



# Adaptation levels of towns towards flood hazards responses in the Winooski River Basin

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# Overview

- Introduction
- What is a Hazard Mitigation Plan?
- Methods
- Results
- Interpretations and key findings

# Introduction

- Climate change=more bigger and frequent storms
- Adaptation process=  
Mitigation plans for natural hazards→ extreme weather events
- Hazard Mitigation Plans
- New Regulations→ Act 16:  
Municipal an Regional Flood Resilience Plan Legislation 2013



# What is a Hazard Mitigation Plan?



<http://centralvtplanning.org/category/uncategorized/>

- According to FEMA, Mitigation planning is a process through which communities assess risks and identify actions to reduce vulnerability to hazards through hazard mitigation.
- A Mitigation Plan is a community-driven, living document that communities use to reduce their vulnerability to hazards.

# Research questions

- Are the towns more affected by Tropical Storm Irene the more aggressive in adoption of the HMPs?
- What are the best practices for HMPs?
- Are the templates of the CVRPC and the CCRPC sufficient?
- Are they just filling the template? How is the quality?
- What is not in these plans?
- What the ideal HMP looks like?



# Hypothesis

- The towns more vulnerable to flood events would be the more aggressive in adoption of Hazard mitigation plans. Tropical Storm Irene has stimulated the adaptation process of these towns.



*Adopted by the Burlington City Council on  
March 28, 2011*

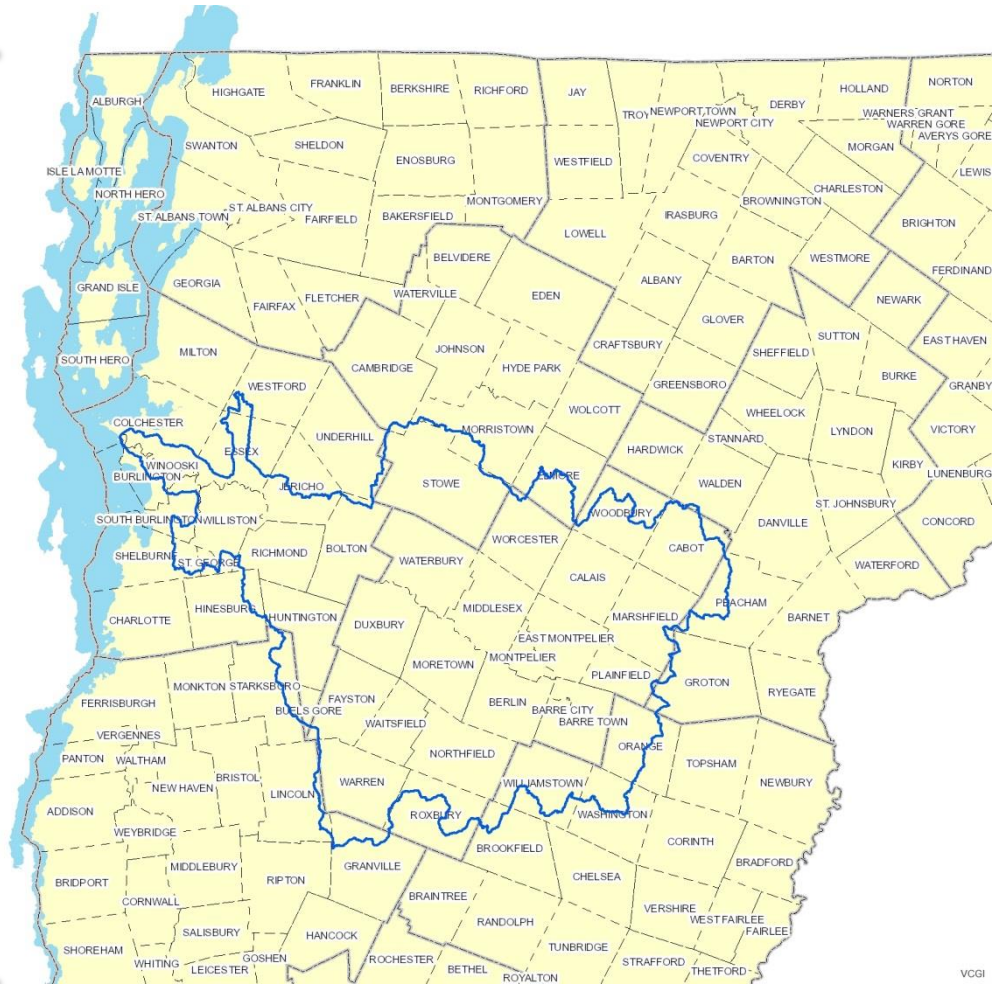
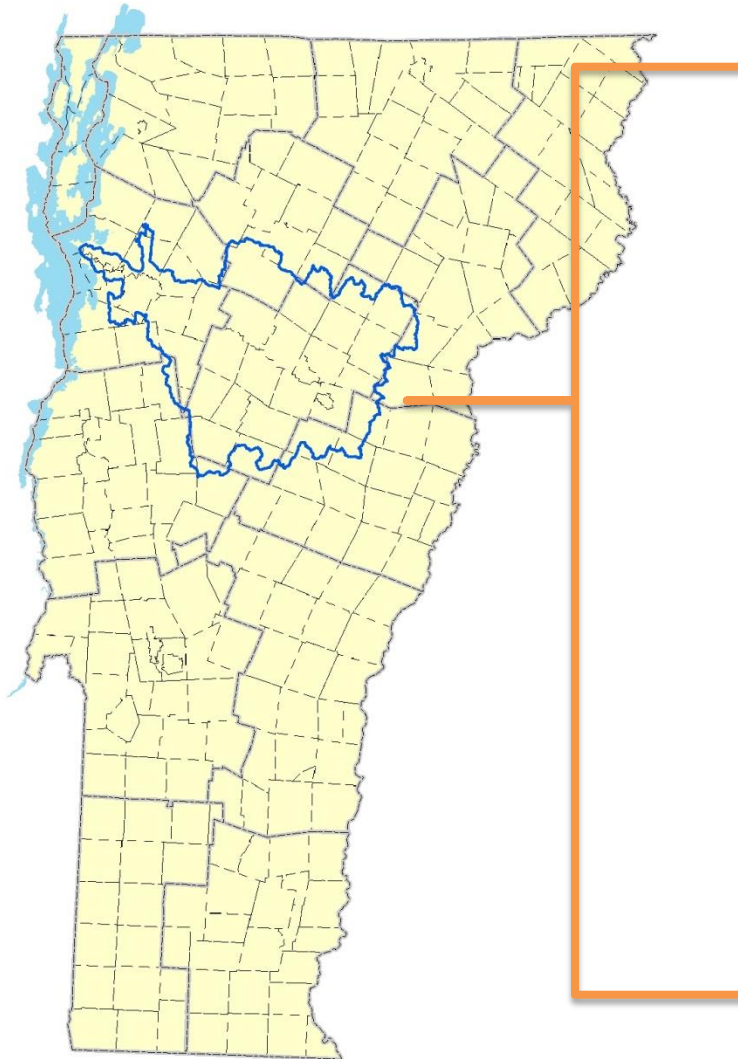
**CITY OF BURLINGTON, Vermont  
All-Hazards Mitigation Plan**

**Annex 3**

**to the  
Chittenden County Multi-Jurisdictional  
All-Hazards Mitigation Plan**

*Prepared by:  
The Chittenden County Regional Planning Commission  
and the  
City of Burlington, Vermont  
March 2011*

# Study area



# Methodology

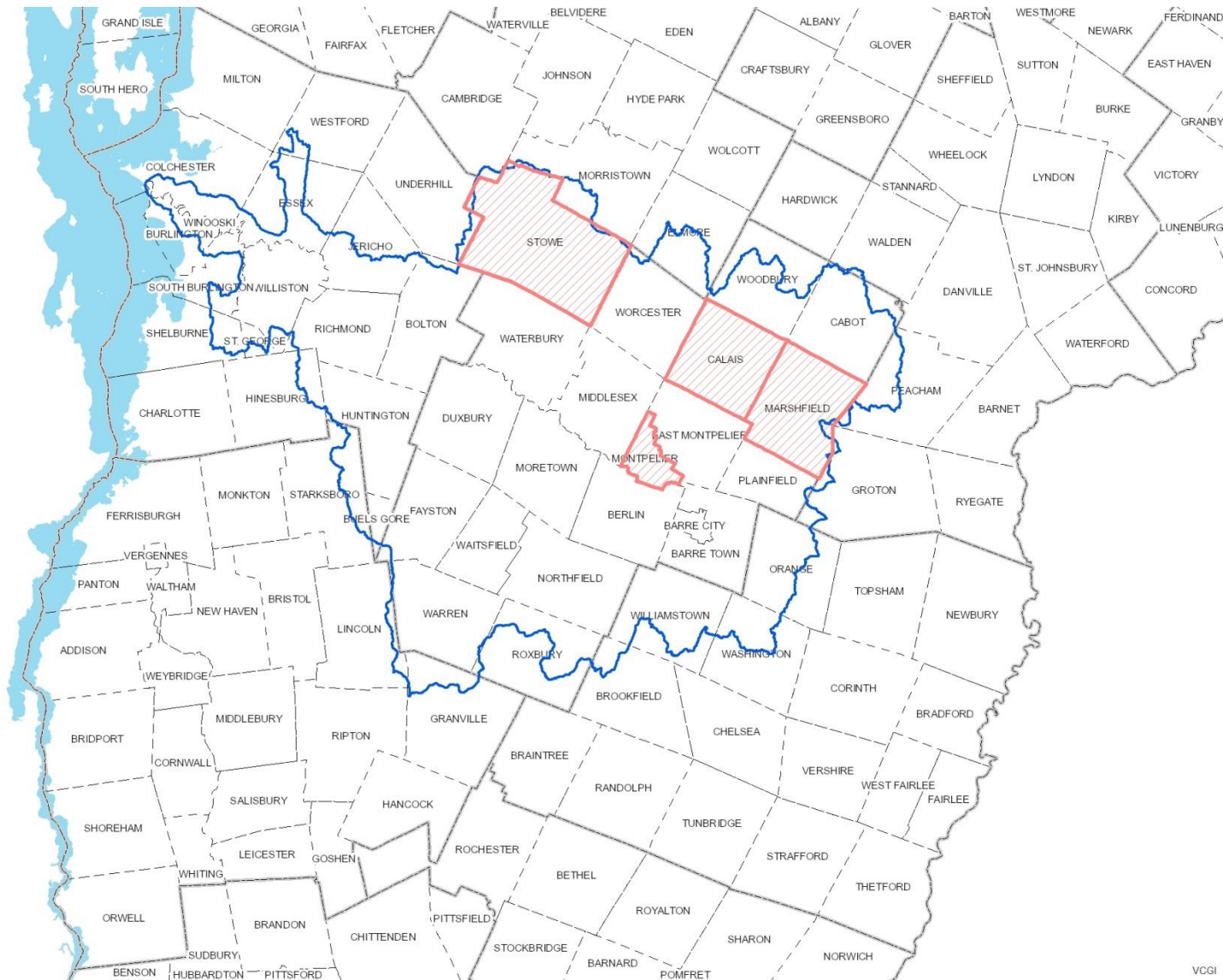
- Literature Review
- Study of Hazard mitigation plans content + structure
- Creation of a HMPs matrix in Microsoft Excel
- Inventory
- Analysis of results
- Interpretations and key findings



# Preliminary Results

Planning process						
Prepared/ coordinated by	Plan status	Type of plan before update	Type of plan after update	First plan date	Last update date	Additional stakeholders
All the plans are prepared and coordinated by the town and their respective planning commission, so they are "in house" plans.	All the towns have adopted a HMP at this point and the plans are current with exception of Calais, Marshfield and Montpelier, that the plans are expired at this point. They are supposed to be updating their plans but I didn't find any evidence of this (no mention of HMP in the available minutes of weekly planning commissions meetings.) Calais has an unapproved draft of 2013. Marshfield has a HMP annex of 2006 and Montpelier a HMP annex of 2007.	Before the towns last revisions and updates of their HMP's, the type of plan was an Annex to the Regional Local Hazard Mitigation Plans and not a standalone town local mitigation plan. After updates since 2004 the HMPs started to be submitted as a standalone local mitigation plan.		2005 seems to be the earlier date of the town's first plan adoption.	The last updates range from 2010-2012, with exception of the town of Stowe, which last update is from 2006, which indicates that it is probably expired. The towns of Calais, Montpelier and Marshfield have expired plans.	All the towns consider invite the VT Agency of Natural Resources to their meetings. So this agency seems to be a key resource for the HMPs planning process and maintenance.

# Plan status



# Preliminary Results

## **Planning Maintenance**

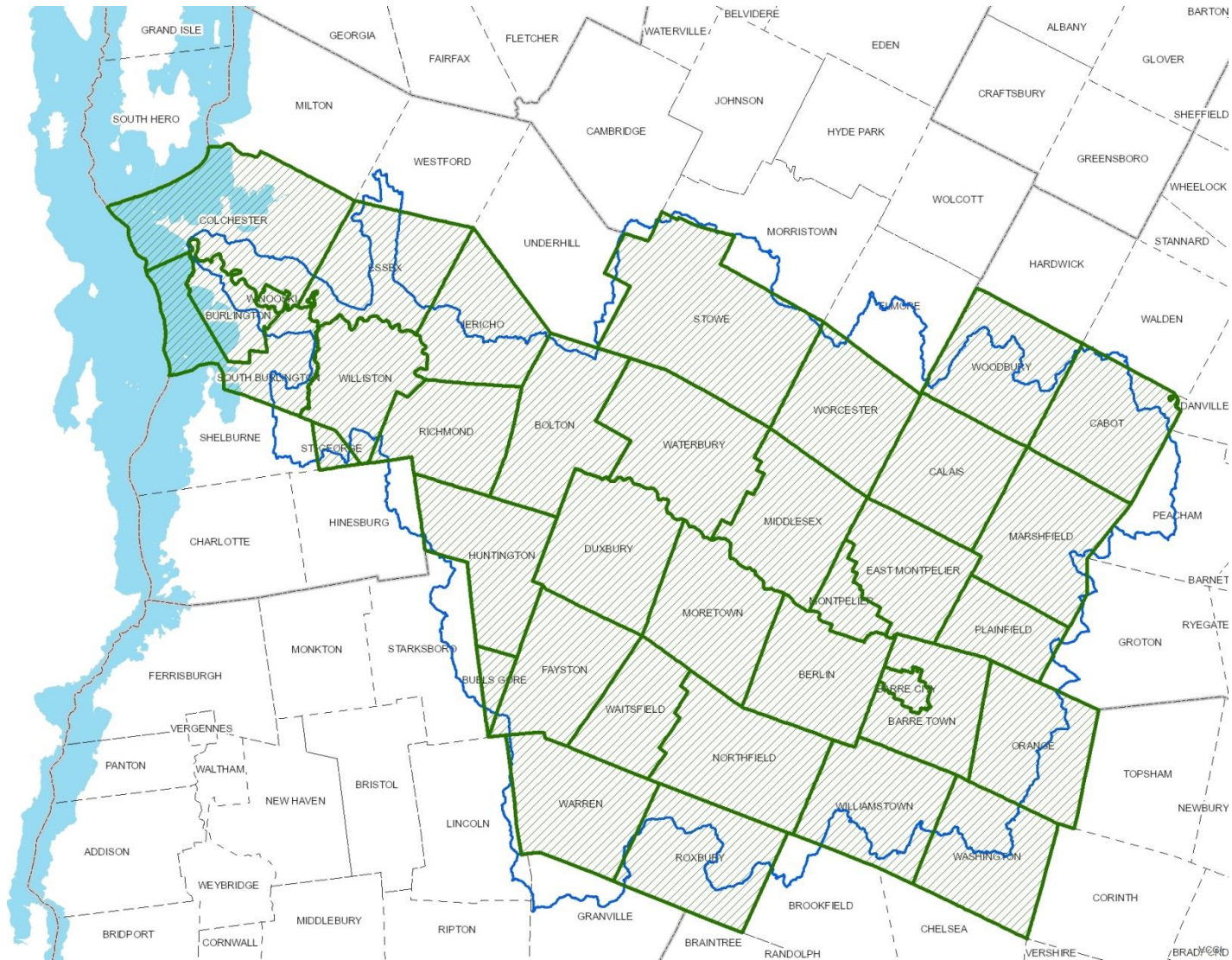
### **When they are going to revise/update the plan?**

In all of the 35 planning maintenance section they establish that the plan is going to be monitored annually. However, it was really hard to find an available minute in which HMP's were at least mentioned.

# Preliminary Results

Risk Assessment- How they identify the risk?				
Due to frequency/likelihood	List of past occurrences	Information from local records	A hazard matrix	Comments
The Chittenden County ones don't specify if they identify the risk due to frequency.	34/35  All the towns, except Stowe, have a list of past occurrences in their risk assessment section.	35/35  All towns present information from local records.	35/35  All of them have a hazard matrix. This table seems to be very useful because it organizes and compiles the risk assessment on a table easy to read.	35/35  All the towns recognize floods as the worst hazards or as one of worst threats. Also, Fluvial erosion hazard is identified in most of the worst hazards.

# Flooding as major threat





# Preliminary Results

Mitigation- How they deal with the risk?					
Hazard mitigated	Possible mitigation action/action	Local leadership/ Lead responsible entity	Prioritization	Possible resources/funding requirements and sources	Time frame
35/35	35/35	35/35	35/35	35/35	35/35
All towns include these elements in their mitigation section					

# Preliminary Results

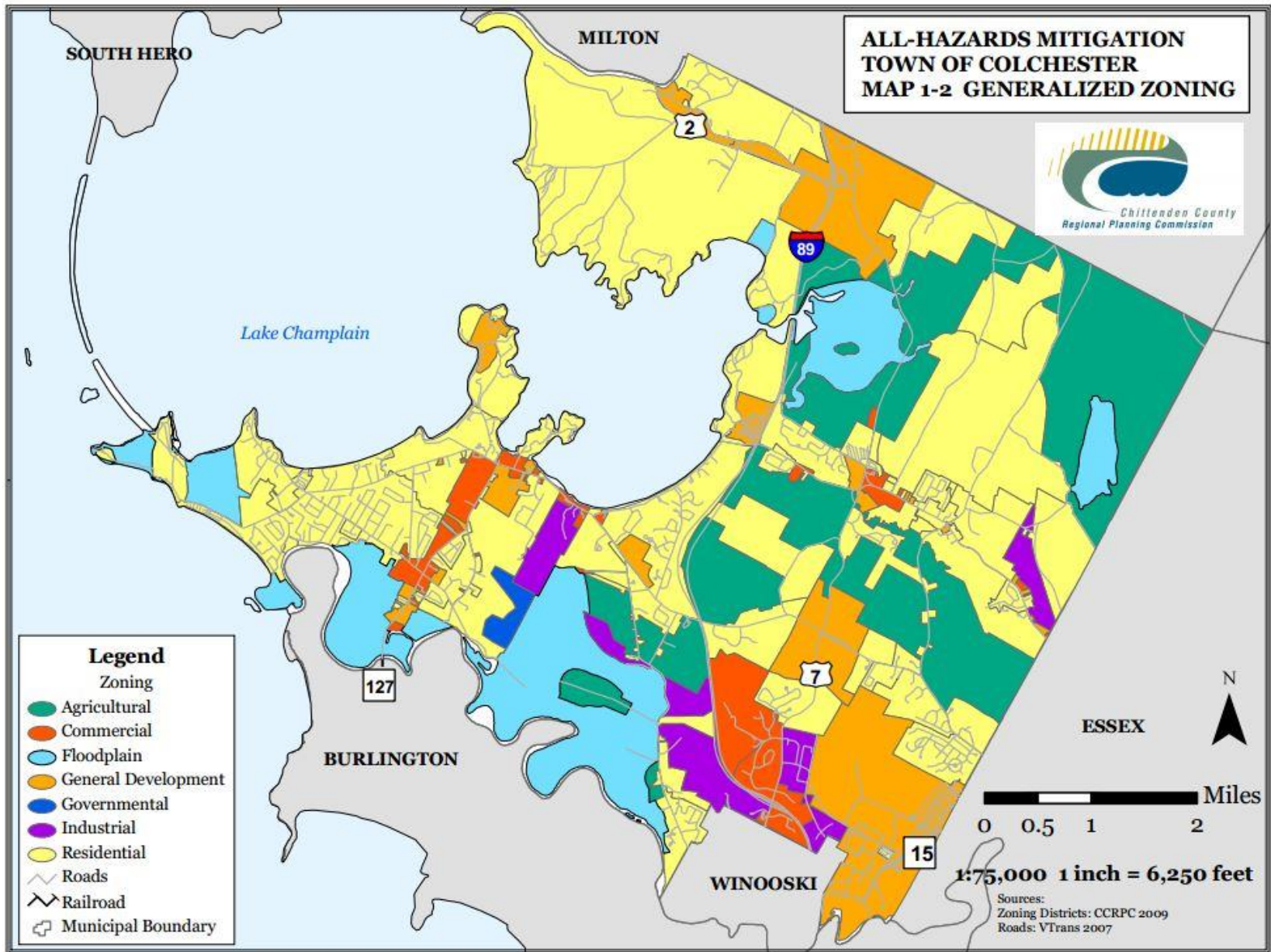
Maps			Diagrams/projects	
Areas of local concern	Zoning	Others	5-year plan review maintenance	Others?
CVRPC HMPs include a map of Areas of local concern.	CCRPC HMPs includes a zoning map/element in their plan. CVRPC does not.	<p>The CVRPC also includes Hazard analysis maps, and Corridor projects. The CCRPC includes a map section with the following maps:</p> <ul style="list-style-type: none"> <li>• Housing and businesses</li> <li>• Zoning districts</li> <li>• Flood hazard areas</li> <li>• Fluvial Erosion Hazard areas</li> <li>• Utilities and critical facilities. The town of Waterbury includes a “Dam inundation map and Irene photos”. It is so interesting because is the only town that includes something related to Irene.</li> </ul>	Only some towns of the CVRPC includes this diagram. 13/35	The CCRPC HMPs includes table 5-3: All hazards Mitigation Plan Implementation matrix.



**ALL-HAZARDS MITIGATION  
TOWN OF COLCHESTER  
MAP 1-2 GENERALIZED ZONING**



- Legend**
- Zoning
- Agricultural
  - Commercial
  - Floodplain
  - General Development
  - Governmental
  - Industrial
  - Residential
- Roads
- Railroad
- Municipal Boundary



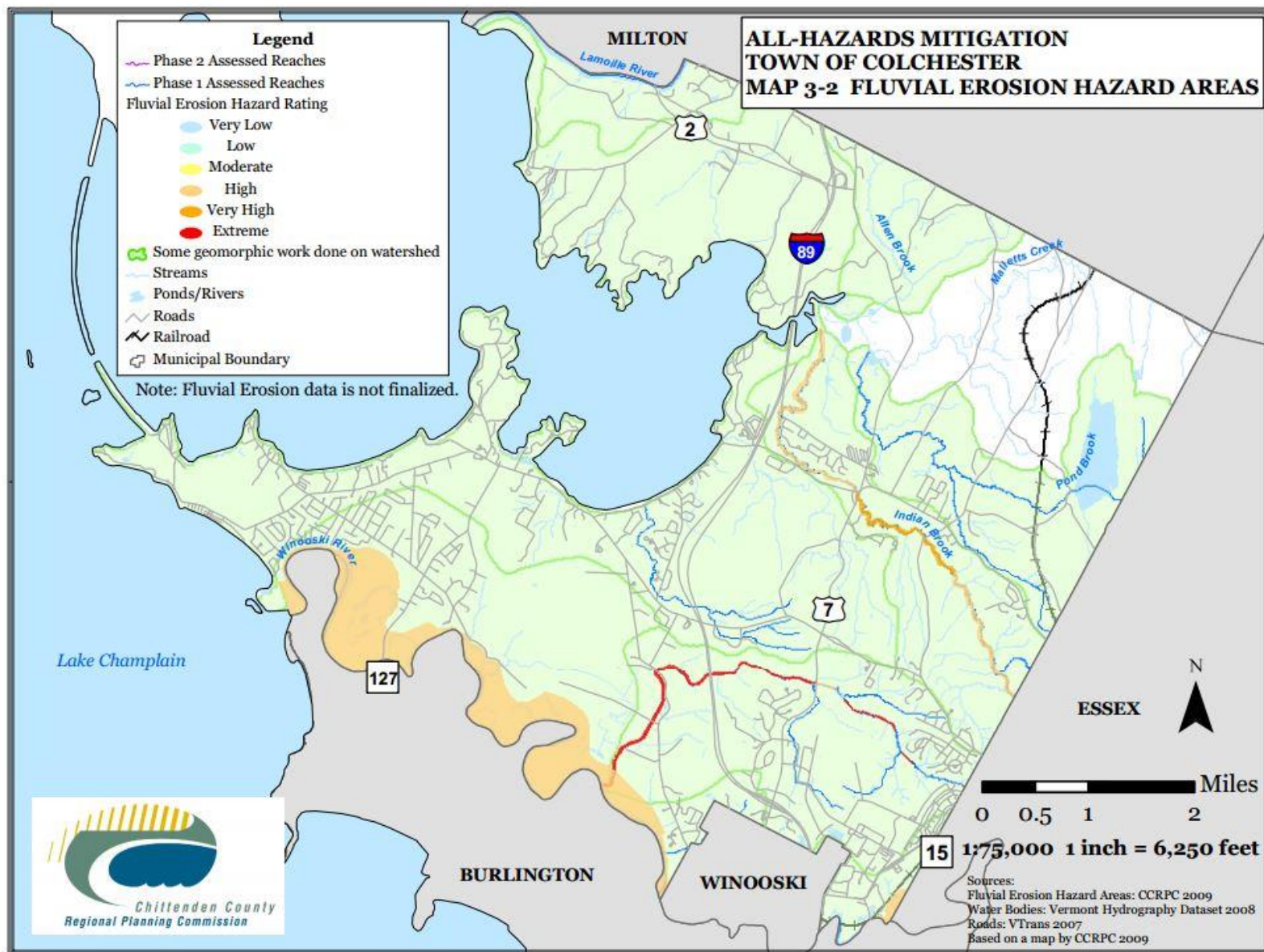
0 0.5 1 2 Miles  
1:75,000 1 inch = 6,250 feet

Sources:  
Zoning Districts: CCRPC 2009  
Roads: VTrans 2007

# Preliminary Results

Other information	
Do they seek outside funding support?	Do they seek for external documents/sources in the planning process?
Seems that the planners get all of the HMPs funding from specialized grants from entities as FEMA, VT ANR.	<p>CCRPC HMPs uses a Fluvial Erosion Hazard study as part of the materials in their planning process.</p> <p>The town of Roxbury looked at the Northfield All hazard mitigation plan.</p> <p>The town of Berlin looked at Norwich University Hazard Mitigation Plan.</p> <p>Besides this, any other town seek for external documents sources in the planning process.</p>

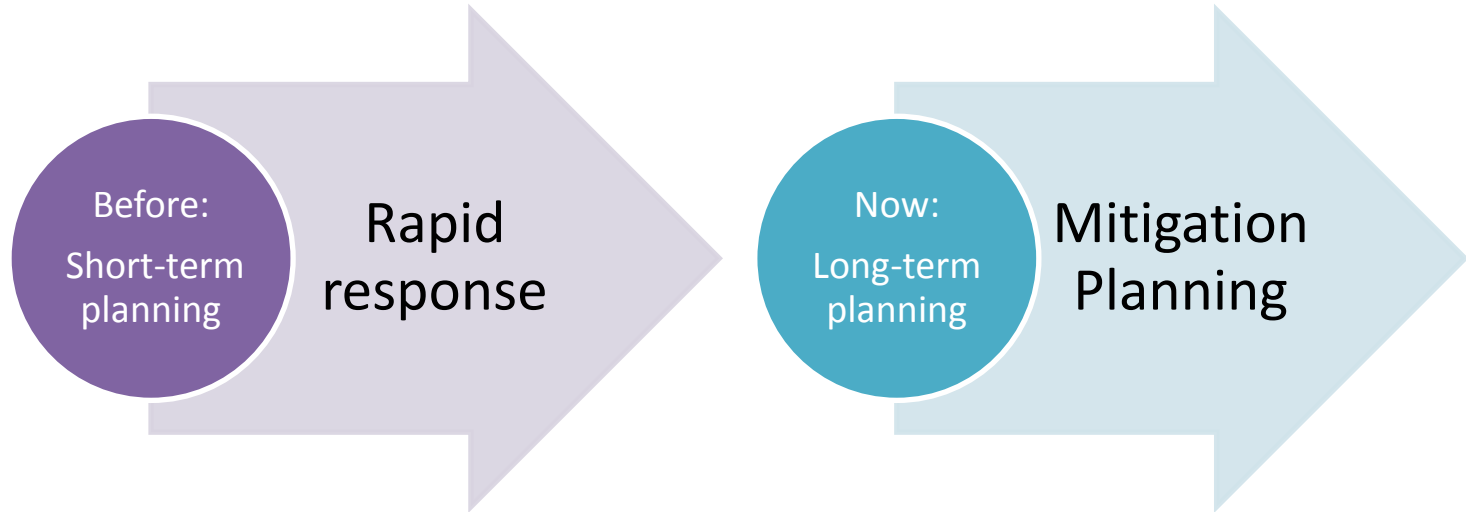




# Key findings

- Each regional planning commission follow an specific template.
- The Mitigation matrix is one of the best elements these plans have.
- The HM planning is relatively new, last 1990's and early 2,000's so regions and towns still in the adaptation process.

# Key Findings



## 5.5 Implementation and Monitoring of Mitigation Strategies

The following table is intended to aid municipal officials in implementing the mitigation actions for Bolton, and to facilitate the annual monitoring of the plan as outlined in the Multi-Jurisdictional All-Hazards Mitigation Plan.

*Table 5-3 Bolton All-Hazards Mitigation Plan Implementation Matrix*

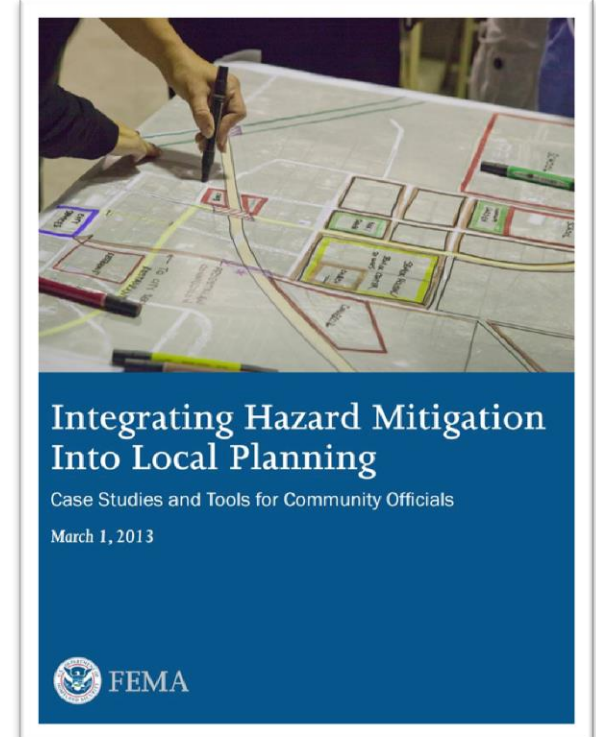
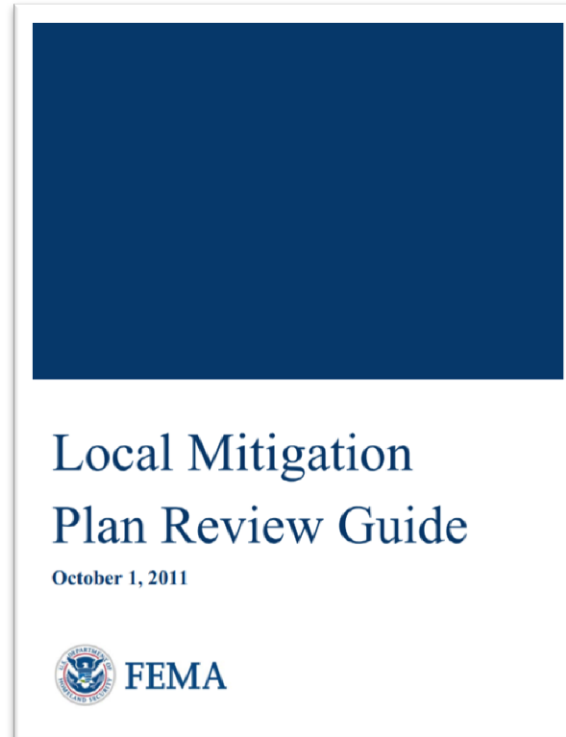
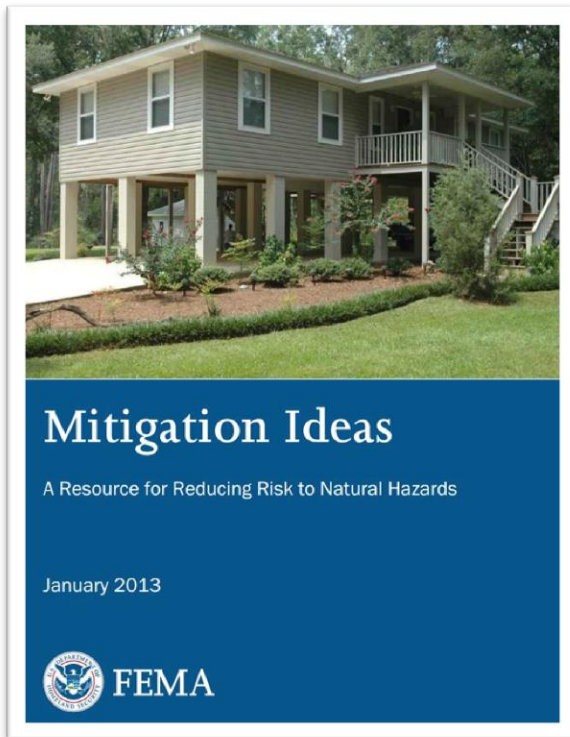
Action	AHMP Page #	Primary Responsible Entity	Task	Brief Description	Progress
#1 Complete fluvial geomorphology assessment and develop strategies in response to identified risk.	25	CCRPC, VT ANR	Fluvial Geomorphic Assessments	Conduct Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Bolton.	
	25	CCRPC, VT ANR	Fluvial Erosion Hazard Mapping	Rate the fluvial erosion hazard for each assessed reach and develop a fluvial erosion hazard map for the waterway using SGAT. Create map of all assessed reaches. Submit to VT ANR for QA/QC.	
	25	TBD, determined by funding.	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	
	25	Bolton Planning Commission	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	
	26	Bolton Planning Commission	Flood Insurance Rating Map Updates	Review draft FIRM data. Update floodplain regulations/zoning.	
#2 Evaluate capabilities of existing road and stormwater management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.	27	Road Foreman	Infrastructure Assessment for Stormwater Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts and stormwater infrastructure.	
	27	Road Foreman	Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts, bridges and other infrastructure to fluvial erosion.	
	27	Road Foreman	Culvert Upgrades	Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt.	

# Key Findings

- The towns more affected by TSI seems to be aggressive in the adoption of HMPs.
- Further study → Inventory for towns from other Regions of Vermont in order to compare the towns more affected by Irene vs the less affected.
- Are hazard mitigation plan in the priority list?



# Key Findings



- Available resources for HM planning

# Key Findings

