

Town of Barre
Local Hazard Mitigation Plan Update
January, 2012
Prepared by the Town of Barre and CVRPC

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i. Glossary of Terms and Acronyms

Central Vermont Regional Planning Commission (CVRPC)

Declaration - Presidential finding that a jurisdiction of the United States may receive Federal aid as a result of damages from a major disaster or emergency.

Emergency - Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States that requires Federal emergency assistance to supplement State and local efforts to save lives and protect property, public health, and safety, or to avert or lessen the threat of a disaster. Defined in Title V of Public Law 93-288, Section 102(1).

Federal Emergency Management Agency (FEMA) - The lead Federal agency with responsibility for responding to Presidential emergencies and major disasters. FEMA's mission is to reduce loss of life and property and protect our Nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of hazard mitigation, preparedness, response, and recovery.

Flood Insurance Rate Maps (FIRMS) - The official map of a community prepared by FEMA, showing base flood elevations along with the special hazard areas and the risk premium zones.

Flood Mitigation Assistance Program (FMA) - Provides pre-disaster grants to State and local governments for both planning and implementation of hazard mitigation strategies. Each State is awarded a minimum level of funding that may be increased depending upon the number of NFIP policies in force and repetitive claims paid. Grant funds are made available from NFIP insurance premiums, and therefore are only available to communities participating in the NFIP.

Fluvial Erosion Hazard (FEH)

Hazard Mitigation - Sustained actions taken to reduce or eliminate long-term risk to people and property from hazards and their effects.

Hazard Mitigation Grant Program (HMGP) - Authorized under Section 404 of the Stafford Act; provides funding for cost-effective hazard mitigation projects in conformance with the post-disaster hazard mitigation plan required under Section 409 of the Stafford Act.

Hazard Mitigation Plan - The plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in society that includes the actions needed to minimize future vulnerability to hazards.

Hazardous Materials (HazMat)

Major Disaster - Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States that, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act, above and beyond emergency services by the Federal Government, to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby defined under Public Law 93-288.

National Climatic Data Center (NCDC)

National Flood Insurance Program (NFIP) - Provides the availability of flood insurance in exchange for the adoption and enforcement of a minimum local floodplain management ordinance. The ordinance regulates new and substantially damaged or improved development in identified flood hazard areas.

Recovery - Activities necessary to rebuild after a disaster. Recovery activities include rebuilding homes, businesses, and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer, and other essential services.

STAPLE(E) - An acronym for the criteria that can be used by a community in selecting an appropriate mitigation strategy: Social, Technical, Administrative, Political, Legal, and Economic/Environmental.

Vermont Agency of Commerce and Community Development

Vermont Agency of Natural Resources (VT ANR)

Vermont Agency of Transportation (VT AOT)

Vermont Department of Environmental Conservation (VT DEC)

Vermont Emergency Management (VEM)

1. Introduction

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this Plan is to provide an all-hazards local mitigation strategy that makes the community of Barre Town more disaster resistant.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous Project Impact efforts, FEMA and State agencies have come to recognize that it is less expensive to prevent disasters than to repeatedly repair damage after a disaster has struck. This Plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of emergency management – preparedness, response, and recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where the hazards are most severe and identify local actions that can be taken to reduce the severity of the hazard.

Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, avert the hazard by redirecting the impact by means of a structure or land treatment, adapt to the hazard by modifying structures or standards, or avoid the hazard by preventing or limiting development.

2. Purpose

The purpose of this Local Hazard Mitigation Plan is to assist the Town of Barre in recognizing hazards facing the region and their community and identify strategies to begin reducing risks from acknowledged hazards.

Barre Town strives to be in accordance with the strategies, goals and objectives of the State Hazard Mitigation Plan, including an emphasis on proactive pre-disaster flood mitigation for public infrastructure, good floodplain and river management practices, and fluvial erosion risk assessment initiatives.

The 2012 Barre Town Local Hazard Mitigation Plan is an update of the 2007 plan. The plan has been reorganized and new sections have been added regarding:

- Plan Update Process
- Plan Maintenance
- Update of hazards
- Updates of Local Areas of Concern and Hazard Analysis Map
- Status update of 2005 mitigation strategies
- Identification of new mitigation strategies

3. Community Profile

The Town of Barre is located within the southeastern corner of Washington County and borders seven neighboring communities; Plainfield and East Montpelier to the north, Berlin to the west, Williamstown and Washington to the south and Orange to the east. Plus Barre Town almost entirely surrounds the 4.2 square miles of Barre City.

Barre Town is known for its large granite quarries and is an integral part of the Barre-Montpelier urban area. The Town itself contains four major villages South Barre, Graniteville, Websterville, and East Barre along with communities on Trow Hill and the Richardson Road area. According to the Municipal Plan “Barre Town is comprised of hilly areas that are like the rim of a bowl, the center of which is Barre City.” The 2010 Census states that Barre Town has a total population of 7,924. This number represents an increase of 4.2 percent from the 2000 Census. Approximately 20 percent of Barre Town’s workforce is employed within the Town, while the remaining 80 percent work outside of the Town’s borders.

Barre Town is within the Winooski Watershed and Vermont Route 302 follows the Jail Branch River in an east-west direction through the approximate middle of the Town. Additional major routes also parallel prominent local waterways. Additional transportation corridors include Vermont Route 63 which connects Vermont Route 14 to Interstate 89 in Berlin.

Housing within the Town is widely dispersed both within rural locations and the four major villages listed above. A majority of new development is scattered site residential development throughout the town. The total number of housing units from the 2010 census is 3,402. This is an increase of 11.7%.

Green Mountain Power provides electricity to the majority of businesses and residents in Barre Town. Washington Electric Cooperative provides service to the remaining structures in the northeast corner and in the southwest region of the town. According to the Municipal Plan: The water supply for Town of Barre consists of numerous sources and the systems are maintained by a variety of entities. There are two different fire districts Graniteville and Websterville which provide full service with varied sources of water to residences within their districts. Water is also provided by the Town of Barre in the Quarry Hill, Sterling Hill, Lower Websterville and East Barre areas utilizing a town well and Barre City water. The remaining households receive water directly from Barre City or maintain private wells.

In the Town, fire protection is provided by the Barre Town Fire Department from stations in South and East Barre. This paid on-call Department participates in an inter-municipal mutual aid system. According to the Fire Chief’s report, the Fire Department responded to an average of 185 calls for assistance. Barre Town EMS is a regional ambulance serving five towns in Central Vermont. The Department operates two 24-hour stations, and it responded to 2,979 calls for assistance during the fiscal year 2009-10. The Barre Town Police Department provides law enforcement within the Town’s borders, and it also participates in an inter-municipal mutual aid system. Additional support is afforded by other law enforcement agencies. The nearest HazMat response truck is located approximately 47 miles away at the IBM Facility in Essex Junction. The nearest HazMat decontamination, rescue and mass care trailer is owned by Berlin.

The Town of Barre has an approved Rapid Response Plan that was adopted in 2009. The Municipal Plan 2008 includes a description, discussion, goals, and policies in regards to groundwater protection, water runoff and drainage and emergency services. The Town does have Zoning By-Laws and a Subdivision Ordinance. In the 2009 zoning ordinances a 50 foot stream buffer was adopted. Flood Hazard Bylaws were updated in 2009-10.

4. Planning Process and Maintenance

4.1 Planning Process

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Barre Town Local Hazard Mitigation Plan process. Shawn Benham, Assistant Town Manager, contacted CVRPC to set up a hazard mitigation meeting. CVRPC sent Town-Specific hazard mitigation material for review. After assessing the material, CVRPC staff held a meeting with Barre Town Staff on December 13, 2011 at the Town Offices. The Barre Town Hazard Mitigation Meeting focused on assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities.

Attendees included:

- Chris Violette, Fire Department
- Carl Rogers, Town Manager
- Jack Mitchell, Emergency Management Chair
- Donna J. Kelty, Town Clerk/Treasurer
- Shawn Benham, Assistant Town Manager
- David Jennings – EMS Director
- Michael Stevens – Police Chief
- Harry Hinrichsen – Town Engineer

The meeting indicated that the Town is most vulnerable to flood/flash flood/fluvial erosion. Previously identified hazards include flooding and flash. Barre Town feels flooding is still a significant hazard. The Town continues to focus mitigation activities on flood events as these events are the most common.

Once the draft was updated, a notice for public comments of the draft update was available on the CVRPC blog, CVRPC newsletter, Barre Town Website, CTVT, the Times Argus, and local markets. The draft update was also available at the Barre Town Municipal office and by request from CVRPC for public review and comments from 12/30/2011 to 01/24/2012. A public hearing was held 01/24/2012 to receive comments. No public comments were received. Public comments received in the future will be reviewed by the Assistant Town Manager (and CVRPC Staff dependant on funding) and attached as an appendix. The announcement of the draft update in the CVRPC newsletter reached over 150 people and businesses in the Region's 23 towns, including the adjacent towns of Barre City, Plainfield, Orange, Washington, Williamstown, Berlin and East Montpelier. In the future, the draft plan will be made available during Town Meeting Day and local meetings with State and local officials to allow for more public comment and review. Once the plan is conditionally approved by FEMA, the plan will go before the Selectboard for adoption.

4.2 Plan Update Process

The Barre Town Local Mitigation Plan was originally adopted by the Town as an Annex to the Central Vermont Regional Pre Disaster Mitigation Plan in December 2005 and received FEMA final approval in 2007. The 2012 update is intended to be submitted as a single jurisdiction local mitigation plan.

The current plan is an extensive update of the 2007 plan. Below is a list of the revisions that have been made from the past plan and the appropriate sections for reference. Flooding continues to remain the main hazard.

General Updates

- General reorganization/restructuring of the plan according to future FEMA/VEM checklist
 - New sections added – 4.2 Plan Update Process, 4.3 Plan Maintenance, 5.2 Worst Threat Hazards – Flood/Flash Flood/Fluvial Erosion 5.3 Moderate Threat Hazards – Severe Storms/Hurricane, Winter Storms/Extreme Cold/Ice Storms, Ice Jams
- Update of all data and statistics using 2010 Town Report and US Census Data (Section 3)
- Revaluation, identification and analysis of all significant hazards (Section 5)
- Acknowledgment of implemented mitigation strategies since 2007 – see matrix below (section 4.2)
- Identification of on-going mitigation projects and strategies – see Existing Mitigation Programs, Projects and Activities section (section 4.2)

Hazard Analysis Updates (Sections 5 and 6)

- New moderate threat hazards – severe storms/hurricanes, winter storm/ice storm/extreme cold
- Added location/vulnerability/extent/impact/Likelihood table for each hazard to summarize hazard description (Section 5.1-5.3 – after each hazard)
- Review of Vermont Hazard Mitigation Plan (Section 5 – hazard analysis table)

Maps

- Review of 2007 Areas of Concern map and Local Hazards Analysis map

Preparation for the meeting included a review of Barre Town's planning documents, including the Barre Town Municipal Plan (2008) and Zoning Ordinances (2010), and the Barre Town Rapid Response Plan (2009), and Stevens Branch/Jail Branch Watershed River Corridor Plan (2009). Information from these documents was incorporated into various sections of the mitigation plan.

The following chart provides an overview of Barre Town's proposed 2005 local hazard mitigation actions along with their current status. Additionally since the 2007 plan, the Town has adopted a 50 foot stream buffer and updated flood hazard bylaws in 2009/10.

2007 Mitigation Action	2011 Status
Improve drainage in proximity to town including improvement of on-site storm water management.	Completed projects within Wilson Industrial Park. Replaced some culverts on Sterling Hill Road. Installed concrete box culvert on Cherrywood Drive. Extended culvert/stabilized bank on Ketchum Brook/Camp Street. Replaced culvert on Hunt Road with a bridge. Replaced Howard Street (private) bridge.
Replace culverts and implement additional recommendations by the VT DEC's watershed coordinator and the VT AOT's Hydraulics Engineer (See attachments titled <i>Sterling Hill Road</i> and <i>Engineering Services Section</i> .)	Completed.
Purchase flood damaged properties located at 628, 634, 636, 638, and 640 East Barre Road (Route 302).	Completed in 2008.

Existing Hazard Programs, Projects & Activities

The ongoing or recently completed programs, projects and activities are listed by strategy were reviewed for the development of the plan.

Community Preparedness Activities

- Rapid Response Plan – 2009
- Emergency Operations Plan – 2009
- School Safety Evacuation Plan
- Capital Equipment Plan

Hazard Control and Protective Works

- Culvert Survey - 2009
- Mutual Aid response agreement with surrounding communities

Insurance Programs

- Participation in NFIP

Land Use Planning/Management

- Municipal Plan, 2008
- Zoning Regulations, 2009
- Subdivision Regulations, 2008
- Stevens Branch Corridor Plan 2009

- Adoption of Vermont AOT “Codes & Standards for Roads”, 2011

Protection/Retrofit of Infrastructure and Critical Facilities

- Dry Hydrants
- Shelters wired for backup generators – St. Sylvester’s Church, East Barre Fire Station, Barre Town Middle and Elementary School

Public Awareness, Training & Education

- Fire safety educational programs for students
- Public Safety Exposition
- Newsletter articles

4.3 Plan Maintenance Process

The Barre Town Local Hazard Mitigation Plan will be updated and evaluated annually at a June Selectboard meeting along with the review of the Basic Emergency Operations Plan. Updates and evaluation by the Selectboard will also occur within three months after every federal disaster declaration and as updates to town plan/zoning and river corridor plans come into effect. The plan will be reviewed by the Selectboard, department heads, and public at the above mentioned June Selectboard meeting. CVRPC will help with updates or if no funding is available, the Emergency Management Chair, or a designee, will update the plan.

The process of evaluating and updating the plan will include continued public participation through means such as notices posted on the municipal website and in the municipal building, Washington World, Times Argus, town newsletter, CVRPC newsletter and CVRPC blog inviting the public to the scheduled Selectboard (or specially scheduled) meeting. Additional stakeholders invited to the meeting will be the Barre Town Middle and Elementary School. Also invited in the future will be the Vermont Agency of Natural Resources (VT ANR), as they are able to provide assistance with NFIP outreach activities, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Town Manager.

Monitoring of plan progress and implementation will be undertaken by the Town Manager. Monitoring updates may include changes in community mitigation strategies; new town bylaws, zoning and planning strategies; progress of implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are identified in the five year interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings. After a five year period, the plan will be submitted for re-adoption following the process outlined in the schematic found in the Attachments section.

Barre Town shall also consider incorporation of mitigation planning into their long term land use and development planning documents. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, zoning regulations, and flood hazard/FEH bylaws. The incorporation of the Local Hazard Mitigation

Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing future Stevens Branch River corridor planning documents for ideas on future mitigation projects and hazard areas.

5. Risk Assessment

5.1 Hazard Identification and Analysis

The following natural disasters were discussed and the worst threat hazards were identified based upon the likelihood of the event and the community's vulnerability to the event. Hazards not identified as a "worst threat" may still occur. Greater explanations and mitigation strategies of moderate threat hazards can be found in the State of Vermont's Hazard Mitigation Plan.

Hazard	Likelihood ¹	Community Vulnerability ²	Worst Threat
Avalanche/ Landslide	Low	No	
Dam Failures	Low	No	
Drought	Low	No	
Earthquake	Low	No	
Extreme Cold/Winter Storm/Ice Storm/Power Failure	Med	No	
Flash Flood/Flood/Fluvial Erosion	Med/High	Yes	X
High Wind	Med	No	
Ice Jam	Med	No	
Hurricane/Tropical Storm/Severe Storms	Med	No	
Structure Fire	Med	No	
Tornado	Low	No	
Water Supply Contamination	Low	No	
Wildfire/Forest Fire	Low	No	

The following hazards were found to be most significant in the Town of Barre:

- Flood/Flash Flood/Fluvial Erosion

Due to the frequent and severe nature of flooding events, Town staff feels flooding is the worst natural hazard, and they will focus on mitigation efforts to reduce the impacts from flooding events.

¹ High likelihood of happening: Near 100% probability in the next year.

Medium likelihood of happening: 10% to 100% probability in the next year or at least once in the next 10 years.

Low likelihood of happening: 1% to 10% probability in the next year or at least once in the next 100 years.

² Does the hazard present the threat of disaster (Yes)? Or is it just a routine emergency (No)?

Moderate threat hazards include:

- Extreme Cold/Winter Storm/Ice Storm
- High Wind
- Ice Jams
- Hurricane/Tropical Storms/Severe Storms

A discussion of each significant hazard is included in the proceeding subsections and a map identifying the location of each hazard is attached (See map titled *Areas of Local Concern.*) Each subsection includes a list of past occurrences based upon County-wide FEMA Disaster Declarations (DR-#) plus information from local records, a narrative description of the hazard and a hazard matrix containing the following overview information:

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Type of hazard	General areas within municipality which are vulnerable to the Identified hazard.	Types of structures impacted	Magnitude of hazard – scale dependant on hazard	Dollar value or percentage of damages	Likelihood of hazard occurring based upon past events: HIGH = Near 100% probability within the next year MED = less than 10% to 100% probability within the next year or at least once in the next 10 years. LOW = less than 10% probability within the next year or at least once in the next 100 years

5.2 Worst Threat Hazards

Flood/Flash Flood/Fluvial Erosion

Recent History of Occurrences (presidential declarations and NCDC query search information. The closest flood gauge is located on the Winooski River in Montpelier, approximately 6 miles downstream):

Date	Event	Location	Extent
8/28/2011	Flood/Tropical Storm	Statewide, Barre Town	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet) DR

			4022
5/27/2011	Flash Flood	Barre Town	Montpelier flood gauge at 17.59 feet, 3-5" of rain DR 4001
8/02/2008	Flash Flood	Barre Town	4-5" of rain fell in 2-3 hrs – Town's northwestern roads flooded
7/11/2007	Flash Flood	Barre Town	3-6" of rain in 2 hrs, DR 1715
12/17/2000	Flood	Barre Town, County Wide	3" of rain, \$1 M in damages
9/16/1999	Tropical Storm Floyd	Barre Town, County Wide	Montpelier flood gauge at 9.30 feet, 5-7" rain county wide DR 1307
6/27/1998	Flash Flood	Barre Town, County Wide	\$5M in damages, 3-6" rain across county DR 1228
1/19/1996	Flood; ice jam	Barre Town, County Wide	Montpelier flood gauge at 14.64 feet
8/4/1995	Flood	Barre Town, County wide	Montpelier flood gauge at 6.94 feet; \$1.5M damages county wide
8/5/1976	Flood	Barre Town, County Wide	Montpelier flood gauge at 12.31 feet DR 518
6/30/1973	Flash Flood	Barre Town,	Montpelier flood gauge at 17.55 feet DR 397
9/22/1938	Flood, Hurricane	Barre Town, County Wide	Montpelier flood gauge at 14.11 feet
11/03/1927	Flood	Barre Town, County Wide	Montpelier flood gauge at 27.10 feet

Flooding/flash flooding/fluvial erosion is Barre Town's most commonly recurring hazard. Flooding is the overflowing of rivers, streams, drains and lakes due to excessive rain, rapid snow melt or ice. Flash flooding is a rapidly occurring flood event usually from excessive rain. Fluvial erosion is the process of natural stream channel adjustments. Fluvial erosion causes erosion of sediment in some areas, while causing aggradation of sediment in other. Fluvial erosion processes occur more quickly and severely during flood events.

Specific extent data for flood levels in Barre Town is lacking as the closest flood gauge is located in Montpelier. During Tropical Storm Irene, the Montpelier flood gauge was 4 feet above flood stage. The worst flooding event in Barre Town's history was the 1927 event; however, exact data from that event is not available. In 1927 event, the Montpelier flood gauge was at 27.10 feet; however, since the 1927 flood a number of flood control dams have been installed in the region to prevent the same flooding extent. Lesser but more regular flooding occurs in Barre Town, with generally 1 foot of water in areas designated on the areas of concern map. Barre can expect to be impacted by flooding at water heights of 3 feet. Most flooding is of the flash flooding nature. During the May 2011 flood, low lying areas of Barre experienced 3-4 feet of flash flooding. An estimate for the worst extent of flooding would be 5 feet in low lying areas. For the next update, Barre Town can better monitor flood waters by having individuals record flood water levels and submit to the Assistant Town Manager for the Town's records.

The most prominent bodies of water in Barre Town are the Stevens Branch River, the Jail Branch River, and the Gunners Brook. As Barre Town is a series of hill tops surrounding the valley all the major water bodies flow in to Barre City and eventually feed into the Winooski River. According to the Municipal Plan “slopes (within Barre Town) in excess of 10-15% are not uncommon, and simultaneously serve to enhance the aesthetic appeal of Barre Town while posing environmental planning challenges for development. The challenges run to erosion control, sewage management, site design, road or driveway integrity, surface water run-off and seasonal access.”

The majority of Barre Town’s development is located outside of the floodplain. Based on the results of overlaying the FIRM flood maps with the location of E911 points, there are 244 properties and 5 structures that are located within the NFIP’s designated 100- year floodplain. The estimated loss for a severe flooding event for all properties located within the town’s 100- year floodplain is approximately \$33,428,000.

Fluvial Erosion Hazard (FEH) Zones extend beyond the NFIP floodplain and take into account the movement of a river channel. Within Barre Town, 28 properties lie within a FEH zone. The estimated loss for a severe flooding event for all properties located within the town’s FEH zone is approximately \$3,562,000.

Barre Town does participate in the NFIP. The Town has 9 active policies for a total coverage of \$1,912,900. There are no repetitive loss properties. The Town’s flood hazard regulations were updated in 2010. The zoning administrator is responsible for enforcement of the flood hazard regulations.

Industrial retention ponds throughout Barre Town present the threat of flooding. Retention Ponds are located at a gravel pit on Quarry Hill Road, at the Rock of Ages Quarry in Graniteville and the former Pike Plant in Websterville. While a data deficit prevents analyzing the specific vulnerability, extent and impact of these industrial retention ponds, these ponds have the potential to over top their banks and inundate homes and buildings in the densely developed neighborhoods of Barre City, and in the village of Graniteville and along a section of Route 302.

The flash flood event of July 11 – 12, 2007 is one of most significant flooding events in recent history. According to the VT DEC report (See *Attachments*) approximately 4-6 inches of rain fell in a 24 hour period between noon on July 11 and July 12 causing significant stream bank erosion, road embankment and shoulder wash, culverts and bridges to be overtopped and outflanked and enormous amounts of sediment and debris to be deposited along private residential property. According to the Town Engineer Barre Town sustained damage upward of \$690,000 and recalls that many of these locations sustained similar damage following a flood event in 1973. The damages from the July 2007 event are outlined below.

Location	Locations Affected
Sterling Hill Road from Cherrywood Drive	wash out, culvert overtopped resulting in stream bank erosion road closure
Graniteville Road in vicinity of McLeod Hill Road intersection.	culvert overtopped resulting in road closure and inundation of residential property

Lowery Road at intersection with unnamed brook	Culvert overtopped resulting in road closure
Route 302, area in the vicinity of the Honey Brook & Jail Branch confluence	Washout resulting in stream bank erosion, inundation of three residential properties
Anderson Road from the intersection of Jalbert Road west to Sierra Lavin Road at intersection with Honey Brook.	wash out, resulting in stream bank erosion, road closure
Nuissl Road between the intersection of the Honey Brook and the unnamed stream to the west.	wash out, culvert overtopped resulting in stream bank erosion, road closure

Since 2007, several additional flooding events have occurred in Barre Town. In 2008, 4-5" of rain fell in 2 -3 hours. The areas of LePage Road and Gun Club Road were damaged. Both roads were washed out and closed. The amount to repair these damages was under \$10,000.

In May 2011, a severe set of storms moved through the Region. 3-5" of rain fell across the county. Barre Town experienced severe flash flooding and damages from this event for public infrastructure are estimated at more than \$300,000. Locations that were damaged include:

- Sterling Hill Road (repeat of 2007 damages)
- Nuissl Road (driveway washouts)
- Hunt Road
- Richardson Road
- Le Page Road
- Gun Club Road
- Cherrywood Drive (private property damages)
- McLeod Hill Road (2 homes damaged)
- Howard Street/Route 14 (basements and storage shed damages)
- Rudd Farm Road (private property damages)

Infrastructure within Barre Town was also damaged in Tropical Storm Irene. 5-7" of rain fell during Irene. The impacts of Irene were lessened thanks to mitigation activities and repairs done to roads and culverts after the May 2011 event. Mitigation actions from the May 2011 event included upsizing culverts on Sterling Hill Road, and upgrading a culvert to a bridge at Hunt Road. Damages from Irene to public infrastructure are estimated to be \$15,000.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
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Flood/ Flash Flood/ Fluvial Erosion	Floodplain and identified areas above, also See <i>Areas of Local Concern</i> <i>Map</i> for flood prone areas	Residents, businesses and road infrastructure.	5" of rain during Irene, 3-5" in 24 hrs during May 2011 event	July 2007 event = \$690,000 in Damages; May 2011 event = \$300,000; Irene damages = \$15,000; Floodplain properties = \$33,428,000	Med/ High
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5.3 Moderate Threat Hazards

Extreme Cold/Winter Storms/Ice Storms/Power Failure

History of Occurrences (county wide)

Snow and/or ice events occur on a regular basis. Recent significant events have included:

Date	Event	Location	Extent
3/6/2011	Winter storm	Barre Town, County wide	12-18" of snow, 10,000 customers lost power statewide
2/23/2010	Winter Storm	Barre Town, County wide	20" of snow and 50,000 customers lost power statewide
2/22/2009	Winter Storm	Barre Town, County Wide	16" of snow, 30 mph wind gusts
2/1/2008	Winter storm	Barre Town, County wide	3-7" of snow and ice 1/4-1/2" thick, 50 mph wind gusts
2/14/2007	Winter storm	Barre Town, County wide	22" of snow
2/14/2006	Winter storm	Barre Town, County Wide	30" of snow
1/4/2003	Winter storm	Barre Town, County wide	19" of snow
3/5/2001	Winter storm	Barre Town, County wide	15-30" of snow
12/31/2000	Winter storm	County wide	10" of snow
1/15/1998	Winter storm	Barre Town, County wide	10-12" snow (not a DR in Washington County)
12/29/1997	Winter storm	Barre Town, County wide	21" of snow
12/7/1996	Winter Storm	Barre Town, County wide	12" of snow
3/21/1994	Winter storm	Barre Town, County	5-11" of snow

		Wide	
11/1/1993	Winter storm	Barre Town, County wide	15" of snow
1/3/1993	Freezing Rain	Barre Town, Statewide	1/4-1/2" freezing rain

A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to wires or trees, but in sufficient depth, can cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surfaces coating the ground, tress, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. Periods of extreme cold tend to occur with these events.

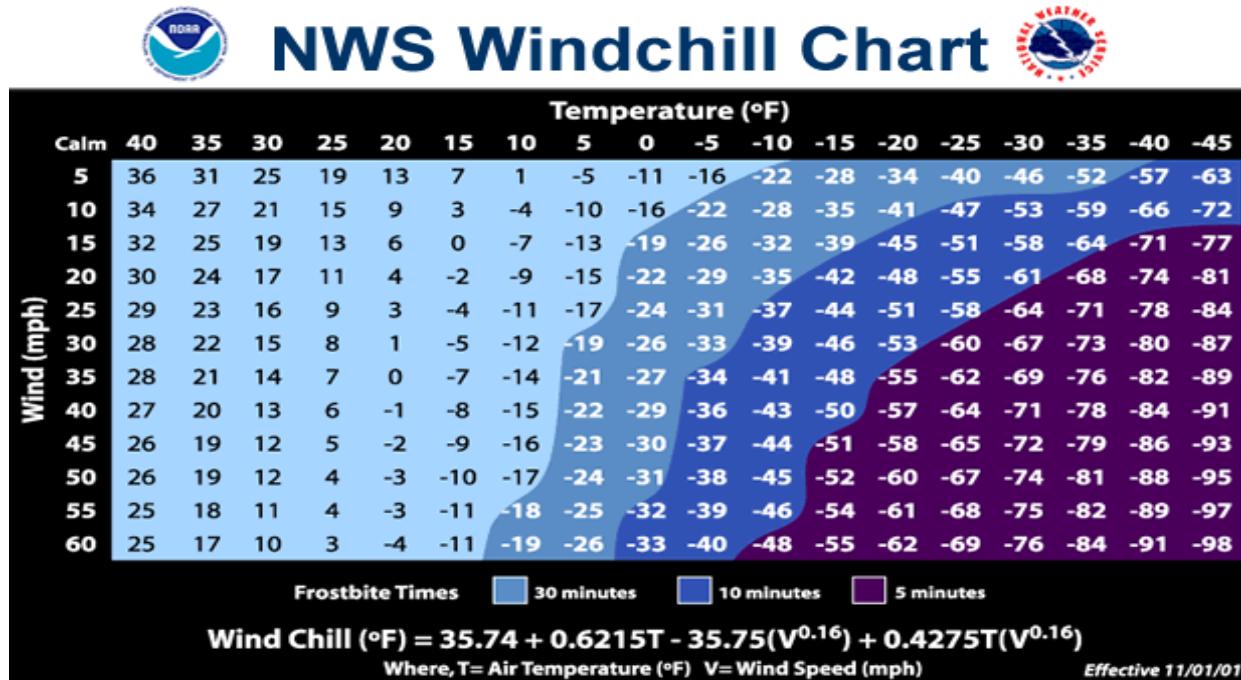
The physical impacts of winter storms are town wide due to the expansive nature of winter storms. For the next plan update, Barre Town will more closely monitor winter storms to determine the worst impacts possible on the Town. Based on past occurrences, the worst anticipated winter weather Barre Town could experience would be 2-3' in 24 hrs of snow with more at higher elevations and several days of power outages. Using the wind chill scale and historical information, the estimate for extreme cold is - 60 degrees Fahrenheit. The worst recent storm was in March 2011 and after that the Blizzard of 1888. Scales to measure the extent of winter storms are:

Heavy snowfall – Barre Town is significantly affected when they experience an accumulation of 7 inches or more of snow in a 12-hour period or 13 inches or more in a 24-hour period.

Blizzard – Barre Town is significantly affected when they experience sustained wind speeds in excess of 40 mph accompanied by heavy snowfall or large amounts of blowing or drifting snow.

Ice storm – Barre Town is significantly affected when they experience ice accumulations of $\frac{1}{4}$ " or greater.

Wind Chill Extent Scale



One of the major problems associated with ice storms is the loss of electrical power. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground.

Other major problems include closed roads and restricted transportation.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Barre. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. Barre Town should plan and prepare for these emergencies. That planning and preparedness effort should include the identification of mass care facilities and necessary resources such as cots, blankets, food supplies and generators, as well as debris removal equipment and services. Shelter locations include: St. Sylvester's Church, East Barre Fire Station and the Barre Town Middle and Elementary School.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Winter Storm/Ice Storm	Town Wide	Utilities, trees, roads, old/under insulated structures, sensitive populations	18+'' snow in March 2011 storm,	additional sheltering/ plowing/ emergency services costs for town - \$15,000	Medium

High Wind

High wind is defined as an event with sustained wind speeds of 40 m.p.h. or greater lasting for 1 hour or longer or an event with winds of 58 m.p.h. or greater for any duration. Thunderstorms can generate high winds and down hundreds of large trees within a few minutes. The State can also experience tornadoes, which are capable of damaging or destroying structures, downing trees and power lines and creating injuries and death from collapsing buildings and flying objects.

Based on past occurrences outlined below and in the hurricane/severe storm/tropical storm analysis an worst extent for high wind events in Barre Town would be Category 1 force hurricane winds. Barre Town can expect to experience damages at winds of a Beaufort number 8 (speeds are below the starts of the Fujita and Saffir Simpson scales), and hail sized H5 on the Torro Hailstorm Intensity Scale. In the future, Barre Town could consider installing a monitoring station to better gather data for wind events. Wind events can be recorded using the Beaufort or Saffir Simpson Scales. Hailstorms can be measured using the Torro Hailstorm Intensity Scale. Tornadoes can be measured using the enhanced fujita scale.

Beaufort Scale

Beaufort number	Wind Speed (mph)	Seaman's term		Effects on Land
0	Under 1	Calm		Calm; smoke rises vertically.
1	1-3	Light Air		Smoke drift indicates wind direction; vanes do not move.
2	4-7	Light Breeze		Wind felt on face; leaves rustle; vanes begin to move.
3	8-12	Gentle Breeze		Leaves, small twigs in constant motion; light flags extended.
4	13-18	Moderate Breeze		Dust, leaves and loose paper raised up; small branches move.
5	19-24	Fresh Breeze		Small trees begin to sway.
6	25-31	Strong Breeze		Large branches of trees in motion; whistling heard in wires.
7	32-38	Moderate Gale		Whole trees in motion; resistance felt in walking against the wind.
8	39-46	Fresh Gale		Twigs and small branches broken off trees.
9	47-54	Strong Gale		Slight structural damage occurs; slate blown from roofs.
10	55-63	Whole Gale		Seldom experienced on land; trees broken; structural damage occurs.
11	64-72	Storm		Very rarely experienced on land; usually with widespread damage.
12	73 or higher	Hurricane Force		Violence and destruction.

Saffir-Simpson Scale for Hurricane Classification				
Strength	Wind Speed (Kts)	Wind Speed (MPH)	Pressure (Millibars)	Pressure
Category 1	64- 82 kts	74- 95 mph	>980 mb	28.94 "Hg
Category 2	83- 95 kts	96-110 mph	965-979 mb	28.50-28.91 "Hg
Category 3	96-113 kts	111-130 mph	945-964 mb	27.91-28.47 "Hg
Category 4	114-135 kts	131-155 mph	920-944 mb	27.17-27.88 "Hg
Category 5	>135 kts	>155 mph	919 mb	27.16 "Hg
Tropical Cyclone Classification				
Tropical Depression	20-34kts			
Tropical Storm	35-63kts			
Hurricane	64+kts or 74+mph			

Combined NOAA/TORRO Hailstorm Intensity Scales

Size Code	Intensity Category	Typical Hail Diameter (inches)	Approximate Size	Typical Damage Impacts
H0	Hard Hail	up to 0.33	Pea	No damage
H1	Potentially Damaging	0.33-0.60	Marble or Mothball	Slight damage to plants, crops
H2	Potentially Damaging	0.60-0.80	Dime or grape	Significant damage to fruit, crops, vegetation
H3	Severe	0.80-1.20	Nickel to Quarter	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	1.2-1.6	Half Dollar to Ping Pong Ball	Widespread glass damage, vehicle bodywork damage
H5	Destructive	1.6-2.0	Silver dollar to Golf Ball	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	2.0-2.4	Lime or Egg	Aircraft bodywork dented, brick walls pitted
H7	Very destructive	2.4-3.0	Tennis ball	Severe roof damage, risk of serious injuries
H8	Very destructive	3.0-3.5	Baseball to Orange	Severe damage to aircraft bodywork
H9	Super Hailstorms	3.5-4.0	Grapefruit	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	4+	Softball and up	Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

Enhanced Fujita (EF) Scale		
Enhanced Fujita Category	Wind Speed (mph)	Potential Damage
EF0	65-85	Light damage. Peels surface off some roofs; some damage to gutters or siding; branches broken off trees; shallow-rooted trees pushed over.
EF1	86-110	Moderate damage. Roofs severely stripped; mobile homes overturned or badly damaged; loss of exterior doors; windows and other glass broken.
EF2	111-135	Considerable damage. Roofs torn off well-constructed houses; foundations of frame homes shifted; mobile homes completely destroyed; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.
EF3	136-165	Severe damage. Entire stories of well-constructed houses destroyed; severe damage to large buildings such as shopping malls; trains overturned; trees debarked; heavy cars lifted off the ground and thrown; structures with weak foundations blown away some distance.
EF4	166-200	Devastating damage. Well-constructed houses and whole frame houses completely leveled; cars thrown and small missiles generated.
EF5	>200	Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 m (109 yd); high-rise buildings have significant structural deformation; incredible phenomena will occur.

source: http://en.wikipedia.org/wiki/Enhanced_Fujita_Scale

Tornadoes are less common than hail storms and high winds, but have occurred throughout Vermont. Across the State, however, 34 tornadoes have been recorded between 1950 and 1999, injuring 10 people and causing over \$8.4 million dollars in estimated property damage. Nearly all of these incidents occurred from May through August with most of occurring in the afternoon. Occurrences include (additional severe storm events outlined in hurricane/tropical storm/severe storm analysis):

Date	Event	Location	Extent
5/27/2011	Hail/Winds	Barre/County Wide	50 knot winds and hail
8/25/2007	Thunderstorm Winds	Barre	61 knot winds
6/02/2007	Thunderstorm Winds	Barre/East Barre	55 knot winds
8/02/2006	Thunderstorm Winds	South Barre	60 knot winds
8/03/2004	Thunderstorm Winds	South Barre	52 knot winds
7/21/2003	High Wind	Barre	60 knot winds

The storm in 2006 downed trees and power lines in the Cherrywood and Barre View neighborhoods, as well as at the Park and Ride in South Barre.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
High Winds	Town Wide	Power lines, trees, structures	Category 1 force winds	\$50,000	Medium

Ice Jams

Ice Jams in Barre Town occur annually. On a river, an ice jam is when chunks of ice create blockage in the flow of a river and cause areas behind the jam to flood. Ice jams often occur in narrow areas of rivers or where there are bridge pylons. Ice jams often occur during winter rain events or during spring thaws when the upper layer of ice begins to melt and crack. Ice jams tend to occur in one place on Barre Town along Route 302. The Town continues to work with surrounding landowners to help clear debris so as to help lessen the threat of ice jams.

According to the USACE Ice Jam Database there have been 45 ice jams recorded between 1936 and 1992 along the Jail Branch. Occurrences include:

Jam Date	Gauge Height -feet (East Barre Dam location)				
3/10/1992	5.46	2/23/1974	8.18	3/9/1953	2.3
3/3/1991	5.69	1/7/1973	9.48	1/30/1952	3.91
3/5/1990	7.95	1/7/1973	9.48	2/14/1951	3.34
2/3/1988	8.04	1/27/1972	4.27	2/20/1950	3.11
3/10/1987	5.5	2/4/1970	3.72	3/23/1949	2.08
1/27/1986	4.96	2/20/1969	5.3	2/16/1948	2.26
1/6/1982	4.9	12/12/1968	3.5	3/14/1947	2.59
2/11/1981	5.82	3/2/1966	4.18	3/4/1946	2.78
3/18/1980	5.18	2/9/1965	n/a	1/3/1945	3
3/6/1979	5.94	3/13/1963	1.58	2/25/1943	2.96
1/9/1978	5.89	2/11/1960	2.93	3/9/1942	3.92
4/2/1975	5.05	2/2/1959	2.1	2/9/1941	22.6
		1/23/1958	2.2	4/1/1940	3.03
		4/5/1956	1.79	2/17/1939	6.35
		3/2/1955	2.29	12/28/1937	3.5
		2/22/1954	2.64	4/6/1937	2.71

3/12/1936	2.68
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Based on past occurrences, an estimated worst extent of flooding from ice jams in Barre Town would be 22 feet (from 2/9/1941 flood). However, Barre Town can experience ice jam impacts and damages starting at flooding of 3 feet.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Ice jams	Route 302	Road infrastructure, structures	22.6 feet of flooding (2/9/1941)	\$15,000 for road damages	Medium

Hurricanes/Severe Storms

History of Occurrence (from NCDC website and FEMA DR List. The closest river gauge is located in Montpelier, approximately 6 miles downstream):

Date	Event	Location	Extent
8/28/2011	Tropical Storm, Flash Flood (TS Irene)	Barre Town, Washington County	Montpelier flood gauge at 19.05', flood stage at 15'; 5" of rain – DR 4022
7/06/2011	Thunderstorm	Barre Town, County Wide	50 knot winds; 15,000 people in VT lost power
5/26/2011	Hail/Thunderstorms/Flash Flooding	Barre Town, County Wide	1" hail, 50 knot winds, 25,000 customers lost power in VT, 3-5" of rain - DR 4001, Montpelier gauge at 17.59 feet
8/9/2010	Thunderstorm/Wind/Hail	Barre Town	50 knot winds
7/21/2010	Hail	Barre Town, County Wide	1" Hail
7/18/2008	Hail	Barre Town, County Wide	1" Hail, 30 knot winds
7/9/2007	Hail, thunderstorms	Barre Town, County Wide	Baseball sized hail - DR 1715
6/19/2006	Hail, thunderstorms	Barre Town, County Wide	50 knot winds
6/9/2005	Severe thunderstorms	Barre Town, County Wide	Downed power lines, 60 knot winds
9/16/1999	Tropical Storm Floyd	Statewide	Tropical storm winds and flooding – DR 1307, Montpelier flood gauge at 9.30 feet,
6/17/1998	Severe Storms	Barre Town, County Wide	3-6" of rain, DR 1228, not a historical crest in Montpelier

7/15/1997	Severe Storms	County Wide	3-5" of rain
5/19/1982	Thunderstorm winds	Barre Town, County Wide	56 knot winds
7/3/1964	Hail	County Wide	1.5" hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

Hurricanes and tropical storms are violent rain storms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. Hurricane season is between the months of June and November. These types of storms originate in the warm waters of the Caribbean and move up the Eastern seaboard where they lose speed in the cooler waters of the North Atlantic. A severe thunderstorm is a thunderstorm that contains any one or more of the following three weather conditions: hail that is 3/4 of an inch or greater in diameter, winds 58 miles per hour or greater, and/or tornadoes. Severe storm events can occur late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes, tropical storms, and severe storms is expected to increase with climate change.

Similar to flooding, the extent of severe storms is not well documented in the Town of Barre \. The impact of storms is usually flood related. See flood extent description in flood section above. Flooding impacts areas along the Jail and Stevens Branches and roads affected are noted in the flooding analysis. Wind impacts are town wide. Wind extent from storms is not well documented as there is no monitoring station in Barre Town. Estimates for wind are gathered from county wide data off the NCDC website. An estimate of the worst anticipated wind extent in Barre Town based on past occurrences would be Category 1 force hurricane winds and H8 hail according to the Hail/Torro scale. Barre Town can expect to experience damages from winds considered an 8 on the Beaufort Scale, and H5 hail on the Torro Hailstorm Intensity Scale. In the future, Barre Town could consider installing a monitoring station to better gather data for wind events. Wind events can be recorded using the Beaufort, Saffir Simpson. Hail events can be recorded using the Torro/Hailstorm Scale.

The most common effect from Hurricanes/Severe Storms is flooding. For more specific flood locations and extents, see the flood/flash flood hazard analysis section. A description of high wind extent can be found in the high winds section.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Hurricane/ Tropical/ Severe Storms	Town Wide for Wind impacts, See flood/flash flood /fluvial erosion hazard analysis section	Large trees, power lines, culverts/ bridges	6" rain Tropical Storm Irene (8/28/2011), 5-7" rain Tropical Storm Floyd (9/16/1999), Cat. 1 Hurricane 1938	\$300,000 from Spring 2011 events	Medium

6. Mitigation

6. 1 Town Plan 2008 Goals & Recommendations that Support Local Hazard Mitigation

- To ensure that development is suitable to the natural features of each site and limited to where development is imprudent and/or marginal due to negative impacts. (Natural Resource Goal)
- The Planning Commission shall review and approve plans regarding storm water management for new subdivisions proposals to ensure that new development will not adversely affect the community (Water Runoff & Drainage – Floodplain Zones & Management)
- A Town storm water control policy should be developed and implemented as soon as possible which includes provisions for:
 - Allowable volumes of storm water run-off. Calculations in subdivision applications, detentions areas, throttling devices for all storm water run-off.
 - Road improvements projects should include an inspection of the domestic sewer lines to check for infiltration of storm water.
 - The Town should develop an inventory of discharge locations. (Water Runoff & Drainage – Floodplain Zones & Management)

The next time the Town of Barre updates its Town Plan, it may consider adding additional mitigation goals.

The goal of this mitigation plan is:

- **To take actions to reduce or eliminate the long-term risk to human life and property from natural hazards.**

Specific hazard mitigation strategies related to the goals of the plan include:

- Upgrade existing and install additional future drainage systems so that they are adequate and functioning properly
- Educate all residents and business owners so that they are aware of the hazards that exist within Barre Town and can protect themselves and insure their property
- Relocate emergency response services and critical facilities functions so that they are not interrupted by natural hazards
- Provide adequate communication systems for emergency personnel and response units
- Provide residents with adequate warning of potential hazards

6.2 Proposed Hazard Mitigation Programs, Projects & Activities

Hazard mitigation programs, projects and activities that were identified for implementation at the Town Local Hazard Mitigation meeting:

Hazard	Possible Action	Local Leadership ³	Prioritization (High, Med)	Possible Resources ⁴	Time Frame
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm	Upgrade and expand Sterling Hill Road culvert to 8' x 5' box culvert per 2007 Hydraulics Study	SB, Town Manager, Town Engineer	High	HMGP	1-2 years
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm	Develop water retention area on upstream side of McLeod Hill Road culvert	SB, Town Manager, Town Engineer	High	HMGP	2 years
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm	Replace and upgrade culvert on Peloquin Road per 2007 Hydraulics Study	SB, Town Manager, Town Engineer	High	HMGP	2-3 years
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm	Develop water retention area at intersection of Sterling Hill Road and Graniteville Road	SB, Town Manager, Town Engineer	Med	HMGP	2-3 years
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm	Develop water retention area behind Barre Town School	SB, Town Manager, Town Engineer	Med	HMGP	2-3 years
Flooding/ Fluvial Erosion, Hurricane/ Tropical Storm/Severe Storm, Ice Jams	Project # 1, 2, 3, 5, 6, and 9 from the Stevens Branch Corridor Plan (see attachments)	SB, Town Manager, Town Engineer, ANR	Med	Town funds, USDA, EPA	4 years

³ SB – Select Board, PC - Planning Commission, ANR – Agency of Natural Resources

⁴ HMGP – Hazard Mitigation Grant Program, EMGP – Emergency Management Grant Program, PSIC/NTIA – National Telecommunications and Information Administration, USDA – United States Dept. of Agriculture

Winter Storms/ Severe Cold/ice storm	Provide training to residents and sensitive populations on how to insulate homes (pipes, attics) for extreme cold spells	SB, PC, Fire Dept	Med	EMGP	2 years
Winter storms/ extreme cold/ice storms, hurricane/ tropical storms/ severe storms, high winds	Provide looped distribution service or other redundancies in the electrical service to critical facilities	Fire Dept, SB	Med	General Funds, EMGP, DPIG	3-4 years
NFIP Compliance	Work with elected officials, the State and FEMA to correct existing NFIP compliance issues and prevent future issues through continuous communications, training and education	Town Planner, ANR	Med	HMGP	2 years
Emergency Preparedness	Install generators at both Town Garages	SB, Fire Dept, Town Manager	Med	EMGP	3-4 years

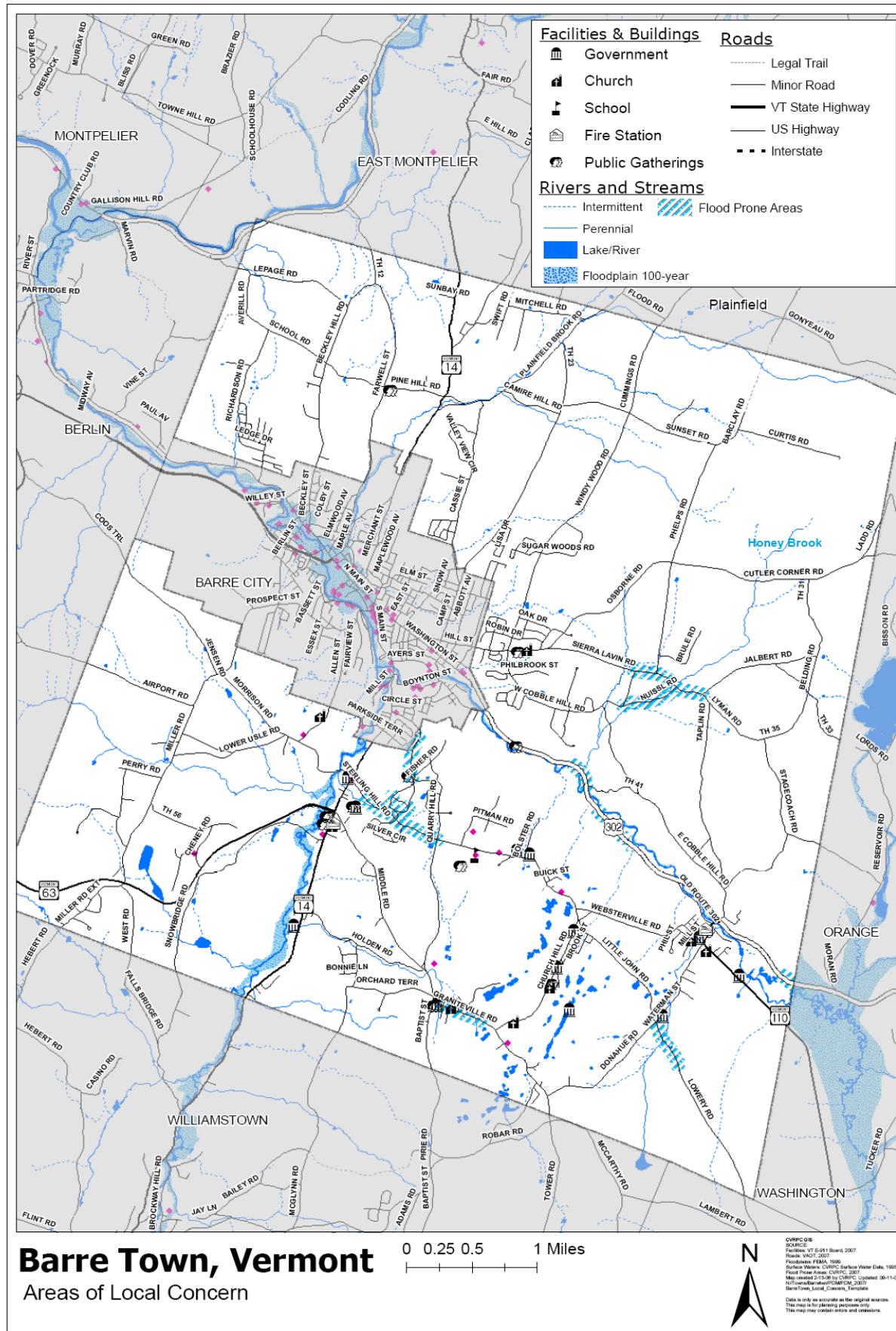
VEM also emphasizes a collaborative approach to achieving mitigation on the local level, by partnering with ANR, VTrans, ACCD, Regional Planning Commissions, FEMA Region 1 and other agencies, all working together to provide assistance and resources to towns interested in pursuing mitigation projects and planning initiatives.

The Hazard Mitigation Activities Matrix (Attached) lists mitigation activities in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the Community's need to address the issue, the action's cost, and the availability of potential funding. The action's cost was evaluated in relation to its benefit as outlined in the STAPLEE guidelines.

Barre Town understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The Town must also have a FEMA approved Hazard Mitigation Plan as well.

A High prioritization denotes that the action is either critical or potential funding is readily available and should have a timeframe of implementation of less than two years. A Medium prioritization is warranted where the action is less critical or the potential funding is not readily available and has a timeframe for implementation of more than two years but less than four. A Low prioritization indicates that the timeframe for implementation of the action, given the

action's cost, availability of funding, and the community's need to address the issue, is more than four years.



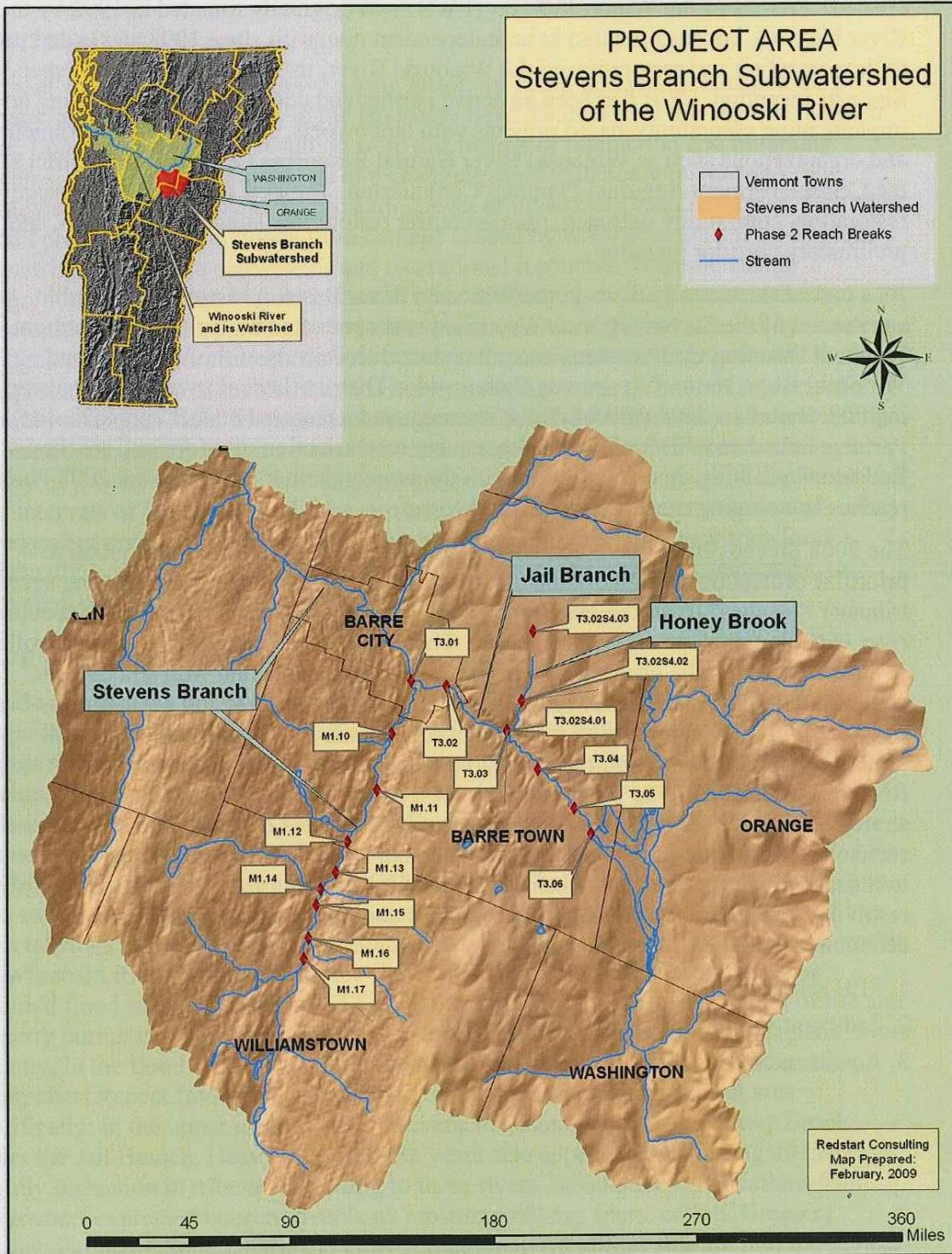


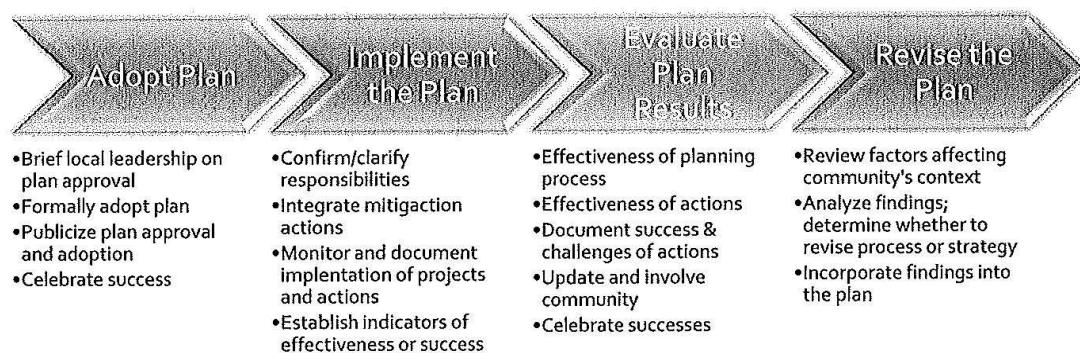
Figure 1. Six mainstem and seven tributary reaches included in the Stevens Branch Corridor Planning process. Inset shows the location of this area in terms of the entire State.

Stevens Branch Watershed 2008 Phase 2 Prioritized Project and Strategy Summary (from Stevens Branch Corridor Plan 3/13/2009)								
Project No.	Reach/Segment Condition Sensitivity	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitment	Potential Partner Commitments
1	All of project area	Extensive straightening and frequent loss of floodplain access, escalating erosion conflicts due to increased stream velocity.	FEH and belt-width-based corridor planning, protection of attenuation assets.	Feasible, high priority; delineation process largely developed. Development pressures in watershed likely to continue, upstream impacts affect success of projects	Flood hazard reduction, fisheries protection, prime farmland protection, viewshed preservation, water quality protection, oversight of management activities affecting stream function	Development of FEH corridor; outreach and educational materials; policy development and implementation	Depends on options chosen; see VT ANR Municipal Guide to Fluvial Erosion Hazard Mitigation (Literature Cited section of this report)	Towns of Barre, Barre City, and Williamstown FWR; CVRPCVT ANR-RMP
2	Numerous reaches High Priority (In order of priority): M1.11-A, M1.11-B, M1.11-C, M1.15-A, M1.10-A, M1.18-B, M1.18-C, M1.19-A	Bank erosion, encroachment leading to bank destabilization and increased flows	Buffer protection and enhancement and corridor easement projects	Feasible, high priority; data available; cheap; easy to promote with landowners; funding available for easement projects	Water quality protection, fisheries protection, flood hazard reduction	Outreach; materials and planting costs; easement development costs	Landowner commitment critical. Potential land use conversion of buffer areas.	Private Landowners; FWR, CVRPC, VT ANR-RMP, CREP
3	Numerous reaches High Priority (In order of priority): M1.10-B, M1.11-B, T3.01-A, T3.01-B, T3.02B, T3.03-A, T3.04-D, T3.05-A, T7.01-A, M1.18-A	Increased flow, downstream reaches incised	Collect and assemble stormwater input data for reaches; develop plan for mitigating flow	Feasible, high priority; data available; towns may have model inventories and budgeting/resources?	Water quality protection, fisheries protection, flood hazard reduction	Data assembling; outreach and education; alteration costs where appropriate	Private landowners are key to success	Towns of Barre, Barre City, and Williamstown Private landowners; FWR; CVRPC VT ANR-RMP
4	Numerous reaches High Priority (In order of priority): T2S4.01-A, T3.01-A, T3.01-B, T2S4.01-B, T2S4.02-A,	Downstream reaches incised, sediment discontinuities reducing movement of larger bedload sediments to help rebuild meanders and floodplain	Collect and assemble geomorphic data for bridges and culverts; develop and disseminate sizing recommendations and/or requirements	Feasible, high priority; data already available; some towns may have model inventories and budgeting	Flood hazard reduction; fisheries protection	Data collection and assembling; replacement costs where appropriate		Towns of Barre, Barre City, and Williamstown FWR; CVRPC VT ANR-RMP

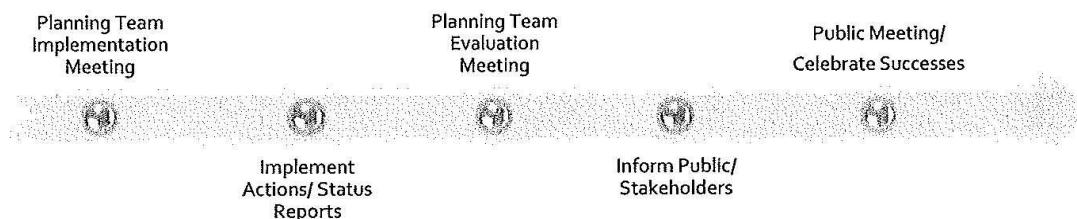
Stevens Branch Watershed 2008 Phase 2 Prioritized Project and Strategy Summary (from Stevens Branch Corridor Plan 3/13/2009)								
Project No.	Reach/Segment Condition Sensitivity	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitment	Potential Partner Commitments
	T2S4.02-B, M1.14-0, M1.15-B, T3.02S4.01S1.01-A, T3.02S4.01S1.01-B, T7.01-B	access	for private installations and help towns with inventory, prioritization, and capital budgeting					
5	M1.10B	RB mass failure exacerbated by stormwater outflow.	Re-location of stormwater input	Feasible, should fit in with City stormwater management priorities.	Protect fisheries and water quality from increased sediment	Landowner outreach and education; relocation of stormwater flow	Land use conversion minimal; landowner will need to commit to project	Landowners, Barre City Engineers, FWR, RMP
6	M1.10D	Extensive tributary erosion and head cut that has moved up to Route 14. Arrest headcutting [more?]	Arrest headcutting at Route 14	Feasible, should fit in with City stormwater management priorities.	Protection of State Highway, improved water quality, protection of fisheries	Replacement of culvert and other structures for arresting headcut	Land use conversion minimal; City road engineer must be on board	Barre City Engineers, VTrans, FWR, RMP
7	M1.15B	Floodplain not accessed on right bank due to berm presence; recent flooding over left bank into developed area	Remove berm	Feasible, should be further evaluated but is possibly simple solution to problematic flooding	Return area of non floodplain habitat to floodplain habitat	Landowner outreach and education, equipment for berm removal and site restoration	Some land conversion of flood-protected land to non-flood- protected land; will need landowner commitment	FWR, RMP, CREP, EQIP
8	T3.01B	Mass failure RB; upstream of bridge is threatening house above	Stabilize stream bank; redirect stream flow with rock vein	Feasible; financial responsibility needs to be worked out	Water quality protection	Riprap and vein boulders, installation costs.	Landowner commitment needed, City commitment needed.	Barre City, Landowner at site, FWR, RMP
9	T3.03A	Gully formation on left valley wall is adding sediment to Jail Branch and is headcutting.	Arrest head cut in tributary gully	Potentially feasible; needs further evaluation to determine source, assess future erosion risk, and consider value of intervention	Landowner education, protection of water quality and fisheries.	Landowner outreach and education, materials and installation costs.	Minimal land use conversion; needs landowner commitment.	Site landowners, Barre Town, FWR, RMP CREP, EQIP

Stevens Branch Watershed 2008 Phase 2 Prioritized Project and Strategy Summary (from Stevens Branch Corridor Plan 3/13/2009)								
Project No.	Reach/Segment Condition Sensitivity	Site Description Including Stressors and Constraints	Project or Strategy Description	Technical Feasibility & Priority	Other Social Benefits	Costs	Land Use Conversion & Landowner Commitment	Potential Partner Commitments
10	T3.01B	Lack of flood attenuation in city.	Remove berm	Potentially feasible; needs further evaluation to assess value and issues involved	Landowner education; reduced flood hazard downstream	Landowner outreach and education would be extensive considering potential flooding over school playing fields; cost of removing berm and stabilizing the site.	Land use conversion possibly; landowner and citizen commitment would have to be high	Barre City Government, Barre City citizens, landowners, FWR, RMP.
	T7.01A	Possibly unnecessary barrier to attenuation.	Remove berms	Potentially feasible; needs further evaluation to assess value and issues involved	Landowner education; reduced flood and erosion hazard downstream	Landowner outreach and education, materials and installation costs.	Minimal land use conversion; needs landowner commitment.	Site landowners, Williamstown Town, FWR, RMP CREP, EQIP

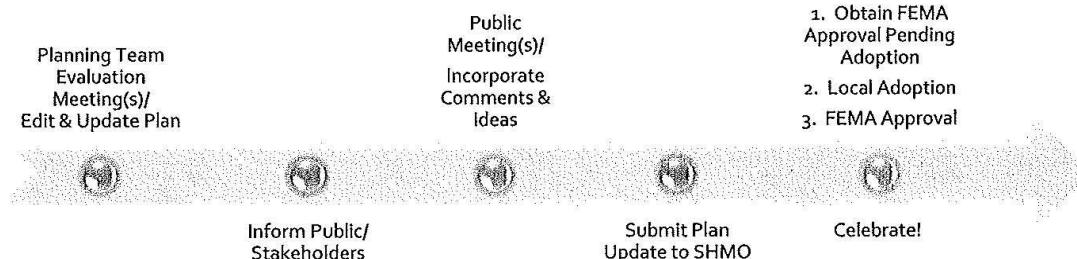
5-Year Plan Review/Maintenance



*After Plan Adoption-Annually
Implement and Evaluate*



*Fifth Year, and After Major Disaster
Evaluate and Revise*



TOWN OF BARRE, VERMONT

RESOLUTION # 6-12

A RESOLUTION OF THE TOWN OF BARRE, VERMONT ADOPTING THE LOCAL HAZARD MITIGATION PLAN UPDATE DATED JANUARY, 2012

WHEREAS, the Town of Barre has worked with the Central Vermont Regional Planning Commission to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Barre Town Local Hazard Mitigation Plan contains several potential projects to mitigate damage from disasters that could occur in the Town of Barre; and

WHEREAS, a duly-noticed public meeting was held by the Town of Barre Selectboard on September 4, 2012 to formally adopt the Barre Town Local Hazard Mitigation Plan.

NOW, THEREFORE, BE IT RESOLVED that the Town of Barre Selectboard adopts the Barre Town Local Hazard Mitigation Plan.

RESOLVED at Websterville, Barre Town, Vermont this 4th day of September, 2012.

BARRE TOWN SELECTBOARD



*Jenny G. Blaw
Jay F. Perkins
Celia Wood
Judi Newton*

ATTEST: *Donna J. Kelty*
Donna J. Kelty, Town Clerk-Treasurer