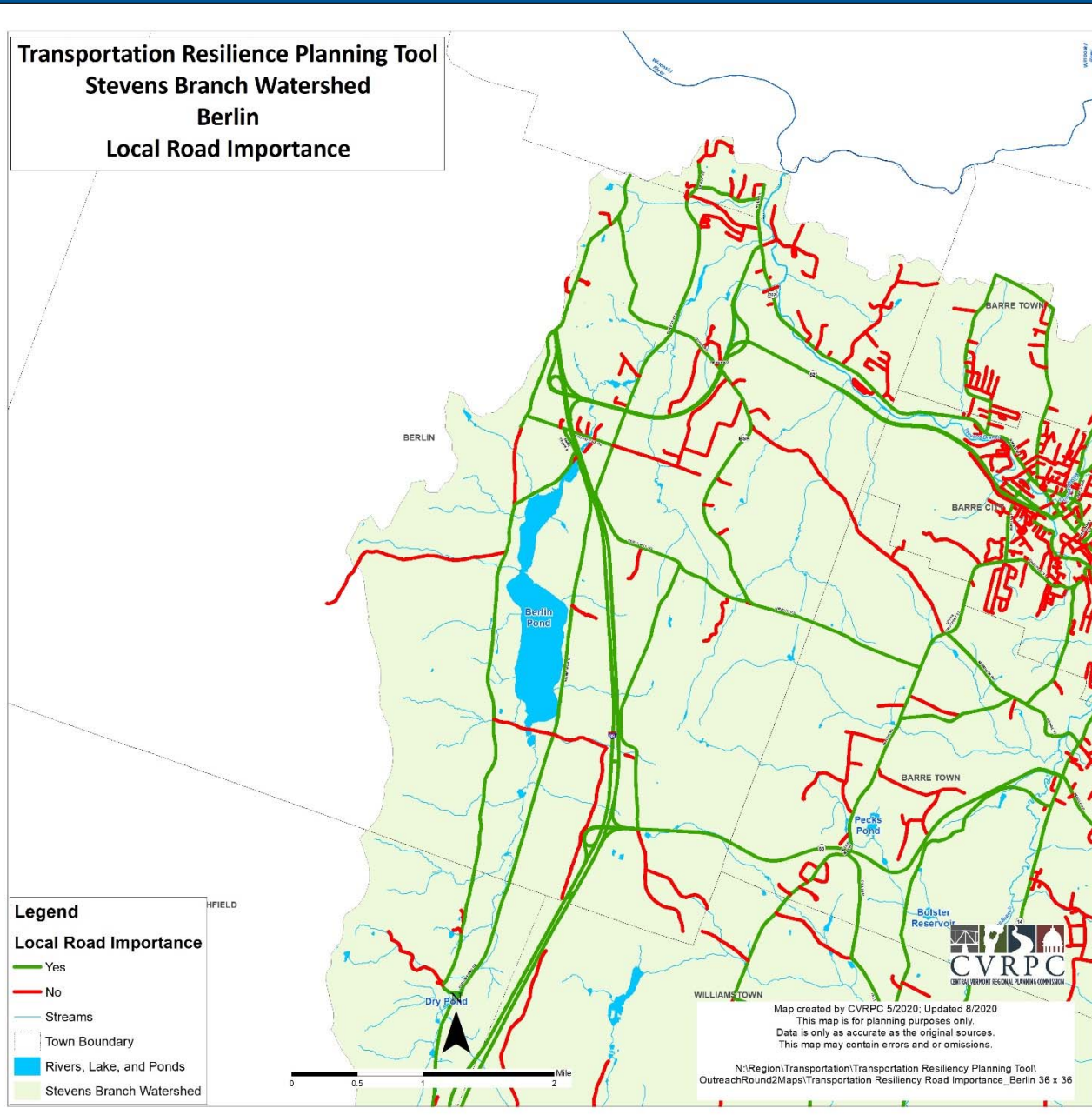
Local Road Importance – Barre Town



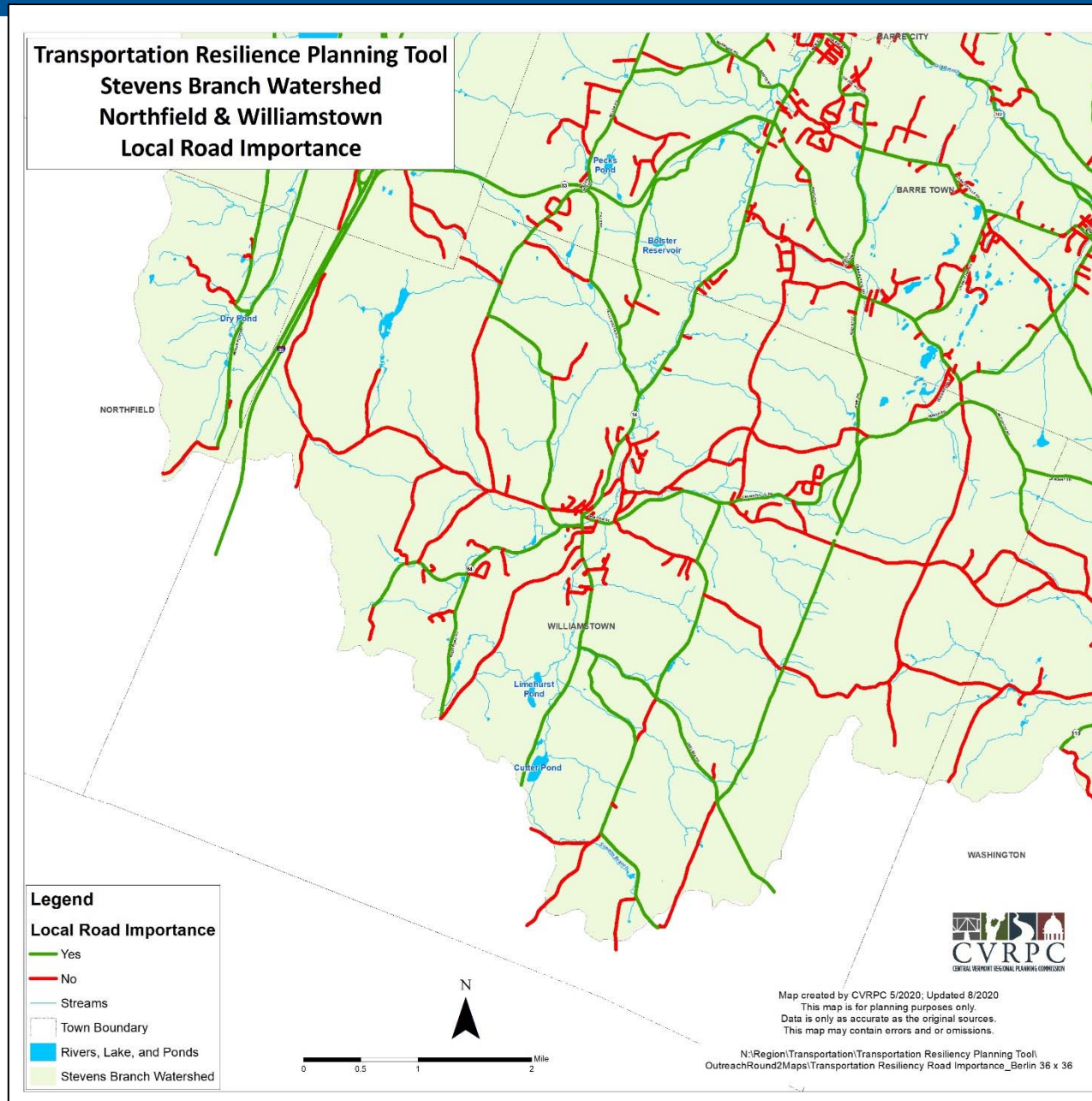
Local Road Importance – Plainfield



Local Road Importance – Berlin

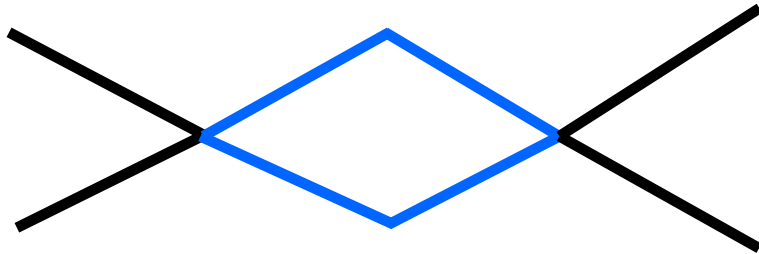


Local Road Importance – Northfield & Williamstown

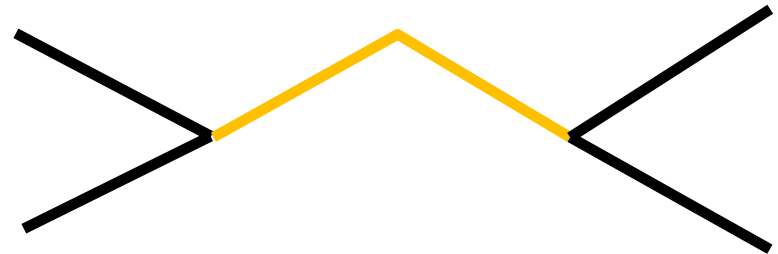


Network Criticality

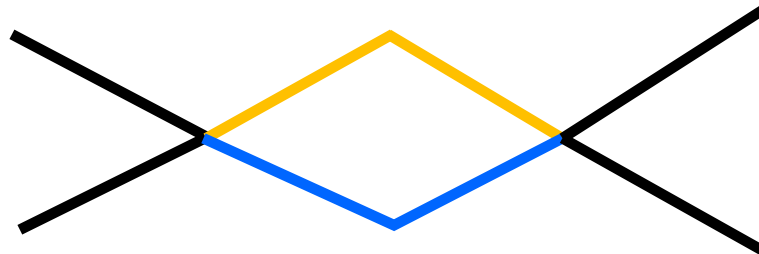
Low criticality – Parallel route



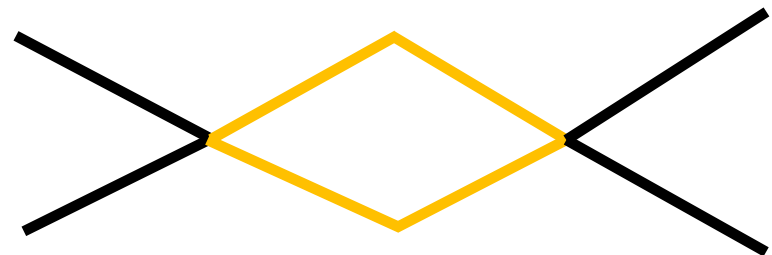
High criticality – No parallel route



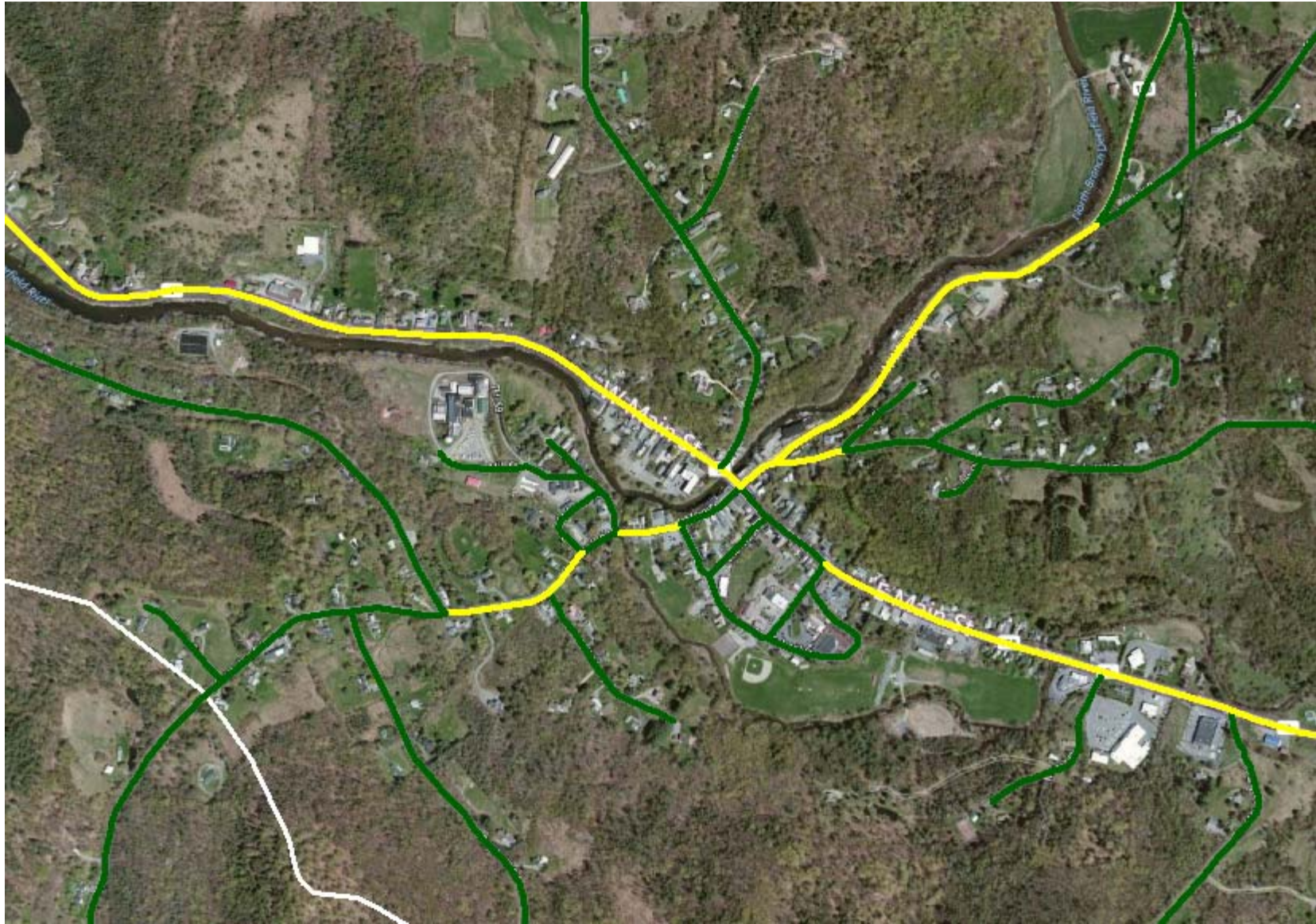
**Moderate criticality – Parallel route
yet one is vulnerable**



**High criticality – Both routes
vulnerable**



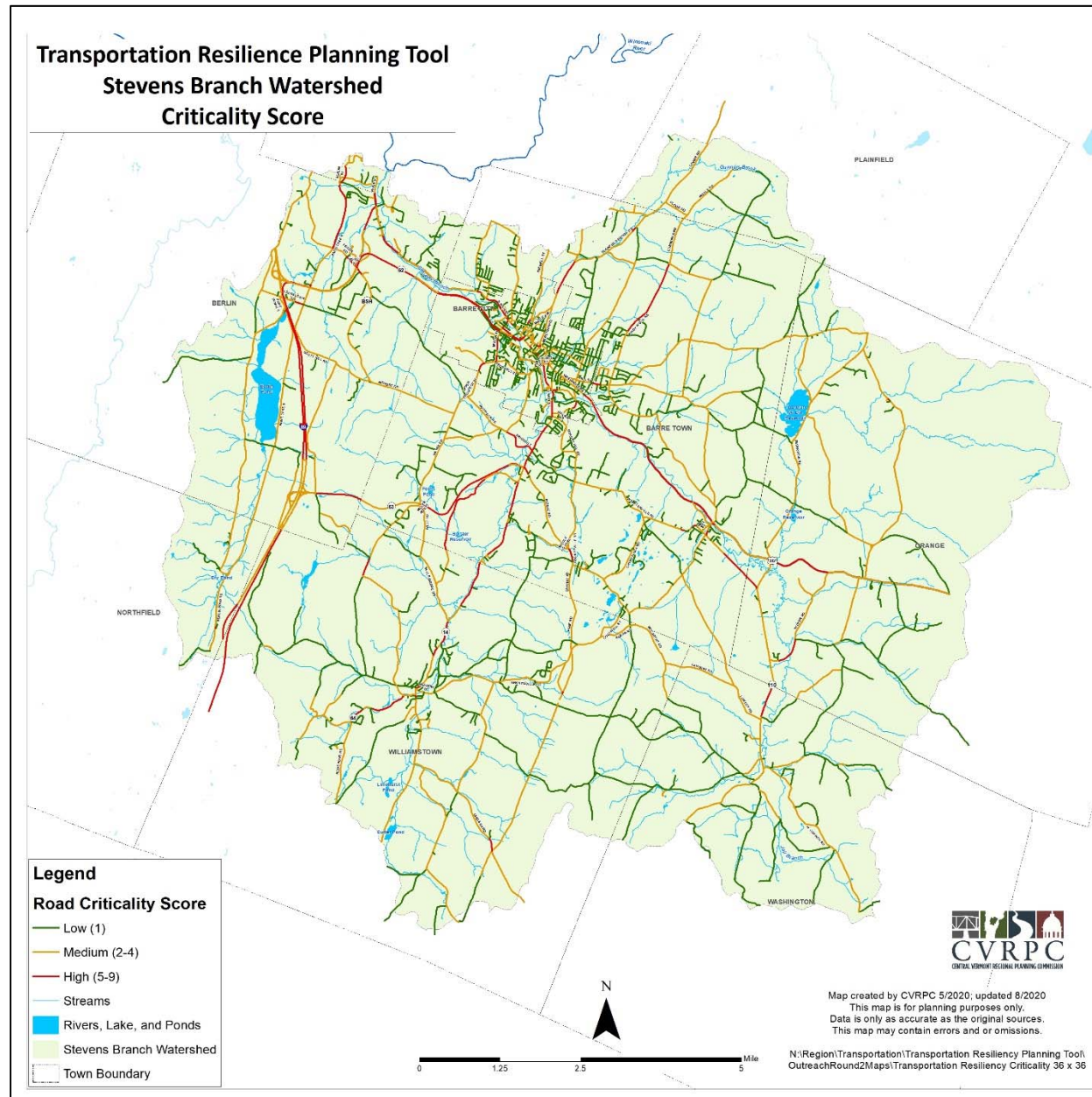
Criticality: Critical Closeness Accessibility



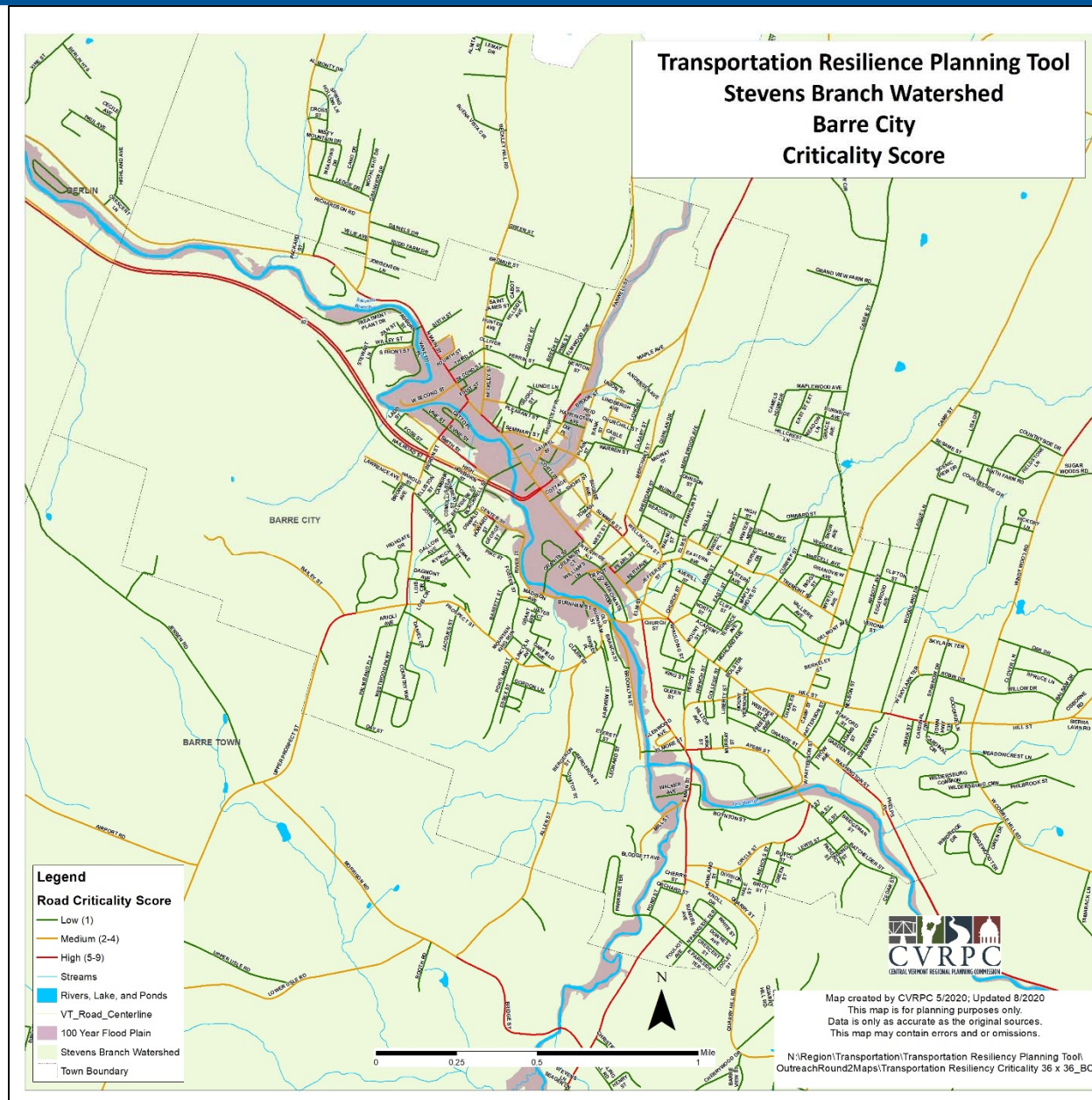
Criticality

SCORE	Key Link in Network Criticality Index (High or Medium)		Critical Closeness Accessibility (UVM)		Locally Important for daily regular function or for detour*	Combined Score for Map Display
10=	High or Medium	AND	High	AND	y	HIGH (RED)
9=	High or Medium	AND	Medium	AND	y	
8=	High or Medium	AND	High or Medium	AND	n	
7=	High or Medium	AND	Low	AND	y	
6=	Low	AND	High	AND	y	
5=	Low	AND	Medium	AND	y	
4=	High or Medium	AND	Low	AND	n	MEDIUM (YELLOW)
3=	Low	AND	High or Medium	AND	n	
2=	Low	AND	Low	AND	y	
1=	Low	AND	Low	AND	n	LOW (GREEN)

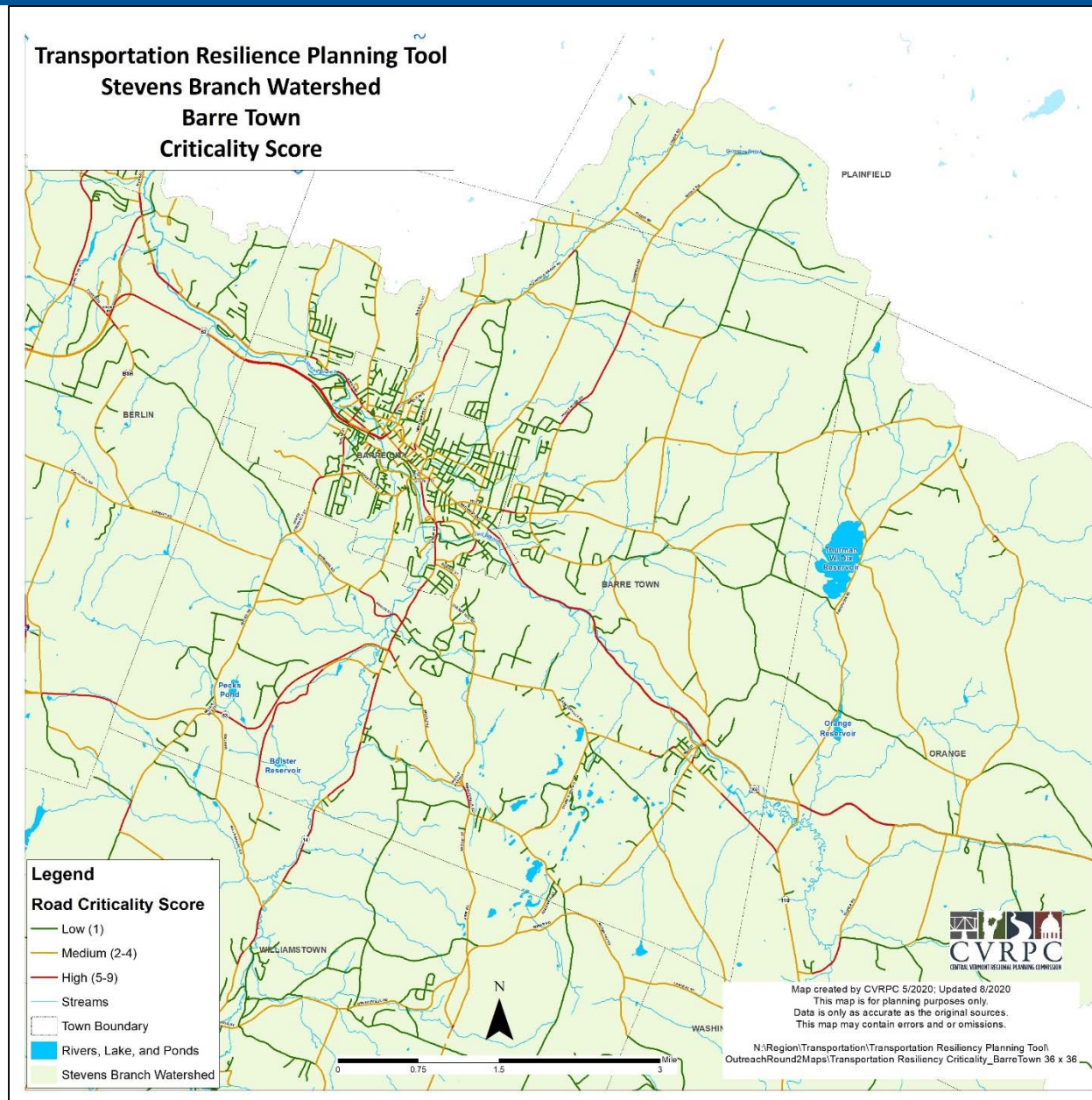
Criticality Scores – Watershed-Wide



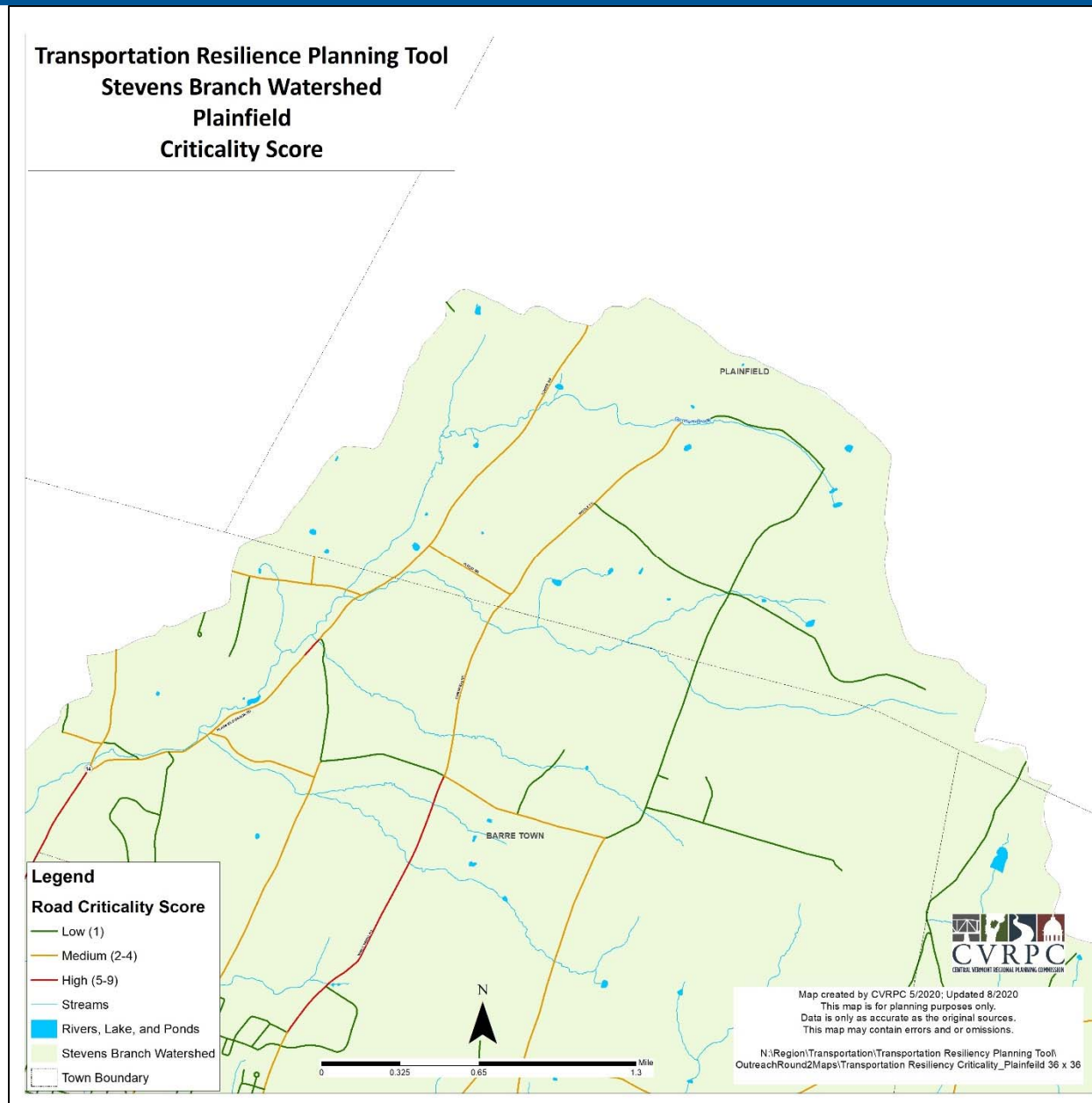
Criticality Scores – Barre City



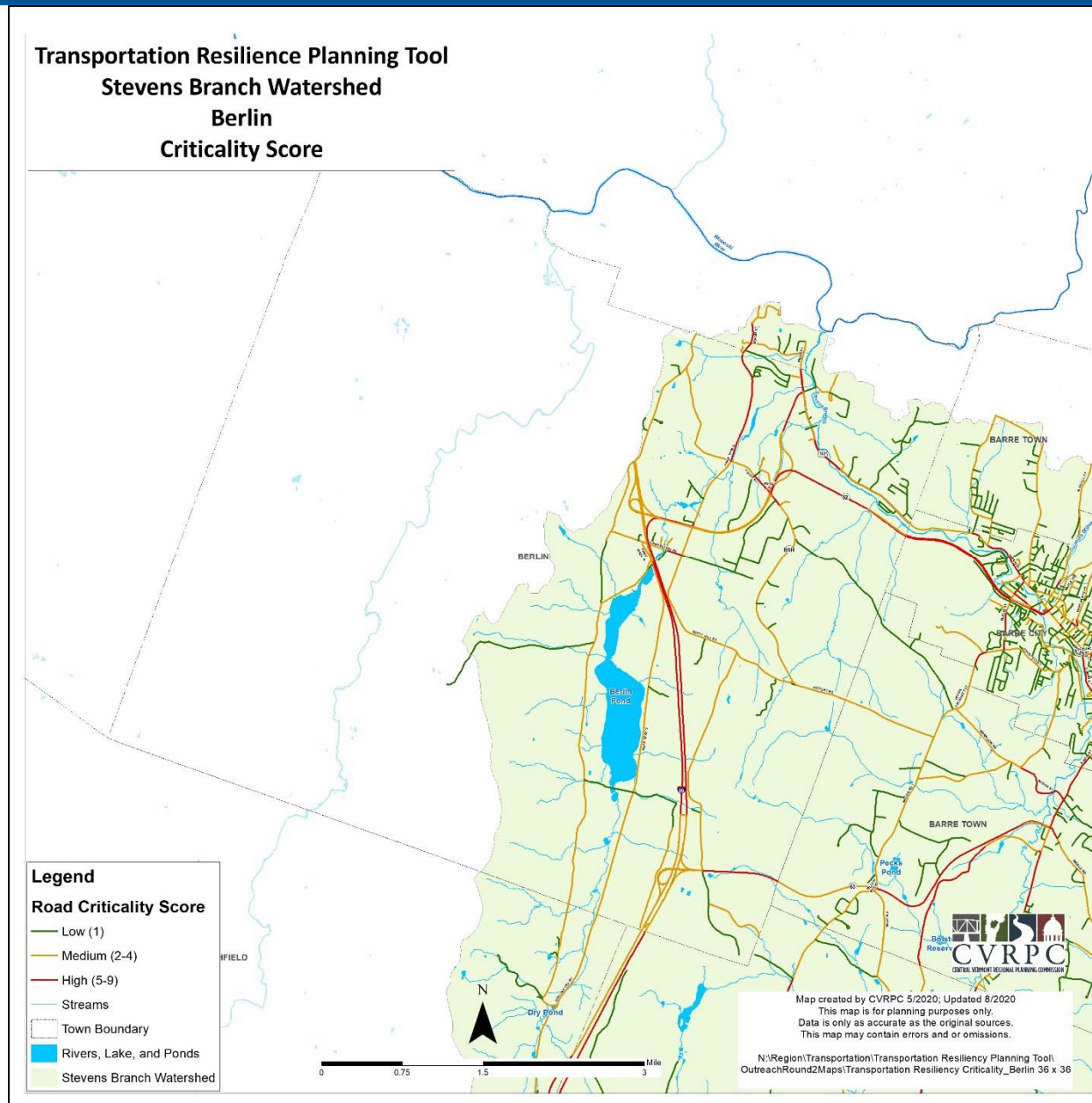
Criticality Scores – Barre Town



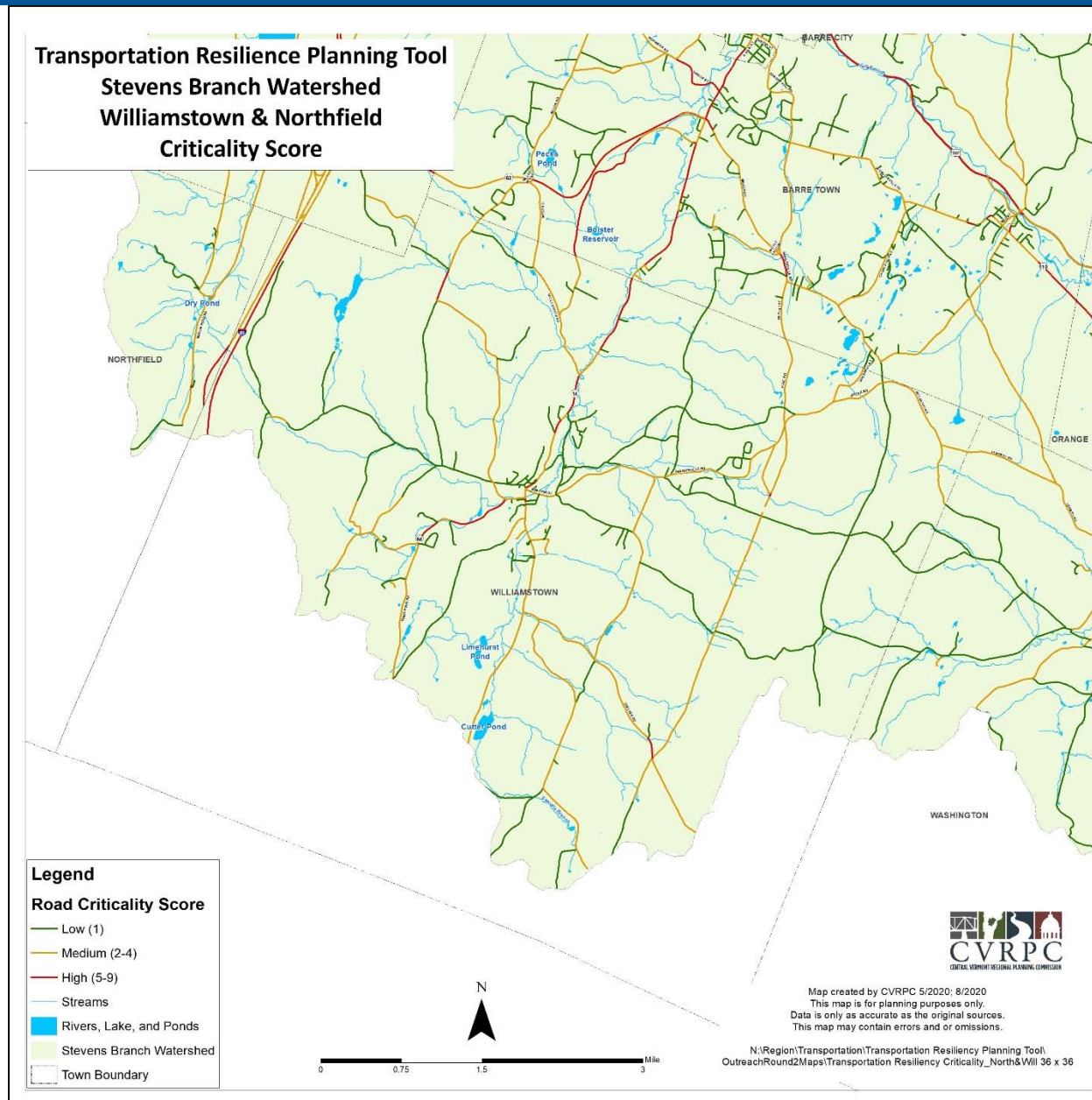
Criticality Scores – Plainfield



Criticality Scores – Berlin



Criticality Scores – Williamstown & Northfield



Next Steps

VULNERABILITY

- Watershed and River Corridor Analysis
- 10-year, 50-year, and 100-year floods
- Road or Structure Failure Mode

CRITICALITY

- Road Segments, Bridges, and Culvert
- Transportation Network Disruption Simulations
- Consequences of Failure

RISK

Mitigation

- Resiliency App
- Watershed Resiliency Plans
- VTrans Prioritization Updates
- Project Report

Links to TRPT Websites

- Direct link to TRPT

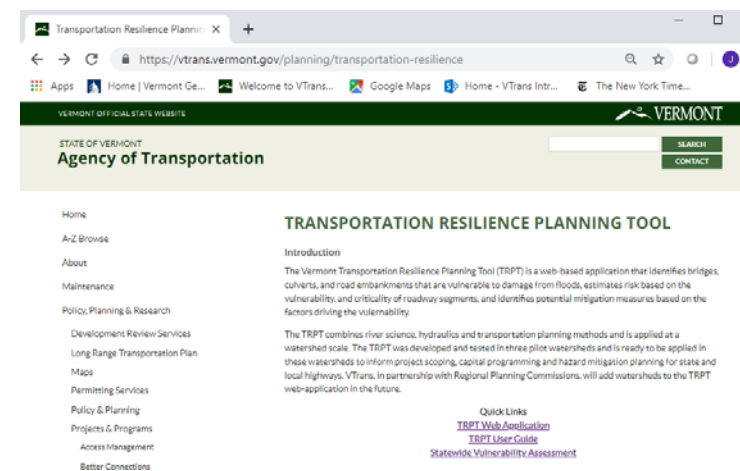
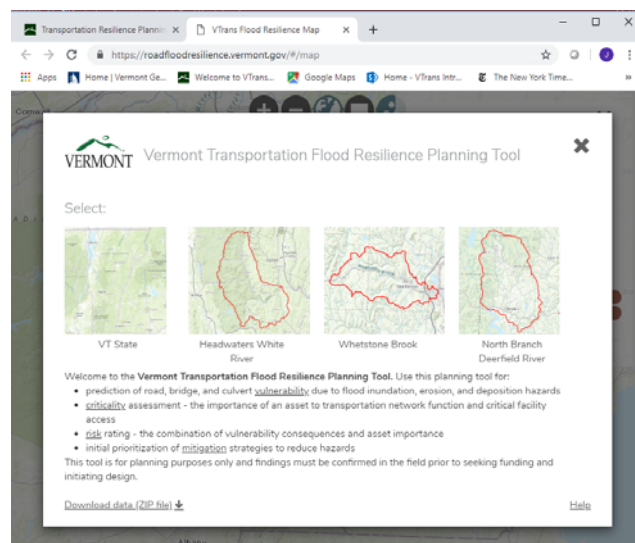
<https://roadfloodresilience.vermont.gov/#/map>

Link to VTrans TRPT Website

<https://vtrans.vermont.gov/planning/transportation-resilience>

- Link to statewide Vulnerability, Criticality and Risk Assessment

<https://vtrans.vermont.gov/planning/transportation-resilience/statewide>



TRPT Tool

VTrans Flood Resilience Map
roadfloodresilience.vermont.gov

roadfloodresilience.vermont.gov/#/map



Vermont Transportation Flood Resilience Planning Tool

Select:



VT State



Headwaters White River



Whetstone Brook



North Branch Deerfield River

Welcome to the **Vermont Transportation Flood Resilience Planning Tool**. Use this planning tool for:

- prediction of road, bridge, and culvert vulnerability due to flood inundation, erosion, and deposition hazards
- criticality assessment - the importance of an asset to transportation network function and critical facility access
- risk rating - the combination of vulnerability consequences and asset importance
- initial prioritization of mitigation strategies to reduce hazards

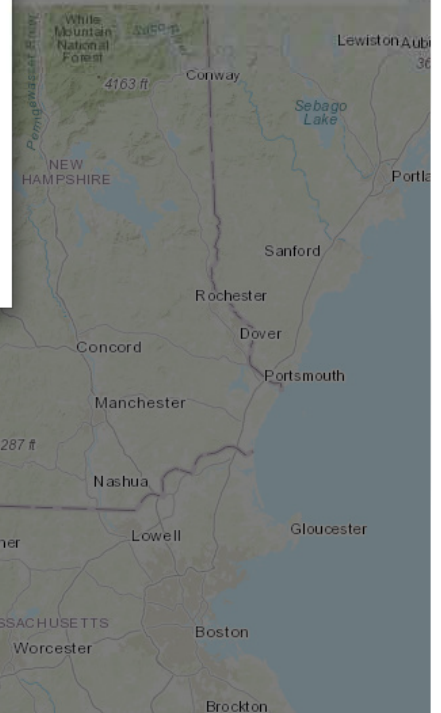
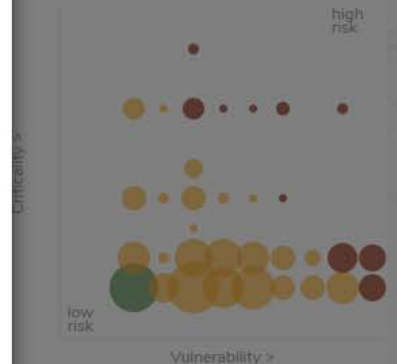
This tool is for planning purposes only and findings must be confirmed in the field prior to seeking funding and initiating design.

[Download data \(ZIP file\)](#) ↓

[Help](#)

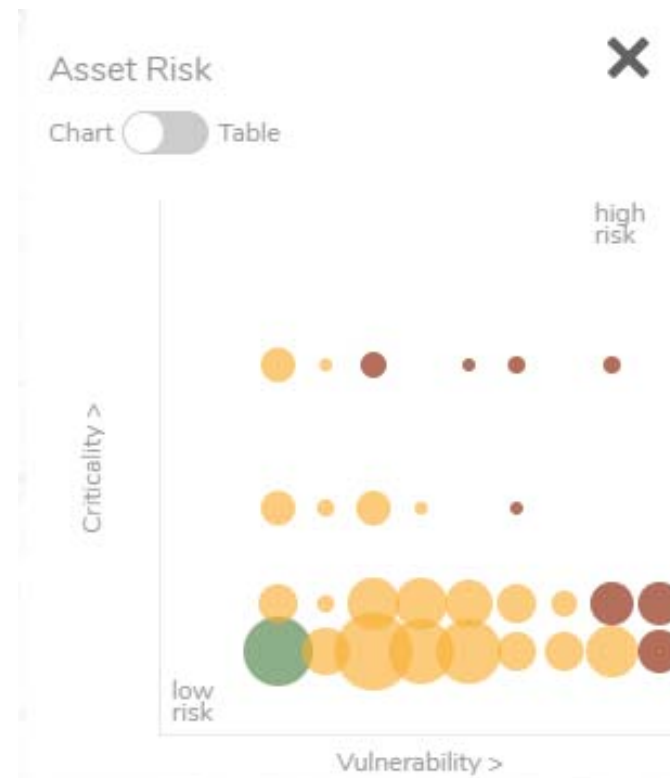
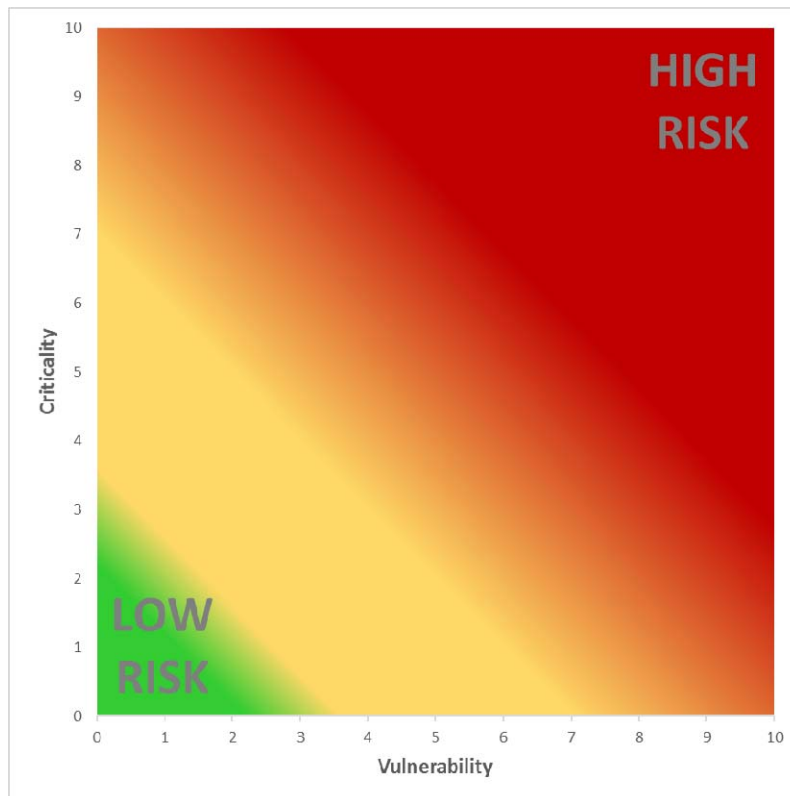
Set Risk

Table



Risk

Risk is equal to the average of Vulnerability and Criticality.



	V	C	R
High	9, 10	5, 6, 7, 8, 9, 10	6, 7, 8, 9, 10
Medium	5, 6, 7, 8	2, 3, 4	2, 3, 4, 5
Low	0, 1, 2, 3, 4	0, 1	0, 1

Mitigation Planning

Mitigation Options

- Infrastructure Improvements
(Revised alternatives analysis and design standards)
- River Management
- Alternative Routes
- Roadway Relocation
- Conservation
- Land Use Regulation



Thank you!

Webster Ave
Barre, VT
1927
Source: VT Historical Society



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