2015 All Hazard Mitigation Plan
Town of Brattleboro
Windham County
Vermont

Prepared by:
Planning Services Department for the
Brattleboro Hazard Mitigation Committee
Town of Brattleboro
230 Main Street, Suite 202
Brattleboro, VT 05301

Adopted
December 15, 2015

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INTRODUCTION AND PURPOSE

This plan is the 2015 All-Hazard Mitigation Plan for the town of Brattleboro. The purpose of this plan is to identify hazards facing the Town and to develop strategies to continue reducing risks from those hazards.

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, Federal Emergency Management Agency (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, averting 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 stopping or limiting development, and could include projects such as:

- Flood-proofing structures
- Tying down propane/fuel tanks in flood-prone areas
- Elevating furnaces and water heaters
- Identifying and modifying high traffic incident locations and routes
- Ensuring adequate water supply
- Elevating structures or utilities above flood levels
- Identifying and upgrading undersized culverts
- Proactive land use planning for floodplains and other natural hazard areas
- Proper road maintenance and construction
- Ensuring critical facilities are safely located
- Public information

BRATTLEBORO GEOGRAPHY & TOWN PROFILE

Brattleboro is 19,731 acres or 32 square miles in area and is bordered to the north by Dummerston, to the west by Marlboro, to the east by the Connecticut River (and New Hampshire), and to the south by Guilford and Vernon. Interstate Highway 91 and State Highway 5 run north/south through Brattleboro, State Highway 9 runs east/west through Brattleboro linking Brattleboro to New Hampshire over the Connecticut River and Marlboro to the west. State Highway 30 runs along the West River, which meets the Connecticut River just north of downtown.

Brattleboro's largest standing water body is the Pleasant Valley Reservoir. This is the primary source of municipal drinking water. While fishing, boating, and swimming at the Reservoir is restricted, many other recreational activities such as hiking and biking occur along the shoreline and in the surrounding watershed. The Retreat Meadows, located at the confluence of the Connecticut River and West River, is an all season recreational resource. Activities include boating, swimming, fishing, wildlife watching, and ice-skating.

Mapped watercourses in Brattleboro include the Connecticut River, Whetstone Brook, Halladay Brook, Crosby Brook, Pleasant Valley Brook, and the West River. Access to these watercourses is primarily through private property. Public access is limited. The West River can be accessed from Route 30 and a State boat launch is on the Connecticut River at the end of Old Ferry Road.

The western portion of Town is dominated by steep slopes, generally adjacent to watercourses. Flatter areas generally lie to the east; floodplains contain a large portion of the Town's flat land.

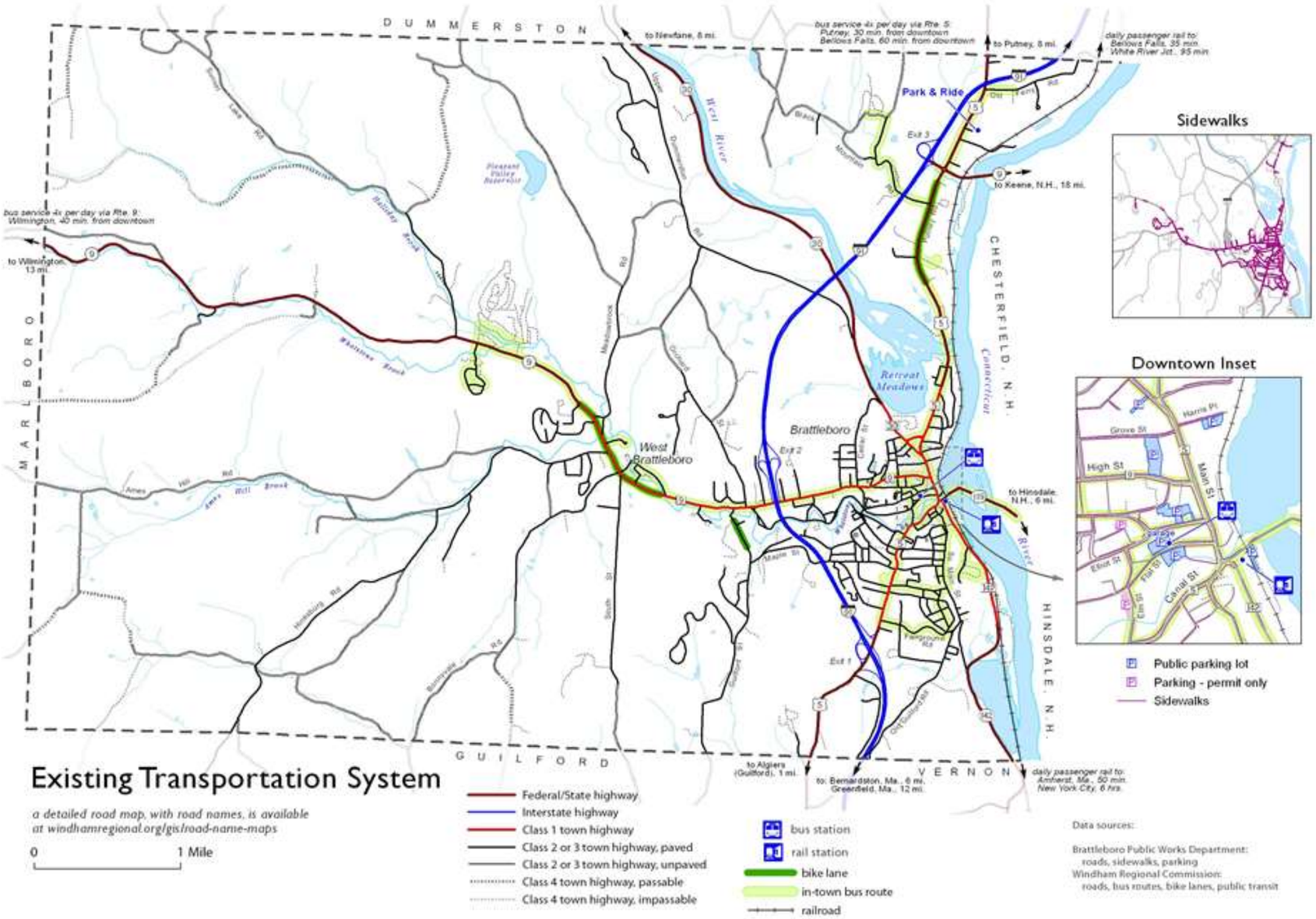
The climate is generally temperate with moderately cool summers and cold winters, as in the rest of Vermont. Average annual precipitation is around 50 inches; snowfall averages 60-65 inches. The weather is highly changeable, large variations in temperature, precipitation, and other conditions can occur both within and between seasons.

<u>Development Trends</u>

In 2010, the total population of Brattleboro was 12,046 (2010 US Census data). This was an insignificant change in population from 2000 with only 41 additional people. Since 1950, Brattleboro's population has been static, fluctuating by only 719 people (from a high of 12,241 people in 1990 to a low of 11,522 people in 1950). The population growth trends for Brattleboro and surrounding areas indicate there has been slow growth:

- Brattleboro grew by 4.5% from 1950–2010
- Brattleboro shrank by 1.5% from 1990–2010
- Windham County grew by only 0.7% from 1990–2010
- Franklin County, MA declined by 0.2% from 1990–2010
- Cheshire County, NH grew by 4.5% from 1990–2010

Brattleboro, similar to Windham County, has a population somewhat older than the Vermont average, 43.2 years vs. 41.5 years (2010 US Census). As a traditional service center for a wider rural region, Brattleboro has a significant stock of affordable housing opportunities—including housing for seniors and the physically disabled. Many Brattleboro households are single person households.


Existing Transportation System
a detailed road map, with road names, is available at windhamregional.org/gis/road-name-maps
0
1 Mile
Federal/State highway
Interstate highway
Class 1 town highway
Class 2 or 3 town highway, paved
Class 2 or 3 town highway, unpaved
Class 4 town highway, passable
Class 4 town highway, impassable
bus station
rail station
bike lane
in-town bus route
railroad
Data sources:
Brattleboro Public Works Department:
roads, sidewalks, parking
Windham Regional Commission:
roads, bus routes, bike lanes, public transit
DUMMERSTON
MARLBORO
GUILFORD
VERNON
CHESTERFIELD, N.H.
HINSDALE, N.H.
Brattleboro
West Brattleboro
Retreat Meadows
Pleasant Valley Reservoir
West River
Connecticut River
Park & Ride
Exit 1
Exit 2
Exit 3
to Newfane, 8 mi.
bus service 4x per day via Rte. 5: Putney, 30 min. from downtown Bellows Falls, 60 min. from downtown
to Putney, 5 mi.
daily passenger rail to: Bellows Falls, 35 min. White River Jct., 95 min.
to Keene, N.H., 18 mi.
bus service 4x per day via Rte. 9: Wilmington, 40 min. from downtown
to Wilmington, 13 mi.
to Hinsdale, N.H., 6 mi.
to Algiers (Guilford), 1 mi.
to: Bernardston, Ma., 6 mi. Greenfield, Ma., 12 mi.
daily passenger rail to: Amherst, Ma., 50 min. New York City, 6 hrs.
Sidewalks
Downtown Inset
Public parking lot
Parking - permit only
Sidewalks
Harris Pl
Grove St
High St
Main St
Elliot St
Canal St
Elm St
Flat St

PREREQUISITES

CERTIFICATE OF ADOPTION
December 15, 2015
TOWN OF BRATTLEBORO, Vermont Selectboard
A RESOLUTION ADOPTING 2015 All Hazard Mitigation Plan, Town of Brattleboro, Windham County, Vermont

WHEREAS, the Town of Brattleboro has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **2015 All Hazard Mitigation Plan, Town of Brattleboro, Windham County, Vermont,** which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Brattleboro has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **2015 All Hazard Mitigation Plan, Town of Brattleboro, Windham County, Vermont (Plan)** under the requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of Brattleboro; and

WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Brattleboro with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this **Plan** will make the Town of Brattleboro eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by Town of Brattleboro Selectboard:

1. The **2015 All Hazard Mitigation Plan, Town of Brattleboro, Windham County, Vermont** is hereby adopted as an official plan of the Town of Brattleboro;

2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;

3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and

4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITHNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Brattleboro this 15th day of Dec. 2015.

Members:

Select Board

David Gartenstein, Chair

Kate O'Connor, Vice Chair

David Schoales, Clerk

John Allen

Donna Macomber

ATTEST

Annette Cappy, Town Clerk

PLANNING PROCESS

PLAN DEVELOPMENT

The Hazard Mitigation Plan is based on the goals and objectives of the Brattleboro Town Plan, the guiding document for town policy, regulation, grant funding, and capital investment. The Town Plan is based on an extensive planning process which began in 2008 and extended into 2012. The process involved the work of the Town Plan Scoping Group, the Town Plan Advisory Group, the Commercial Land Use Study, the Town Sustainability Forum, and the EPA Sustainable Communities Building Blocks Workshop. Public input included a kickoff meeting, a visioning session with Brattleboro Union High School students, a Sustainability Forum, small group meetings, and the Active Living Workshop. Participants included citizens from surrounding towns, town board and committee members, town officials, business persons, students and non-profit groups. The outreach activities were aimed at identifying Brattleboro's assets – human, social, cultural, institutional, built and natural environment attributes – that make the town strong and give it its identity. The outreach identified a number of common goals: improve resilience to climate change and other impacts, improve pedestrian and bicycle infrastructure, preserve agricultural land for local food production, encourage growth in areas already developed or where infrastructure exists, access the waterfront and maintain and enhance the natural environment.

In 2011, Brattleboro experienced wide spread flood damage from Tropical Storm Irene. The Town Plan process paused as the town shifted its focus to recovery. Already identified goals, like waterfront access, maintaining and enhancing the environment, and focusing growth on developed areas, helped inform recovery. These goals lead the Town to promote buyouts and relocation of structures from the Special Flood Hazard Area. This justified the reconstruction of Town infrastructure in a way that respected the natural environment, including the potential hazards posed by the natural environment, resulting in longer bridge spans and larger culverts.

When the Town Plan process resumed in earnest, the natural hazard issues that had been woven into the identified goals came to the forefront. The EPA Smart Growth Sustainable Communities workshop was of particular value in focusing the community discussion on natural hazard and Brattleboro's future development. The workshop reviewed existing community development, plans, regulations and policies. The workshop examined strategies for guiding future development, including use of conservation subdivisions, steep slope regulations, fluvial erosion hazard regulations, and reuse of lands adjacent to the Whetstone as a public recreation and conservation asset.

The Town Plan as adopted identified the following goals and objectives that informed this Hazard Mitigation Plan:

9 HISTORIC & SCENIC RESOURCES
9.2 Ensure minimal impacts [on historic & scenic resources]:
9.2.2 Consider standards for conservation subdivision;
9.2.3 Consider guidelines for tree preservation and development on steep slopes

10 MUNICIPAL FACILITIES & SERVICES
10.2.1 Maintain systems [utilities] to meet state and federal standards
10.3 Stormwater management:

10.3.1 Evaluate feasibility and options for establishing a stormwater services enterprise fund or program;
10.3.2 Work with property owners to address stormwater and infrastructures needs;
10.7.1 Support compact growth, neighborhood revitalization, and sustainable new neighborhood design;

11 NATURAL RESOURCES
11.1 Wildlife corridors, wetlands, and riparian habitats:
11.1.1 Maintain Class I wetlands in natural state; comment on applications for state permit[s];
11.1.2 Adopt Fluvial Erosion Hazard Regulations;
11.1.3 Consider requiring riparian buffers for all surface waters;
11.1.4 Provide incentives for protecting wildlife corridors, wetlands, and riparian habitats;
11.1.5 Support land acquisition or conservation easements;
11.4 Stormwater and Erosion Control:
11.4.1 Educate developers on Low Impact Development;
11.4.2 Consider regulating development on slopes greater than 15%;
11.5 Participate in FEMA's Community Rating System (CRS);

12 LAND USE
12.2 Flood hazard protection:
12.2.1 Continue to participate in NFIP and take advantage of preferential ratings;
12.2.2 Adopt Fluvial Erosion Hazard regulations;
12.2.3 Prohibit structure[s] in the floodway;
12.2.4 Consider requiring vegetated setbacks from streams;
12.2.5 Preserve areas for natural storage in floodplains;
12.3 Watershed approaches to flood hazard reduction:
12.3.1 Consider regulating development on steep slopes;
12.3.2 Propose development regulations to address stormwater management;
12.3.4 Require the integration of infrastructure best-management practices into public and private development;
12.3.5 Review and update road design standards;
12.3.6 Consider increasing the minimum lot size in Rural Districts;
12.3.7 Consider regulating tree clearing.

These goals informed the considerations of the Hazard Mitigation Committee members as they reviewed capital plans, policies and regulations and sought further public input in the development of this plan.

The Hazard Mitigation Committee also reviewed the 2010 Brattleboro All Hazard Mitigation Plan annex of the Windham County Regional All Hazard Mitigation Plan, reviewing past goals and updating community information. Other aspects of the plan have been substantially altered or elaborated upon.

REVIEW OF SUPPORTING MATERIALS
The Hazard Mitigation Committee reviewed existing plans, reports, studies, policies and regulations to identify hazard mitigation goals and opportunities for changes that would address hazard mitigation goals going forward. These included: the 2013 Brattleboro Town Plan; the multi-year capital expense matrix of the 2013 Town Report; the 2010 Brattleboro All Hazard Mitigation Plan annex of the Windham County Regional All Hazard Mitigation Plan; the Brattleboro Subdivision Ordinance; the Brattleboro

Zoning Code; the Road and Bridge Standards; the Local Emergency Operations Plan; the Brattleboro Grand List; local land use permit records; local GIS data; FEMA community FIRMs; FEMA Repetitive Loss Data as of December 31, 2011; the EPA Smart Growth Sustainable Communities Workshop Next Steps Memo; the Brattleboro Commercial Land Use Study; the Vermont Downtown Action Team Brattleboro report; the draft Brattleboro Vermont Economic Resilience Initiative report; the Tactical Basin Report for the Deerfield River and Southern Connecticut Tributaries of Vermont; the Crosby Brook Phase I Stream Geomorphic Assessment; the Crosby Brook Phase II Stream Geomorphic Assessment; National Climate Data Center database excerpted for Windham County; *Climate Change in Vermont*, Alan K. Betts, June 2011, published online by the Vermont Agency of Natural Resources; University of Vermont, *Summary of Hydroclimatic Hazards in Vermont; Whetstone Brook Watershed Stream Geomorphic Assessment And River Corridor Plan May, 2008,* prepared by Landslide Natural Resource Planning; Ball Mountain Dam Failure Inundation Map; Brattleboro Historical Society Webpage; New England Seismic Network, Weston Observatory, Boston College Webpage; *A Report on the Seismic Vulnerability of the State of Vermont* by John E. Ebel, Richard Bedell and Alfredo Urzua; http://www.healthvermont.gov/tracking/enviro_climate_moreinfo.aspx; Climatenexus.org.

In addition, the Plan relied extensively on local knowledge.

PLANNING PARTICIPATION

The matrices below lists people involved in the hazard mitigation planning process:

Hazard Mitigation Committee Member	Affiliations
Patrick Moreland	Emergency Co-Director; Interim Town Manager
Michael Bucossi	Emergency Co-Director; Chief, Brattleboro Fire Department
Peter Lynch	Assistant Chief, Brattleboro Fire Department
Steve Barrett	Public Works Director
Hannah O'Connell	Public Works Utilities and Roads Supervisor
Eugene Wrinn	Police Chief, retired
Michael Fitzgerald	Police Chief
Rod Francis	Planning Director
Brian Bannon	Zoning Administrator, CRS Coordinator

Committee Member	Brattleboro Planning Commission
James Valente	Chair
Elizabeth McLoughlin	Vice-Chair
Karolina Oleksiw	
Timberly Hund	
Mark Ethier	
David Cadran	

Committee Member	Brattleboro Select Board
David Gartenstein	Chair
Kate O'Connor	Vice Chair
David Schoales	Clerk
Donna Macomber	
John Allen	

DOCUMENTATION OF THE PLANNING PROCESS

TASK	April, 2014	May, 2014	June, 2014	July, 2014	Aug, 2014	Mar, 2015	April, 2015	May, 2015	June, 2015	July, 2015	Aug, 2015
Meetings											
Process Overview											
Map Needs											
Work Plan											
Data Collection											
Work Review											
Public Meeting I				PM I							
Public Meeting II					PM II						
Draft Reviews											
Maps											
Data											
Risk Assess.			RA								
Mitigation Strategies			MS								
BCA				BCA							
Draft (pre-public comment)											
FINAL Draft (post-comment)											
FEMA Revisions											
DEMHS Revisions											

The planning process followed the schedule as outlined in the planning grid, above. Work commenced with the Brattleboro Hazard Mitigation Committee review of the 2010 HMP. The Committee review Town activities for potential hazard mitigation plan items.

Items in the mitigation schedule were identified in the Town Plan, by town personnel, by state agencies, and by third parties in the community. Community Involvement was through regularly scheduled public meetings on the items mentioned. Many activities in this plan are projects that town departments have pursued for several years; they will be implemented as funding becomes available.

The town of Brattleboro will continue to evaluate and update the plan throughout the next 5 year cycle. This will take active involvement on the part of the town department heads to identify and plan for ongoing hazard mitigation work and coordination among stakeholders to identify structures and engineering projects that will mitigate future hazardous events; e.g. bridge and culverts replacements, road replacements and grading, as well as removal or floodproofing of any repetitive loss structures that may be in the Special Flood Hazard Area as identified on FEMA Flood Insurance Rate Maps (FIRMS).

PUBLIC PARTICIPATION

Hazard Mitigation Plan meetings were held:

- April 16, 2014, Brattleboro Hazard Mitigation Committee Meeting
- June 2, 2014, Planning Department, Tri-Park Housing Cooperative, Inc, and the Agency of Natural Resources
- June 5, 2014, Hazard Mitigation Committee meeting
- June 30, 2014, Planning Commission public meeting (video: http://brattleborotv.org/brattleboro-planning-commission/brattleboro-pc-63014)
- August 20, 2014, Hazard Mitigation Committee meeting
- September 2, Selectboard public meeting (video: http://brattleborotv.org/brattleboro-selectboard/brattleboro-sb-mtg-9214)

Targeted Interviews were held with:

- Gary King, Engineering Technician, GIS Technician, Public Works Department: culverts and bridges.
- Hannah O'Connell, Utilities and Road Supervisor: stormwater and road standards.
- Hannah O'Connell and Steve Barrett, Public Works Director: drought, dam safety, road standards, and stormwater.
- Brian Bannon, Zoning Administrator, CRS Coordinator: CRS and NFIP participation.
- Michael Bucossi, Chief and Peter Lynch, Assistant Chief, Brattleboro Fire Department: rail and interstate impact on response time, EOC replacement, school safety, communications system improvements.

The Brattleboro Hazard Mitigation Plan was made available for public comment to the following:

- Copies of the draft plan were made available for public review at the Town Manager's Office and Planning Department.
- The draft plan was placed on the Town website on August 19, 2014. Comments were solicited via letter or email.
- The draft plan was made available in the Brattleboro Town Clerk's office on August 19. 2014.
- The draft plan was made available at Brooks Memorial Library on August 19, 2014.
- The draft plan was also submitted to the Emergency Directors and Selectboard Chairs of the Towns of Dummerston, Vernon, Marlboro, Halifax, and Guilford.

- The draft plan was also submitted to Brattleboro Housing Authority, and Tri-Park Cooperative Housing, on August 19, 2014.
- The draft plan was submitted to the Windham Regional Commission (WRC) on August 19, 2014.

No public comments were received outside of the Planning Commission and Select Board meetings. In both meetings, the public had an opportunity to make comments or ask for clarifications; comments were received regarding the impact of the ongoing level 3 stream geomorphic assessment, the need for town departments to identify hazards in their areas of operations, the town's location at the center of a transportation network introducing a regional scale to crisis response, wildfire risk, radiological emergency, mass shootings responding to needs of mental health hospital, public emergency notification, and a winter storm event not included in plan; the comments were incorporated into the relevant plan sections. Also noted were editing issues for wording, job titles, appropriate references, and contradictory statistics for annual rainfall. Approximately 9 people commented. The Planning Director recorded comments made by the public, and modifications were immediately incorporated into the draft plan after the Planning Commission and Selectboard meeting.

ONGOING HAZARD MITIGATION PUBLIC OUTREACH

Brattleboro has been selected by the Environmental Protection Agency for a Smart Growth Implementation Assistance project. The project aims to reduce damage from future flooding and protect water quality with green infrastructure elements to capture and filter stormwater. This project seeks to take input from the community and combine it with the EPA team's knowledge of contemporary design principles to visualize the area as a resilient urban landscape with high amenity. A multi-disciplinary team will suggest innovative projects that resolve conflicts between natural hazards and the built form in ways that improve resilience by reducing risk and strengthening community.

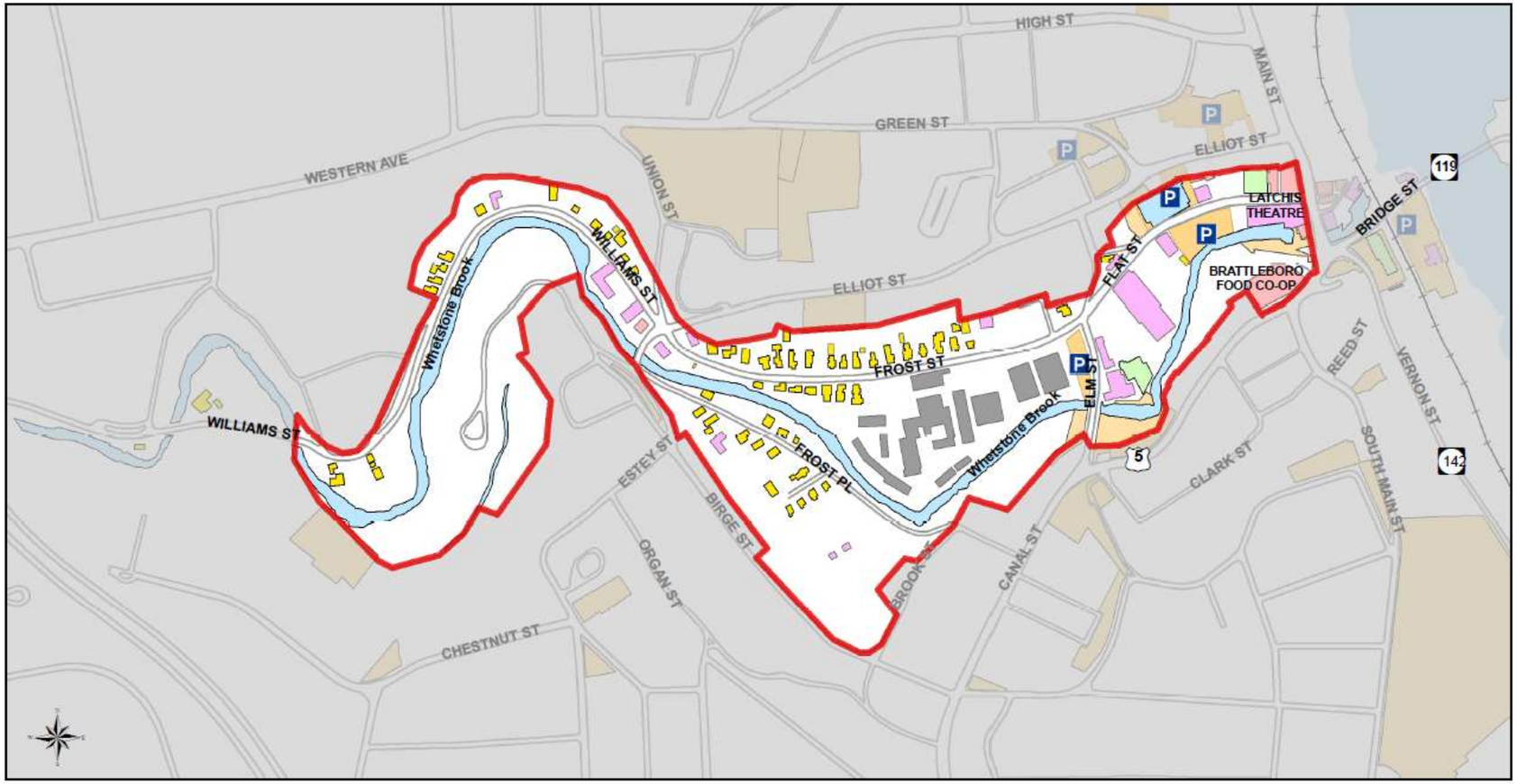
A redeveloped Whetstone Brook Corridor that responds to climate change will reduce the impact of flooding and erosion and support the existing neighborhoods by preserving the traditional built form. Green infrastructure will provide open space and offer opportunities to engage with the brook.

The project will identify stakeholders -- property owners, residents, businesses, private institutions and government agencies -- seeking their input into project design and selection. The design group will conduct a series of public meetings, a design charrette, and public site visits.

Hazard mitigation projects identified will be incorporated in the annual 2015 Hazard Mitigation Plan update.

(See map following page; also, Brattleboro letter of interest, EPA Smart Growth Implementation Assistance Project Appendix G)

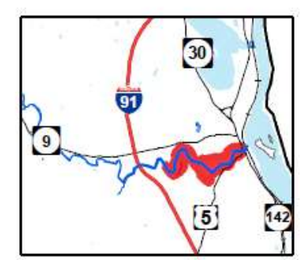
Whetstone Brook Corridor
Project Area



Legend

- Parking Area
- Streets
- Rail Road
- Study Area
- Town Owned
- Commercial
- Cultural
- Government
- Industrial
- Mixed
- Residential

0 250 500 1,000
Feet



floodwater path
new channel
bank erosion
flood deposition on road
road damage
municipal sewer system damage
bridge destroyed
bridge damaged
erosion at bridge
Building affected by flooding:
total loss
major, structural
major, other
minor
Map 1
Cooke Rd to
Meadowbrook Rd
Tropical Storm Irene Damage
Whetstone Brook, Brattleboro, Vt.
WINDHAM
REGIONAL
COMMISSION
500 0 500 1,000 1,500 Feet
Data sources:
- Brattleboro Public Works Department (Gary King), specifically road, bridge, and sewer line damage
- Brattleboro Planning Services Department (Brian Bannon), specifically building damage
- Brattleboro Fire Department (Pete Lynch)
- Windham Regional Commission
Map 2
Meadowbrook Rd to
the Connecticut River

RISK ASSESSMENT

The risk assessment portion of a Hazard Mitigation Plan contributes to the decision-making process for allocating available resources to mitigation projects. 44 CFR Part 201.6(c)(2) of FEMA's mitigation planning regulations require local municipalities to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

IDENTIFYING AND PROFILING HAZARDS

The community has identified and focused mitigation action items on the following hazards: flood (including fluvial erosion hazard and ice jams), dam failure, winter storm/ice storm, high wind/tropical storm/tornado, droughts, wildfire, structure fire, earthquake, landslide and extreme heat. Hail events are not addressed in Risk Assessment because there is no history of previous events causing damage. Other hazards, such as water supply contamination, school safety, mass casualty event, air crash, railroad accident, extreme cold and infrastructure catastrophic failure are addressed in the town Emergency Operations Plan (EOP); multiagency coordination during EOP development identified operational changes to reduce hazard and protect life and property.

This plan will profile and analyze natural hazards that have been deemed as having a "High" vulnerability for the Town of Brattleboro. In the "Assessing Vulnerability: Overview" section, a "High" vulnerability hazard is determined by likely impact and hazard probability. The methodology is fully explained in that section.

The following hazards include a narrative explaining Location/Geographic Area, Extent (magnitude or severity), and Probability, of all natural hazards that affect the planning area.

"Regional" refers to Windham and Windsor County, Vermont; "local" refers to the town of Brattleboro.

REGIONAL FLOODING

August 28, 2011 - The last Presidentially Declared Disaster, DR-4022, resulted from Tropical Storm Irene. Tropical Storm Irene tracked north-northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding and damaging winds across the region. Irene tracked from a position over New York City around 8 AM EST Sunday, to approximately 65 miles south of Rutland, VT at 4 PM EST. The greatest impact from Irene across southern Vermont was due to heavy to extreme rainfall, which resulted in catastrophic flooding. Rainfall amounts generally averaged 4 to 8 inches. Much of the rain which fell occurred within a 12 hour period, beginning early Sunday morning, and ending Sunday evening. This heavy to extreme rainfall resulted in widespread flash flooding and river flooding across southern Vermont. Strong winds also occurred across southern Vermont, with frequent wind gusts of 35 to 55 mph, along with locally stronger wind gusts exceeding 60 mph. The strongest winds occurred from the north to northeast during the morning hours, then from the west to northwest during Sunday evening. The combination of strong winds and extremely saturated soil led to numerous downed trees and power lines across the region. This also resulted in widespread long duration power outages. In particular, approximately 18,000 customers lost power in Windham County.

LOCAL FLOODING

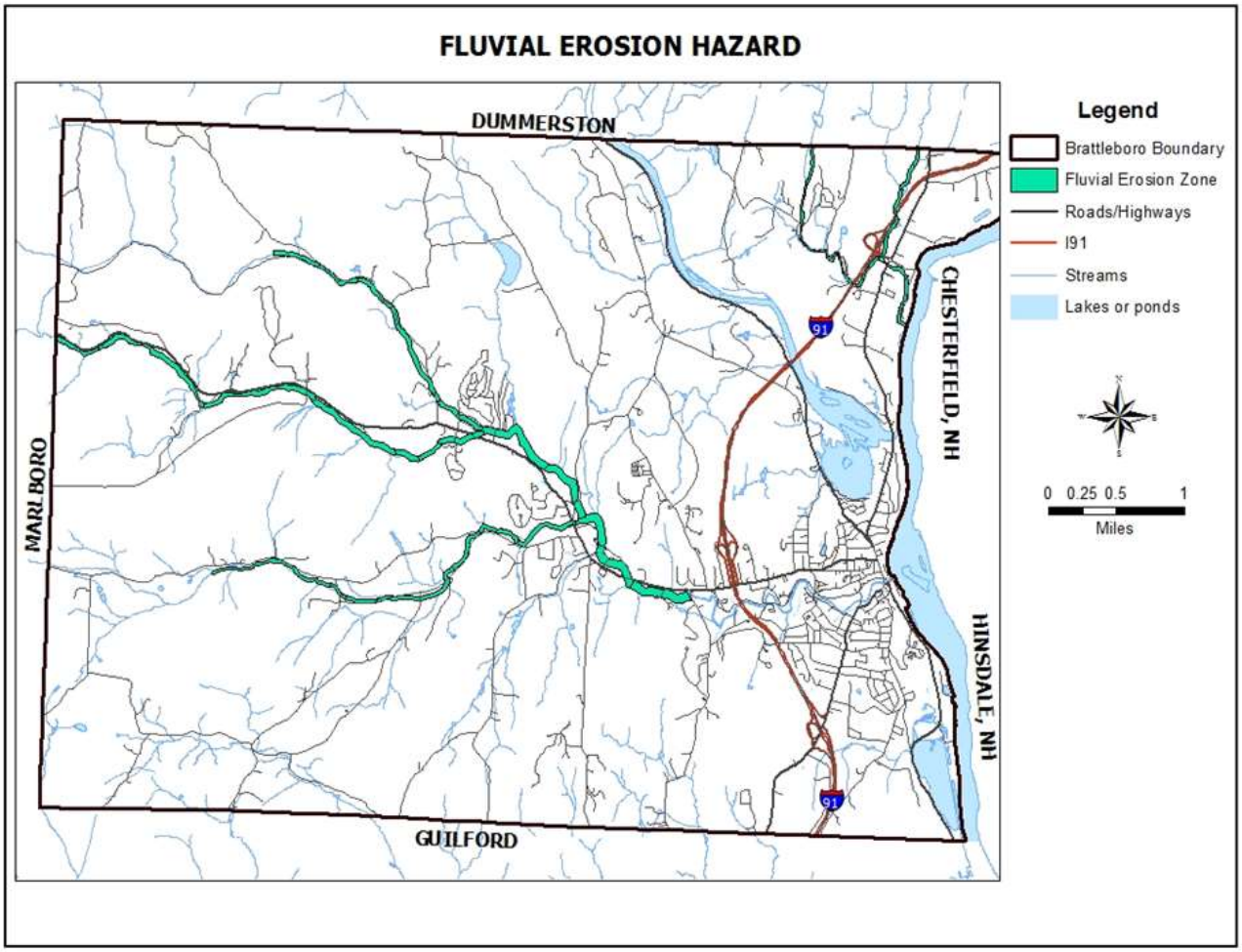
Description and Geographic Area of Hazard

Brattleboro is susceptible to flooding from ice dams, flooding with fluvial erosion, inundation flooding and localized street flooding.

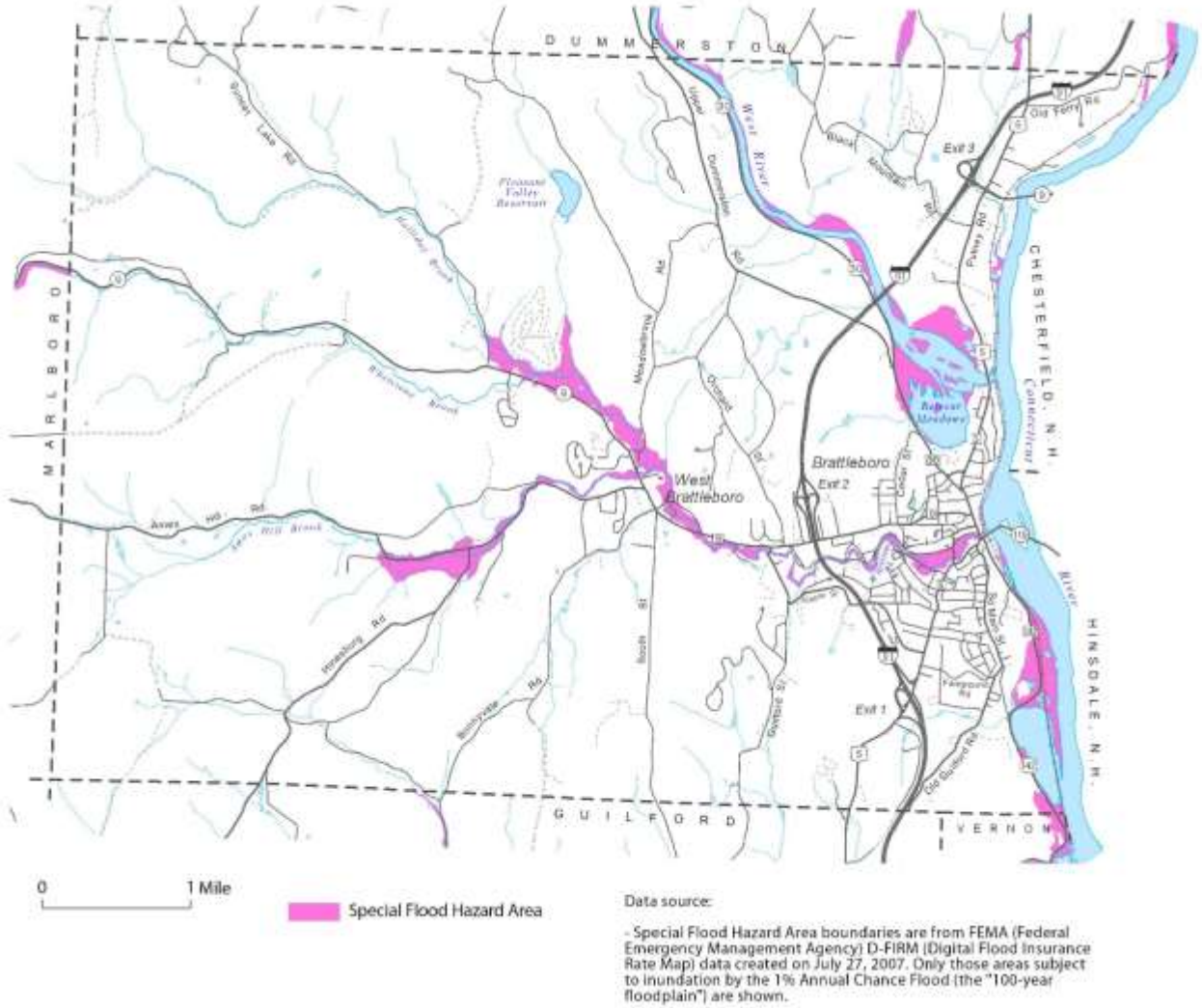
There are over 1,000 acres of land in Brattleboro located within one of the Special Flood Hazard Areas (SFHA) defined by the Federal Emergency Management Agency (FEMA) and shown on the Flood Insurance Rate Map (FIRM). The floodplains extend along the shores and wetlands of the Connecticut and West Rivers and along the flatter portions of the Whetstone and Ames Hill Brook. Over 500 structures are located in the floodplain. Flooding along the Whetstone and Halliday Brooks can come with little warning. In severe floods, the banks can be subject to rapid erosion.

Ice dams – Ice dams have occurred on the Connecticut River, West River, and the Whetstone Brook in past years. Ice dams on the Whetstone Brook have resulted in flooding of the low-lying areas of Mountain Home Park and Westgate Drive. Ice dams on the Whetstone have potential to close roads temporarily. Small ice dams occur on an annual basis with higher likelihood in late winter or early spring. The most recent ice dam was by Winding Hill Drive Bridge in the spring of 2014. While common, these events are not recorded in National Weather Service data base.

Fluvial Erosion Hazard/Stream Channeling/Flash Flooding –these types of events primarily affect the Whetstone and Crosby Brooks due to the narrow channels in relatively small valleys with steep slopes. Tropical Storm Irene in 2011 created fluvial erosion impacts concentrated along the Whetstone Brook. In Brattleboro, the greatest impacts were to low-lying housing and public infrastructure, with additional damage to commercial properties along the Whetstone. Flash floods typically occur during summer when a large thunderstorm or a series of rain storms result in high volumes of rain over a short period of time. Higher-elevation drainage areas and streams are particularly susceptible to flash floods. Flash floods are likely in Brattleboro, and potential damage to Route 9 and Route 5 could limit access to town as they are major travel corridors through Town and the region. Damage to hill roads is likely to occur from flash floods as the amount of rainfall overloads culverts resulting in loss of roadway.



Inundation flooding –these types of events primarily affect the Connecticut shoreline and low lying areas along the Whetstone Brook especially in Mountain Home Park at and by Valley Road. This flooding is characterized by lower water velocities, but flood depths can reach up to 7 feet deep and the event may be longer in duration; affecting up to 43 mobile homes in Mountain Home Park. Flood risk is lower along the Connecticut due to the elevation of existing structures.



Localized Street Flooding – these events affect portions of the road network with undersized stormwater networks. Flooding interrupts road traffic and impairs emergency response. The increase in intense rain events associated with climate change has led to an increase in localized street flooding. In areas where the flooding occurs near steep slopes, landslides can result from water flowing off roads onto adjacent land. This type of flooding has been most common by the intersection of Main St. and Harris Place, on segments of South Main St. and Western Ave. and by the intersection of Frost, Flat and Elm streets.

Past Occurrences:

Spring, 2014 –Ice Dam, flooding by Winding Hill Drive Bridge resulting in minor damage to three mobile homes.

September 12th, 2013 – High Winds, Flooding - A series of cold front moved towards the region on Thursday, September 12th. Despite some periods of cloudiness, a warm and humid air mass ahead of the approaching boundaries allowed for moderate amounts of instability to be in place. Along and ahead of the boundaries, several lines of showers and thunderstorms developed and moved across the region during the afternoon and early evening hours. In addition to a large amount of cloud to ground lightning, a few of the thunderstorms became severe, with damaging wind gusts. Several trees were downed across the region. Some areas that received repeated showers and thunderstorms experienced flash flooding as well, with roads washed out and/or closed as a result. The hardest hit areas were within the town of Brattleboro. Two to four inches of rain in a short period of time was reported in the areas that experienced flash flooding. As the last in the series of cold fronts crossed during the evening hours, the threat for showers and thunderstorms ended. In Brattleboro, the Elm Street Bridge over the Whetstone Brook was damaged as a result of the flooding. Flooding also closed a portion of Flat and Frost Streets due to overwhelmed stormwater drains. Roads were washed out at Morningside Cemetery as a result of flash flooding from heavy rainfall overloading stormwater drains. Several portions of Williams Street were washed out as a result of flash flooding from heavy rainfall which overwhelmed stormwater drains. Damages totaled in excess of $143,000.

Aug. 28, 2011 – High Winds, Flooding - Tropical Storm Irene tracked north northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding, and damaging winds across the region. Strong winds occurred across southern Vermont, with frequent wind gusts of approximately 30 mph in Grafton. The strongest winds occurred from the north to northeast during the morning hours, then from the west to northwest during Sunday evening. The combination of strong winds, and extremely saturated soil led to numerous downed trees and power lines across the region. This also resulted in widespread long duration power outages. In Brattleboro, the major impacts were in the Whetstone Brook area which received severe flood damage to West Brattleboro, downtown Brattleboro and Williams Street. The Ames Hill Brook destroyed the Barrows Road Bridge and caused damage along Ames Hill Road. The Westgate and Melrose Street Bridges were closed due to flooding. Marlboro Road was closed due to flooding and washouts. Numerous structures were damaged or destroyed. The West River caused minor damage as most adjacent land is conserved and most adjacent structures are compliant, post-FIRM structures. Damages to public and private property were in excess of $4,000,000.

December 12, 2008 – Flooding - A cold front moved across eastern New York and western New England on Wednesday, December 10th, ushering a cold air mass into the region. A low pressure system developed over the southeast states Wednesday and Wednesday night. This storm then headed northeast Thursday and Thursday night, December 11th, with precipitation spreading northward well in advance of the low. The low continued to track northeast, passing over the mid-Atlantic region late Thursday night, and over the New York City Metropolitan area and southern New England Friday morning, December 12th. The low then moved to the Canadian Maritimes Friday night. As the storm approached, warmer air moved in aloft, and with a cold air mass remaining in place at the surface, this set the stage for a significant mixed precipitation event. The precipitation came down heavy at times, especially Thursday night. Hourly precipitation rates of one quarter to one third of an inch were reported for several hours in the form of freezing rain across much of the region. The precipitation changed back to snow before ending early Friday afternoon. Total liquid amounts of 1 to 3 inches fell across eastern Windham County. This heavy rain led to widespread ponding of water, especially in urban and low lying areas due to ice blocking storm drains. Heavy rain led to high flows on the Whetstone Brook in Brattleboro, along with widespread ponding of water in low lying areas, especially near Brattleboro.

October 9, 2005 – Flooding - On October 8 at daybreak, a nearly stationary cold front was over southwestern New England. The air over the northeastern United States was very moist. Low pressure in the vicinity of the eastern Carolina states moved slowly north northeast along the cold front. Heavy rain fell over southern Vermont through the early morning hours of October 9. During this period, there was over 6 inches of rainfall in southern Vermont, triggering widespread flooding. Several evacuations of people from their homes occurred. The Brattleboro emergency manager said the Whetstone Brook was flooding at a level that was about a foot higher than ever observed by him. Stream flooding occurred. Melrose Terrace and Glen Park, housing projects for the elderly and disabled, were evacuated.

April 3, 2005 – Flooding - A slow moving storm tracked through the Appalachians and into the Northeast on Saturday, April 2nd, and lasted through the 4th of April. This storm produced an extended period of heavy rain. Rain developed during the pre-dawn hours Saturday and picked up during the morning. The heaviest rain occurred Saturday afternoon and evening. Lighter rain, some mixing with snow, persisted on Sunday and Monday. This rainfall, combined with the effects of earlier rains that fell over the region toward the end of March, produced widespread major river and small stream flooding with extensive damage. The total estimated flood damage in all counties of eastern New York and adjacent western New England was $4,891,700. The Whetstone Brook came out of its banks in West Brattleboro. There was a precautionary evacuation of SFHA areas of Mountain Home Park, Glen Park, and Melrose Terrace.

August 30, 2004 – Flooding - Flash flooding resulted in washouts of small bridges at Ames Hill, Hescock and Cooke Roads in Brattleboro.

April 1, 2004 – Flooding - As much as three inches of rain fell from March 31 through April 2 across southern Vermont. This rain combined with the last of the snow melt to produce an excessive runoff of water. In Windham County, flooding was reported in West Brattleboro, where the Ames Brook and Whetstone Brook both rose over their banks and impacted nearby roads. Mountain Home Park had flood depths of up to three feet.

December 17, 2000 – Flooding - A complex storm system began to evolve on Saturday December 16 across the Mississippi Valley. A surface low tracked north into the eastern Great Lakes by December 17. At the same time, the associated upper level trough became negatively tilted as it moved toward the northeast on Sunday. This allowed for rapid deepening cyclogenesis. Unseasonably warm and moist air was transported northward from the Gulf of Mexico. This scenario brought a record breaking rainstorm to southern Vermont. Rainfall averaged 2-3 inches. Peru in Bennington county specifically receiving 3.21 inches and Ball Mountain in Windham County, 3.02 inches. The rain fell very heavily at times, up to an inch per hour. The rain, combined with snowmelt and frozen ground, lead to a significant runoff and flooding. In Windham County, the Brimstone Creek flooded at Ames Hill. In Brattleboro, Route 30 and Route 9 were flooded.

July 16, 2000 – Flooding - A stalled frontal boundary across extreme southern Vermont interacted with a strong upper level disturbance from July 15 into early July 16. The result was a slow-moving low pressure area which formed over Virginia. This low pumped a deep layer of tropical air into the region and produced the second widespread heavy rainstorm of the summer. Two to four inches of widespread rain fell, with locally higher amounts across the higher terrain of Windham County. Specific amounts included 5.17 inches at West Wardsboro, in Windham County. The Deerfield River

rose 6 feet above unofficial flood stage in Wilmington, Windham County. Several roads were reported under water. The widespread heavy rain event set the stage for more widespread flooding later Sunday. The air remained very moist and unstable in wake of the rainstorm. More thunderstorms erupted late in the day across southern Vermont. These storms moved very slowly, trained over the same region, and were further enhanced by the steep terrain. The thunderstorm rainfall, as well as the earlier rainstorm, dumped in excess of 8 inches locally at Newfane, Windham County. Since the ground was already saturated, the heavy rains from the thunderstorms produced flooding and flash flooding across the region. In Windham County, a five mile stretch of State Route 30 was closed due to flooding and residents were evacuated. Street flooding was reported at Brattleboro.

September 16, 1999 – Tropical Storm, Flooding - The remnants of Hurricane Floyd moved up the eastern seaboard on September 16 and during the early hours on September 17. The storm brought both high winds and heavy rainfall to Southern Vermont, which included a large swath of 3 to 6 inch amounts. Specific rainfall amounts included 2.91 inches in Bennington, 3.89 inches in Sunderland, 4.54 inches at Peru and 5.70 inches at Brattleboro. The rain produced significant flooding across the region, which proved destructive. Many smaller tributaries reached or exceeded bankfull. Winds from the passage of Floyd were estimated to have gusted to over 60 mph, especially over the hilltowns. The combination of the wind and very saturated ground, produce widespread downing of trees and power lines across much of Southern Vermont. The rain and wind produced power outages across the region. As many as 2,000 people lost power in Southern Vermont.

Sept. 21, 1938 – Hurricane, Flooding - A hurricane Igor hit the region of Southeast Vermont to include the Town of Grafton, paralyzing it for weeks. As it was coming, packing winds over 100 miles an hour, authorities were unaware of the magnitude so no evacuation procedures were instituted and very few precautions were taken. As a result over 600 people lost their lives and tens of thousands were left homeless. Wind, rain and flash flooding wiped out trees, church steeples and buildings, leaving behind nearly $400 million in damage. The Whetstone Brook in downtown Brattleboro experienced flood levels similar to those expected in a hundred year flood, based on photographs of the storm damage in relation to buildings that exist now and at the time of the flood. The Whetstone Brook flooded Flat, Elm, Frost and Williams streets as well as portions of West Brattleboro. Power and phone communication was lost due to downed poles. Train service was interrupted for a week. The Brattleboro highway team and WPA workers were said to have streets opened in just a couple of days. No deaths or injuries in town, but Brattleboro estimated the cost for damage at $15-20,000

October 2, 1869 – Flooding - The Whetstone Brook in downtown Brattleboro experienced flood levels similar to those expected in a hundred year flood, based on photographs of the storm damage in relation to buildings that exist now and at the time of the flood. A bridge on Main Street and a downstream rail bridge were destroyed; buildings were damaged. On Oct. 2, 1869, it began raining and didn't stop for three days. The Whetstone rushed over Flat Street, and Frost, and washed away a frame shop, a tannery, a furniture shop, a shoe shop, a lumber office (and the lumber stored nearby), a fish market, a sawmill, and a barn. The canal from which Canal Street gets its name was also severely damaged. The flood came on with such unexpected speed that many people barely had time to escape the rushing waters that slammed into buildings and tore them down in less than a minute. Two people were swept to their deaths.

Extent – Strength or Magnitude of Hazard

Localized flooding due to small ice dams on the Whetstone and Halliday Brooks with street and building flooding may occur multiple times a year, generally causing only minor damage. Localized

street and building flooding with attendant erosion has become more common during rain bursts, occurring several times in any year, in some cases with substantial damage to public and private structures. The Elm Street Bridge suffered $ 92,371.09 in damage in a 2013 rain burst.

Recent large flood events occurred on the Whetstone and Halliday Brooks during Tropical Storm Irene and in an unnamed flood in 2006.

During Irene, some areas experienced flooding in the mapped Shaded X zone; other areas experience flood levels of BFE +3; most areas experienced predicted BFE for a 1% probability flood with flood depths of up to 7 feet above grade. One stick built dwelling was destroyed; 22 mobile home units were destroyed by the flood or destroyed by mold caused by the flood; 52 structures in the SFHA received permits to repair flood damage; six historic, large commercial structures and three dwellings outside of the SFHA experienced extensive damage. Seventy-one businesses experienced flooding, with some experiencing large economic losses through loss of inventory and loss of business while structures were repaired. Permitted repairs to structures in the SFHA totaled $1,763,073.66. The value of property destroyed was approximately $512,000. Damage costs for structures outside of the SFHA are not available to the Town. The cost of public infrastructure repair reached $2,000,000.

Probability

The Hazard Mitigation Committee for the town of Brattleboro concludes that flooding is highly likely in any given year; by type, ice dam and localized street flooding highly likely, inundation flooding and fluvial erosion likely.

Sources used

Steve Barrett, Director of Public Works; Gary King, Engineering Technician, Department of Public Works. *Climate Change in Vermont*, Alan K. Betts, June 2011, published online by the Vermont Agency of Natural Resources. University of Vermont, *Summary of Hydroclimatic Hazards in Vermont. Whetstone Brook Watershed Stream Geomorphic Assessment And River Corridor Plan May, 2008,* prepared by Landslide Natural Resource Planning.

REGIONAL DAM FAILURE

The Connecticut River is used to generate hydroelectric power along its entire length. Dams are located at regular intervals along the river. This includes the dam between Bellows Falls, Vermont, and North Walpole, New Hampshire. Upstream are large dams at Wilder, Ryegate, McIndose Station, Comerford Station, Monroe Reservoir, Gilman Project, Lower Canaan, Murphy Dam, First CT Lake, Second CT Lake and Moose Falls. A failure of any upstream dam could cause damage to downstream facilities. Hydroelectric power generator license holders maintain emergency plans with the Federal Energy Regulatory Commission (FERC).

LOCAL DAM FAILURE

Description and Geographic Area of Hazard

Smaller dams can create localized flooding. Pleasant Valley Lake dam poses flood risks to Mountain Home Park and areas to the east of the Park along the Whetstone Brook. Chestnut Hill Reservoir dam poses risks to Chestnut Hill, Acorn Lane, Cedar Street and Western Avenue area. Dam failures on the West or Connecticut River would result in flooding along both rivers with additional flooding in the lower Whetstone Brook due to inundation. There is no history of regional or local dam failure in Brattleboro.

Past Occurrences:

There is no record of past dam failures in Brattleboro.

Extent – Strength or Magnitude

Dam failure could lead to critical to catastrophic damage to large numbers of structures and probable loss of life absent sufficient warning to evacuate residents. Failure of smaller dams would inundate tens of acres in Brattleboro; larger dam failures would inundate hundreds of acres. Most inundation areas are confined to the SFHA except for the Chestnut Hill Reservoir which does not have other flood risk. Flood depths for major breaks are similar to base flood elevations, up to six feet above grade. There is no data for potential flood depths for Chestnut Hill or Pleasant Valley Reservoir dam failures.

Probability

The Hazard Mitigation Committee of the town of Brattleboro deems dam failure as possible to happen every year.

Sources Used:

Steve Barrett, Director of Public Works; Ball Mountain Dam Failure Inundation Map; Brattleboro Historical Society.

SEVERE WINTER STORM / ICE STORM

Description and Geographic Area of Hazard

Winter storms, with snow, ice and freezing temperatures in varying combinations are commonplace with a high probability in Brattleboro, and may occur throughout the town. Heavy wet snows of early fall and late spring, as well as ice storms, often result in loss of electric power, leaving people without adequate heating capability. Storms often lead to downed trees, resulting in power failures and impassable roads or driveways.

Damage from heavy snow and ice storms can vary depending upon wind speeds, snow or ice accumulation, storm duration, and structural conditions (i.e. heavy snow and ice accumulation on large, flat roofed structures).

Past Events:

Winter Storms are a regular event in Brattleboro, since 1998, 73 winter storms that have impacted Brattleboro are noted in the National Climate Data Center database.

Extent – Strength or Magnitude

Typical snowfall in southeast VT ranges from 60-65 inches per year. Impacts depend on the rate of accumulation and the amount of snow melt-off between storms, with rapid accumulation and frequent storms straining transportation networks, emergency and municipal services. Snowfall accumulations are generally three to six inches in the valleys and 6 to 12 inches in the mountains. Large snow events have had up to three feet of snow; ice storms may have more than one inch accumulation, but are more commonly co-occurring with snow events.

Probability

The Hazard Mitigation Committee of the town of Brattleboro deems winter storm/ice storm as highly likely to happen every year.

Sources used

National Climate Data Center database; local knowledge.

LOCAL HIGH WIND/TROPICAL STORM/HURRICANE/TORNADO

Description and Geographic Area of Hazard
Windstorms are high-wind events that are sufficient to cause damage to property and occur at any time of year. These include high winds in conjunction with a thunderstorm and high winds that sweep through the region after the passage of a weather front. There have been 49 events in Windham County since 1996 that are notated by the National Climatic Data Center as being High Wind, Strong Wind, Thunderstorm Wind or Tornado events.
High wind events are a highly likely event in Brattleboro, with the potential for limited resulting damage. The most likely local threats for high winds are from northeasters, hurricanes, downbursts or wind shear. Trees downed by high winds can block roads, and down power and communications lines. Mobile home parks and houses on ridge lines are at greater risk from wind damage. Most high wind events in Brattleboro have resulted in minor damage from downed trees and power lines. Tornados have occurred recently in Springfield, VT, Keene, NH and central Massachusetts. Tornados are unusual in Brattleboro, but a F3 (so rated as it predated the adoption of the Enhanced Fujita Scale) tornado in 1968 caused 1 injury and property damage in West Brattleboro. Research at the Brattleboro Historical Society did not find other instances of tornados in Brattleboro.

Past Occurrences
There have been 29 events in Windham County with impacts on Brattleboro since 1996 that are noted by the National Climatic Data Center as being High Wind, Strong Wind, Thunderstorm Wind or Tornado events. There are no recorded tornadoes since 1996 in Brattleboro according to the National Climatic Data Center, although there have been four recorded tornados in Windham County since 1950.
September 12th, 2013 – High Winds, Flood -- A series of cold front moved towards the region on Thursday, September 12th. Despite some periods of cloudiness, a warm and humid air mass ahead of the approaching boundaries allowed for moderate amounts of instability to be in place. Along and ahead of the boundaries, several lines of showers and thunderstorms developed and moved across the region during the afternoon and early evening hours. In addition to a large amount of cloud to ground lightning, a few of the thunderstorms became severe, with damaging wind gusts. Several trees were downed across the region. Some areas that received repeated showers and thunderstorms experienced flash flooding as well, with roads washed out and/or closed as a result. The hardest hit areas were within the town of Brattleboro. Two to four inches of rain in a short period of time was reported in the areas that experienced flash flooding. As the last in the series of cold fronts crossed during the evening hours, the threat for showers and thunderstorms ended. In Brattleboro, the Elm Street Bridge over the Whetstone Brook was damaged as a result of the flooding. Flooding also closed a portion of Flat and Frost Streets due to overwhelmed stormwater drains. Roads were washed out at Morningside Cemetery as a result of flash flooding from heavy rainfall overloading stormwater drains. Several portions of Williams Street were washed out as a result of flash flooding from heavy rainfall which overwhelmed stormwater drains. Damages totaled in excess of $143,000.

October 29, 2012 – Tropical Storm - Strong and gusty winds in association with Hurricane Sandy caused damage to trees and power lines across the region. Although not quite as widespread as areas across southeastern New York and New Jersey, power outages occurred throughout the region. Most of the outages in Vermont were primarily in the western part of the state. Wind gusts of 40 to 60 mph were

common from the afternoon of the 29th until the early morning hours of the 30th. The highest wind gust in southern Vermont occurred in Woodford, where a wind gust to 58 mph was reported. Route 9 was closed to traffic due to power lines down in the road near the Molly Stark Motel just west of Brattleboro. Two trees were reported down on Interstate 91 in southern Vermont. In Brattleboro, East Orchard Street and Bonnyvale Road were temporarily closed due to downed trees and power lines.

Aug. 28, 2011 – Tropical Storm, Flood - Tropical Storm Irene tracked north northeast across eastern New York and western New England during Sunday, August 28th, producing widespread flooding, and damaging winds across the region. Strong winds occurred across southern Vermont, with frequent wind gusts of approximately 30 mph in Grafton. The strongest winds occurred from the north to northeast during the morning hours, then from the west to northwest during Sunday evening. The combination of strong winds, and extremely saturated soil led to numerous downed trees and power lines across the region. This also resulted in widespread long duration power outages. In Brattleboro, the major impacts were in the Whetstone Brook area which received severe flood damage to West Brattleboro, downtown Brattleboro and Williams Street. The Ames Hill Brook destroyed the Barrows Road Bridge and caused damage along Ames Hill Road. The Westgate and Melrose Street Bridges were closed due to flooding. Marlboro Road was closed due to flooding and washouts. Numerous structures were damaged or destroyed. The West River caused minor damage as most adjacent land is conserved and most adjacent structures are compliant, post-FIRM structures. Damages to public and private property were in excess of $4,000,000.

June 1, 2011 – High Winds - A strong cold front swept across the region during Wednesday afternoon and evening, June 1st. Atmospheric conditions were favorable for severe thunderstorms, including supercells with an explosive environment in place across the region. The thunderstorms had strong and persistent (sometimes rotating) updrafts. Severe thunderstorms affected southern Vermont. Large and historic hail occurred with only a few strong wind reports. Hail sizes of greater than one inch in diameter were common, with reports of greater than baseball size hail, 3 inches, being reported in Shaftsbury in Bennington County. Nickel size hail was reported near Brattleboro during a thunderstorm.

May 26, 2010 – High Winds - A backdoor cold front approached the area from the northeast and provided a focus for thunderstorms during the late evening hours of Wednesday, May 26th. Numerous trees and wires were reported down in area due to strong thunderstorm winds. Trees and wires were reported down in West Dummerston and Brattleboro due to strong thunderstorm winds.

May 31, 2009 – High Winds - The passage of a strong upper level disturbance produced strong winds across portions of southern Vermont during Sunday afternoon and evening on May 31st. Wind gusts of 35 to 45 mph were estimated. These strong winds led to a fallen tree and wires on Route 5, approximately 10 miles south of Brattleboro.

July 9, 2008 – High Winds - The passage of a cold front, combined with a warm and humid air mass in place, led to the development of isolated severe thunderstorms across portions of southern Vermont during the afternoon hours of Wednesday July 9th. Numerous trees and power lines were downed between Brattleboro and Guilford due to strong thunderstorm winds. Route 5 was partially closed between Brattleboro and Guilford due to numerous downed trees and power lines. In Brattleboro, some of the streets that had downed trees included Vernon, Thomas, South Main, Acorn, Oak, Spring, and Cotton Mill Hill.

August 3, 2007 – High Winds - A cold front approaching from the west, along with a hot, moist and unstable air mass in place, led to the development of numerous showers and strong thunderstorms across eastern New York and western New England during the mid to late afternoon hours on Friday August 3rd, into the evening hours. Some thunderstorms became severe during this time period. Lightning struck the steeple of a church in Brattleboro, at the corner of Main and Grove streets. The damaged area of the steeple was approximately 25 feet tall, and 4 feet wide. Estimated monetary damages from the lightning strike is around $250,000.

October 29, 2006 – High Winds - A low pressure system moved northeast from the Tennessee Valley into the eastern Great Lakes by Saturday evening on October 28th, and intensified rapidly before moving into eastern Canada on Sunday, October 29th. Strong southeast winds ahead of the low developed Saturday morning, with some gusts exceeding 60 mph, particularly across the higher elevations, and within channeled valley locations. Once the storm lifted into eastern Canada, strong west to northwest winds developed, with some gusts locally reaching or slightly exceeding 60 mph. The winds finally diminished across the region by Sunday evening. Trees and wires went down in Guilford and Dummerston.

December 1, 2004 - High Winds – High winds brought down numerous trees across the region; measured wind speeds in Bennington County reach 38 mph. There was wide spread trees down in Hinesburg, Bonnyvale, and Goodenough Roads in West Brattleboro.

October 15, 2003 - High Winds - An area of low pressure deepened as it moved from the Ohio Valley northeast to the Canadian Maritimes on October 15. A steep pressure gradient between this storm and high pressure building across the Appalachians produced destructively strong winds across extreme southern Vermont. Trees and wires were blown down in Brattleboro blocking some roads.

July 21, 2003 – Tornado - A large upper air trough dug across the western Great Lakes on Monday, July 21. At the surface, a deep low pressure area moved across the eastern Great Lakes, driving a warm front across New England during the evening hours. The air became very unstable in the warm air mass behind the front. A supercell, that originated in the Mid-Hudson Valley of New York and producing a long lived significant tornado, spawned a second twister which touched down in the town of Pownal, Bennington County. The twister cut a swath longer than 25 miles and up 150 yards wide. After touching down in Pownal, the tornado moved northeast into the city of Bennington, then continued into the Green Mountain State Forest in extreme western Windham County where it caused significant forest damage. Most of the destruction was to trees. There was also some structural damages in Bennington County. A tree collapsed onto a house. Another massive pine slammed into a 100-year-old house's roof in Pownal. A steakhouse in the city of Bennington, suffered damage that closed it for a couple of days, including shattered windows and water damage due to an open roof. An awning had been blown from the deck of the structure, all the way across Route 7A. The owner was slammed against a wall while venturing outside on the open deck, with no injuries. During the height of the storm, power was knocked out to over 2,000 customers in extreme southern Vermont. The tornado was not classified using the Enhance Fujita Scale.

May 2, 2003 - High Winds - During the afternoon of May 2, thunderstorms formed along a slow moving cold front in southern Vermont. One of the storms became briefly severe. Wind gusts estimated to 60 mph blew trees down in Brattleboro.

June 27, 2002 – High Winds - Thunderstorms, developing ahead of a cold front, moved into southern Vermont during the late afternoon and early evening of June 27. One cell became severe as it deposited one inch hail in the town of North Bennington, Bennington County. The same storm blew down trees in Brattleboro.

May 3, 2002 – High Winds - The gradient between a high pressure center in the Ohio Valley, and deep low pressure over eastern Canada, produced a marginally high wind event across high elevations of southern Vermont during the midday hours of May 3. Many trees and power lines were reported blown down across the county. Over 1,000 customers were temporarily without power in southern Vermont as a result of the wind. Total of $20,000 in damages countywide.

Mar. 10, 2002 – High Winds - The pressure gradient between deep low pressure over Ontario, and high pressure off the southeast coast, produced a strong southerly flow across southern Vermont on the evening of March 9. Then, a strong cold front moved across the region shortly after midnight, early on March 10th. A line of showers and embedded thunderstorms accompanied the front. Strong winds ahead of and along the front produced some damage across Windham County. Law enforcement personnel reported a large number of trees and power lines down throughout the county.

June 30, 2001 - A weak trough rippling through a very unstable air mass touched off a round of thunderstorms in southern Vermont during the afternoon of June 30. One of the storms became severe in Windham County. Thunderstorm winds brought a large tree and wires down in Brattleboro.

June 2, 2000 – High Winds - A powerful cold front moved across southern Vermont on June 2. This front produced thunderstorms, one of which became severe in Windham County.

September 16, 1999 – Tropical Storm, Flooding - The remnants of Hurricane Floyd moved up the eastern seaboard on September 16 and during the early hours on September 17. The storm brought both high winds and heavy rainfall to Southern Vermont, which included a large swath of 3 to 6 inch amounts. Specific rainfall amounts included 2.91 inches in Bennington, 3.89 inches in Sunderland, 4.54 inches at Peru and 5.70 inches at Brattleboro. The rain produced significant flooding across the region, which proved destructive. Many smaller tributaries reached or exceeded bankfull. Winds from the passage of Floyd were estimated to have gusted to over 60 mph, especially over the hilltowns. The combination of the wind and very saturated ground, produce widespread downing of trees and power lines across much of Southern Vermont. The rain and wind produced power outages across the region. As many as 2,000 people lost power in Southern Vermont.

Jul 6, 1999 – High Winds - A cold front moved from the Great Lakes eastward across New York State and then into southern Vermont on July 6. With sultry air in place, and favorable strong upper level winds, this front triggered a powerful squall line around midday which bore down on southern Vermont during the afternoon. Destructive thunderstorm winds brought down trees and power lines in Pownal and Stamford, Bennington County. Dime size hail was noted in Halifax, Windham County. By far the most widespread damage occurred at Guilford Center in Windham County. A microburst with estimated winds up to 90 mph, brought hundreds of trees down or sheared them in half. The microburst travelled 3 miles and damage fanned out to nearly 2.5 miles wide. $150,000 in damages countywide, mostly in Guilford.

Nov. 27, 1997 – High Winds - The passage of a cold front produced strong winds across southern Vermont during the early morning hours of November 27. Winds gusting to 40-50 miles an hour downed trees and power lines in Bennington and Windham Counties. Approximately 1,500 customers lost power for a six to eight hour period.

November 1, 1997 – High Winds - During the afternoon and evening hours of November 1, damaging winds occurred across parts of southern Vermont, due to a combination of deep low pressure over the Mid-Atlantic States and strong high pressure in southern Canada. Trees and wires were downed by the wind, which resulted in power outages to approximately 1,000 customers in Windham and Bennington Counties. At Brattleboro in Windham County, numerous trees and power lines were downed by the wind.

Feb. 24, 1996 – High Winds - A rapidly deepening low pressure system moved from southern New Jersey northeast to northern Maine by the morning of February 25. This system brought damaging winds to southern Vermont including Bennington and Windham counties, which downed many trees across the area and produced scattered power outages.

Jan 19, 1996 – High Winds - An intense area of low pressure located over the Mid-Atlantic Region on Friday morning January 19th produced damaging winds across southern Vermont. This storm was associated with a strong southerly flow which resulted in scattered reports of downed trees, limbs and power lines.

July 15, 1995 – High Winds - A widespread severe weather outbreak hit Vermont during the morning hours of July 15th. A long lived squall line, known as a Derecho, crossed Vermont during the morning hours. Southern Vermont was hardest hit especially across Windham, Windsor, Rutland and Bennington Counties. $10,000 in damages.

July 14, 1988 - Tornado in Windham County (exact location not known). Traveled 10 yards. Caused $250,000 in damages. The tornado strength was not classified.

Summer of 1968 – EF3 or EF 4 Tornado in West Brattleboro with one injury and property damage.

July 5, 1957 – Tornado in Windham County (exact location not known). Traveled 33 yards. Caused $2,500 in damages.

Sept. 21, 1938 – Hurricane, Flooding - A hurricane Igor hit the region of Southeast Vermont to include the Town of Grafton, paralyzing it for weeks. As it was coming, packing winds over 100 miles an hour, authorities were unaware of the magnitude so no evacuation procedures were instituted and very few precautions were taken. As a result over 600 people lost their lives and tens of thousands were left homeless. Wind, rain and flash flooding wiped out trees, church steeples and buildings, leaving behind nearly $400 million in damage. The Whetstone Brook in downtown Brattleboro experienced flood levels similar to those expected in a hundred year flood, based on photographs of the storm damage in relation to buildings that exist now and at the time of the flood. The Whetstone Brook flooded Flat, Elm, Frost and Williams streets as well as portions of West Brattleboro. Power and phone communication was lost due to downed poles. Train service was interrupted for a week. The Brattleboro highway team and WPA workers were said to have streets opened in just a couple of days. No deaths or injuries in town, but Brattleboro estimated the cost for damage at $15-20,000

Extent – Strength or Magnitude
In 1938 winds from Hurricane Igor were recorded at 100 mph, and in recent years winds have been recorded at 60 mph in the Southeast region of Vermont, including the Town of Brattleboro. Wind gusts during Tropical Storm Irene reached 60 mph at times.
Extent/magnitudes of Hurricanes and Tropical Storms are ranked using the Saffir-Simpson Scale in the Western Hemisphere, as follows: CAT1=74-95 mph winds, CAT2=96-110 mph winds, CAT3=111-130 mph winds, CAT4=131-155 mph winds, Tropical Storm=39-73 mph winds, Tropical Depression=0-38 mph winds.
Tornado magnitude is measured by the Enhanced Fujita (EF) Scale which rates strength based on damage caused, EF-0: 65 to 85 mph, EF-1: 86 to 110 mph, EF-2: 111 to 135 mph, EF-3: 136 to 165 mph, EF-4: 166 to 200 mph, EF-5: Over 200 mph.

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that high winds is a highly likely natural hazard event that will occur in any given year; hurricane is possible in any given year; tornado is possible in any given year.

Sources used
Local knowledge and records; data for Windham County from the National Climatic Data Center storm event database; Allyssa Sabetto, Windham Regional Commission; Brattleboro Historical Society.

REGIONAL DROUGHTS
Drought is a recurring hazard that tends to be a summer occurrence, but it can occur at any time of the year. This hazard is cyclic in nature such that severe droughts are rare, last for several years and affect the entire state. Less severe droughts are much more frequent and localized in extent. Localized moisture deficits are often a function of the topography, soil type and precipitation receipt, while statewide impacts are driven by the regional storm systems. The timing of the onset and duration of a drought influences the population affected (e.g. farmers in the summer, water management and tourism in the fall and winter). The nature of a drought also varies by Vermont's three climate divisions - the northeastern division (1), the western (2) and the southeastern (3). The southeastern division (3), which includes Brattleboro, is consistently drier than the rest of the state, and is at times the only part of the state experiencing drought. The southeastern division (3) displays a strong coupling between the atmosphere and hydrology. (University of Vermont, *Summary of Hydroclimatic Hazards in Vermont*.)

LOCAL DROUGHTS
Description and Geographic Area of Hazard
Drought impacts all areas of town, affecting natural systems, farms, residential, commercial, and industrial users. Public water supply is especially crucial to the Town's food processing industry. Some industrial users have private water supplies which are less vulnerable to drought disruption as they draw from the Connecticut River or otherwise unexploited well recharge areas. Local farmers rely on other private water supplies which may be inadequate in a drought. Pleasant Valley Water Plant supplies an average of about 1.0 – 1.5 million gallons per day of quality water to the town of Brattleboro depending on season. Water is taken from Pleasant Valley Reservoir, a surface water supply. During periods of drought and high water usage, this system can reach its capacity. Brattleboro has a backup system of wells located on Route 30 north of the Brattleboro Retreat. The wells are operated two days a week for a few hours each day to keep them in running order.

Past Occurrences:
The 1998-1999 drought was the most severe in the State in the past 15 years; there have also been droughts in 2001-2002 and 2006-2007.

Extent – Strength or Magnitude
Brattleboro has experienced droughts leading to low water reserves, most recently in 1995 and 1997, with reservoir water level down 6'7" and 7'2" from full capacity respectively. Following demand management and operating the backup well system were necessary for maintaining supply for critical uses. Vermont experienced the most severe recent drought in 1968-69; the drought event was estimated as having a 2% probability of occurrence for any given year (http://md.water.usgs.gov/publications/wsp-2375/vt/). Brattleboro responded to the drought by developing the backup well system. Climate change is expected to increase the risk of drought and drought severity in Vermont.
Droughts have lasted up to 12 months. Drought records used in this plan did not use a drought intensity scale.

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that drought is a likely natural hazard event that will occur any given decade.

Sources used
Steve Barrett, Director of Public Works; Gary King, Engineering Technician, Department of Public Works. *Climate Change in Vermont*, Alan K. Betts, June 2011, published online by the Vermont Agency of Natural Resources. University of Vermont, *Summary of Hydroclimatic Hazards in Vermont*

WILDFIRE

With the exception of the urban downtown area, most of Brattleboro is heavily forested; however, wildfire conditions do not occur frequently due to the relatively high annual precipitation level. Forested areas are lightly settled. Structures are typically surrounded by fields or lawns and are less vulnerable to wildfire. Large forest tracks are managed to maintain eligibility for favorable tax treatment, reducing excess fuel loads. Forest areas are fragmented by the town road network. Fires can be encircled and controlled quickly. Residents can be evacuated if Fire personnel feel that they cannot safely shelter in place. Wildfires are most likely in the summer and fall months.

Recent Occurrences:

2009-2014 In the past five years, there has been a large wild fire across the Connecticut River along the Wantastiquet Mountain State Park; Brattleboro Fire Department helped extinguish the fire. There have been no large wildfires in Brattleboro during this period.

May 4 & 5, 2015 – Hescock Road Fire: a brush fire was caused by a tree downing a power line in a wooded area. Soils and fuel where dry after an extended period of warm, dry weather. The fire burned over 47 acres of wooded and brushy area. The three alarm fire was controlled by over 100 fire fighters from Brattleboro and ten surrounding towns in Vermont, New Hampshire and Massachusetts. In addition, Rescue, Inc. (an ambulance service), Vermont Forestry & Parks, Green Mountain Power, and the Franklin County (MA) task force responded. Firefighters were hampered by steep terrain and limited water supply. An unnamed brook off Melchen Road was used to fill tankers. Hoses were hand carried to steep areas.

There were five fire fighters injured; none seriously. There was no damage to structures. Most of the fire area is enrolled in the State current use program for forestry management. The blaze was a ground fire; it did not climb into the tree crowns. Peat soils did smolder for several days and will contribute to tree death. Any loss of lumber value has not been evaluated at this time.

Extent – Strength or Magnitude

Forest areas are fragmented by the town road network. Fires can be encircled and controlled. The largest area of continuous forest is 2.5 sq. mi. There have been no wildfires resulting in structure damage in the past 10 years. Rates of occurrence and intensity will increase as climate change causes more frequent or severe drought and extreme heat events; extended warm periods will lead to drier soils and increased risk.

Probability

The Hazard Mitigation Committee for the town of Brattleboro concludes that wildfire is a likely natural hazard event.

Sources used

Target interview, Michael Bucossi, Fire Chief, Peter Lynch, Assistant Chief. *Climate Change in Vermont*, Alan K. Betts, June 2011, published online by the Vermont Agency of Natural Resources; 5.5.2015 Brattleboro Fire Department press release.

STRUCTURE FIRE

Structure fires can result in loss of property and/or life. They can affect a single residential structure or spread to other homes, businesses or apartment complexes. Residential fires kill more people in the

U.S. each year than all natural disasters combined. In Vermont there were 4 fatal fires in 2013. All of these deaths occurred in single family dwellings and the average age of the victims was 58 years old. The most significant common factor in fire fatalities in Vermont continues to be the absence of a functioning smoke detector in the sleeping area of residential structures. Space heating is the leading cause of fires followed by cooking.

Recent Occurrences:
Single family home fires occur regularly in Brattleboro. In the past five years, Brattleboro has also experience fires in multi dwelling unit and mixed use buildings, including a fire on South Main Street in a 12 unit building, a fire on Elm in an 8 unit building, and a fire on Main Street in a 55 unit mixed use building with office and retail space. These buildings took from 3 months to two years to rehabilitate, leading to tenant and business displacement. In addition, there has been a fire on Green Street which destroyed a 3 unit building and a fire on Elliot Street which destroyed a 5 unit building. Losses ranged from $85,000 to $2,000,000. Fires in these larger structures cause strain on town emergency services and to local human service agencies which assist displaced tenants.

Extent – Strength or Magnitude
Structure fires are highly likely, and one usually occur every few months in Brattleboro. With an average assessed single family residence value of $210,000 (2014 Grand List), and assuming one structural fire resulting in the total loss of a structure happens on average once every three months, structural fires result in $840,000 damage in an average year.

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that structure fire is a highly likely hazard event that will occur on multiple occasions per year.

Sources used
Michael Bucossi, Fire Chief; Peter Lynch, Assistant Chief; Russell Rice, Assessor.

EARTHQUAKE
There is not a history of earthquake damage in Brattleboro. Due to masonry construction in the more densely developed part of town, there is potential for extensive damage in the event of a larger earthquake. Current building codes for public buildings (which exclude one and two family homes and farm structures) include some seismic standards. The most extensive damage from an earthquake in the State of Vermont was cracked walls and objects knocked off shelves. This occurred during the earthquake of April 10, 1962 centered in Middlebury.

Extent – Strength or Magnitude
Minor earthquakes in New England are not uncommon; however, damage is unusual. There have been 97 earthquakes in the US Northeast and Southeastern Canada since 2007, ranging in strength from 0.1 to 4.9 Nuttli Magnitude. There have been five earthquakes in New England of magnitude five or higher in the period of European settlement. (Weston Observatory)

Past Occurrences:

LARGEST EARTHQUAKES IN VERMONT THROUGH 1993

Date	Time	Lat (N)	Long (W)	Mag.	MMI	Epicenter
04/10/62	09:30am	44.11	72.97	4.1	V	Middlebury, VT
07/06/43	05:10pm	44.84	73.03	4.1	IV	Swanton, VT
03/31/53	07:59am	43.07	73.00	4.0	V	Brandon, VT

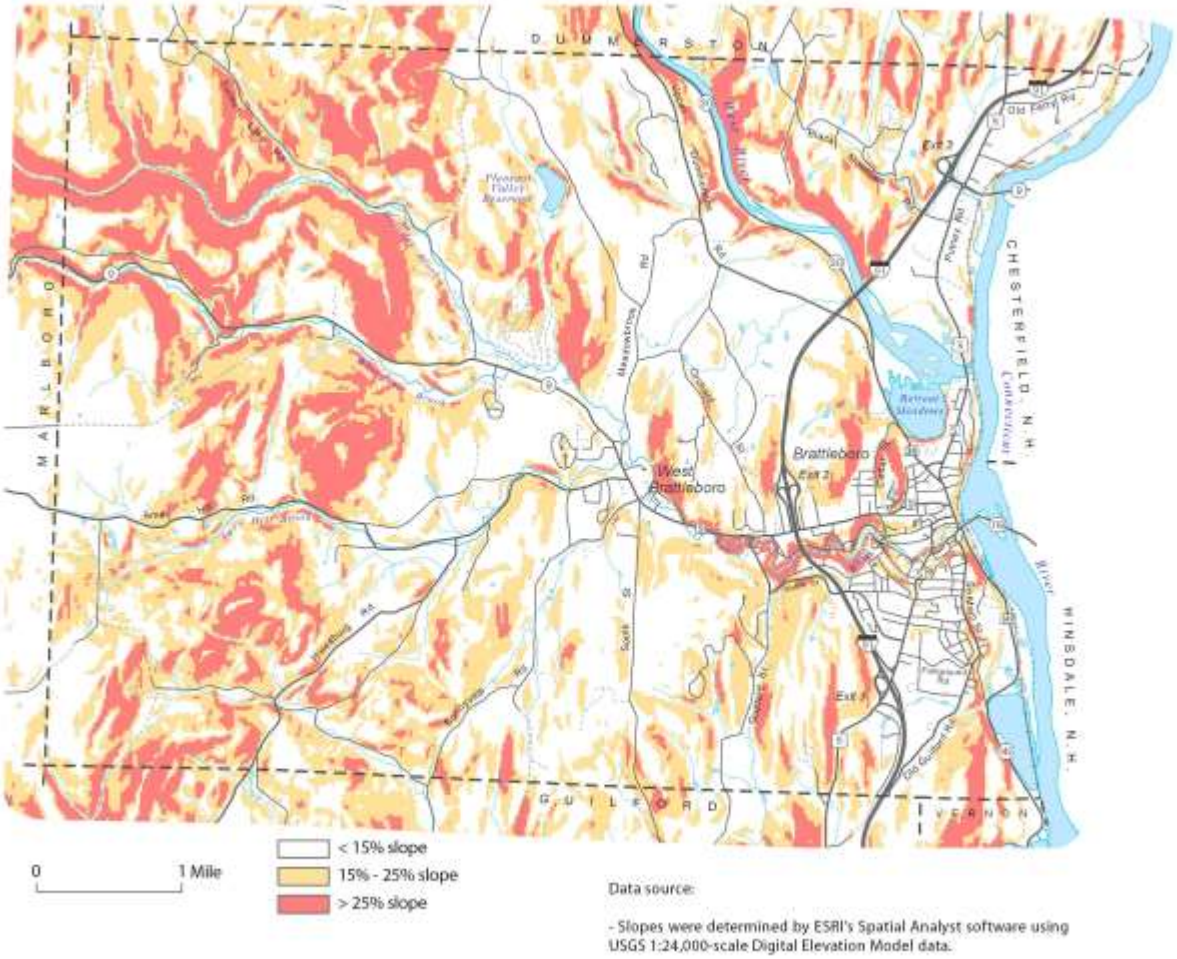
(Ebel, Bedell, Urzua)

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that a damaging earthquake is an unlikely hazard event.

Sources used
New England Seismic Network, Weston Observatory, Boston College; Excerpts from: *A Report on the Seismic Vulnerability of the State of Vermont* by John E. Ebel, Richard Bedell and Alfredo Urzua.

LANDSLIDE
Landslides are a serious geologic hazard common to almost every state in the United States. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly. Gravity is the force driving landslide movement. Factors that allow the force of gravity to overcome the resistance of earth material to landslide movement include: saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, removal of trees and other vegetation and earthquake shaking. Landslides are typically associated with periods of heavy rainfall or rapid snow melt and tend to worsen the effects of flooding that often accompanies these events. In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Landslides in Brattleboro have been related to fluvial erosion and over bank runoff in intense rain events. More frequent intense rain events overwhelm drainage on existing retaining walls causing failures and land movement.

Steep Slopes:



Past Occurrences:
Brattleboro has a history of minor landslides associated with fluvial erosion or local street flooding. Recent fluvial erosion landslides include 300 feet long, 35-40 feet high slope failure on the Whetstone Brook downstream of the Citizens Bridge. Repairs were necessary to protect the upstream bridge abutment from undermining and to protect a dwelling unit; repairs totaled approximately $500,000.
A currently stable slope failure has occurred further upstream adjacent to Living Memorial Park and a four unit condominium. The failure is approximately 400 feet long and 25 to 30 feet high. Repair costs would be similar to that of Citizens Bridge slope failure, $500,000. Continued erosion could endanger tennis courts and the condominium building.

A slope failure caused by drainage from localized street flooding occurred between Western Avenue and Williams street. The land falls approximately 100 feet at a 25% grade. No structure was damaged; no public infrastructure was threatened. Repairs consisted of private re-grading for landscaping at a cost unknown to the town.
A history of similar street flooding related slope failures occurs by the intersection of Oak Grove Avenue and Morningside Cemetery. The erosion forms deep cuts into the hillside. The cuts are up to 20 feet

wide and 50 to 75 feet high. The steep slope between South Main Street and the Cemetery is approximately 1,500 long. There are three active cuts and several others that have stabilized. All active cuts have been rip-rapped with geotextiles installed. The most recent cut occurred in 2014; repairs consisted of rip-rapping and laying geotextiles to stabilize the slope at a cost of $50,000. Continued erosion of this would undermine two dwellings and South Main Street. Continued erosion on the other cuts threaten similar damage: undermining two to three dwellings and South Main Street. Reducing this landslide threat will require expanding stormwater infrastructure which is less able to transport waters from increasingly severe large rain events. Climate change will likely make such rain events more frequent.

Green Street retaining wall failed in 2014, closing a roadway and threatening sewer and water service to a portion of downtown. The failure may be related to intense rain events. Reconstruction will cost approximately $500,000. A total slope failure would rupture water and sewer lines risking flood damage to real estate valued at more than $10,000,000.

Extent – Strength or Magnitude
Landslides have been on steep slopes of up to 25 % grade. In Brattleboro, those associated with road flooding have been 20 to 25 feet wide and up 50 to 100 feet high. Those associated with fluvial erosion have been up to 400 feet long and 40 feet high.
There have been no recent structures damaged by landslides. Landslides pose a risk of road and structure damage and increased stream siltation. Damages have required grading and rip-rapping repairs. Unrepaired damage could lead to future structure loss.
Due to the increased frequency of extreme rain events caused by Climate Change, the risk of landslides is increasing.

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that landslides are a likely hazard event that will occur in any given year.

Sources used
Steve Barrett, Director of Public Works; Gary King, Engineering Technician, Department of Public Works, Patrick Moreland, Assistant Town Manager; Alyssa Sabetto, WRC; *Climate Change in Vermont*, Alan K. Betts, June 2011, published online by the Vermont Agency of Natural Resources.

EXTREME HEAT
Nationwide, extreme heat events, or heat waves, are the most common cause of weather-related deaths. They cause more deaths each year than hurricanes, lightning, tornadoes, floods and earthquakes combined. Vermont has not yet experienced the number of prolonged extreme heat events that many other states have. As climate change continues, heat stress will become a more significant risk in the lives of Vermont residents. Due to generally moderate summer temperatures, many structures are not air-conditioned increasing vulnerability, especially for low income and elderly residents.
The numbers of hospitalizations for heat stress have been small for residents of Vermont during the decade from 2000 through 2009. The total number of Vermont residents admitted to hospitals in Vermont, Massachusetts, New Hampshire, and New York for heat stress has been fewer than six each year for all but three years during the period (2001, 2002, 2008) In Vermont, the number of visits to hospital emergency rooms for heat stress is greater than the number of people admitted for inpatient care, but still remains fairly small. When numbers of cases are fewer than six, Vermont Tracking does

not show exact counts. With fewer than six cases, it is almost impossible to tell random changes from true changes in the data. Reporting small numbers is also avoided to maintain confidentiality of individuals. Due to the need to preserve privacy, there are no statistics for local emergency room visits or hospitalizations.

> *"Climate change amplifies the intensity, duration and frequency of heat wave events. Even a small change in average global temperature can lead to a dramatic change in the frequency of extreme events such as heat waves.*
> *Since 1950, the number and duration of heat waves worldwide has increased, as has the frequency of hot days and nights (IPCC AR5 WGI, Table SPM.1) and the level of humidity in the air (Willett et al. 2007). The geographic area hit by extreme summer temperatures has grown by well over ten times in the past 30 years (Hansen et al. 2012).*
> *The influence of human-caused global warming has been firmly identified in all of these trends (IPCC AR5 WGI, Table SPM.1; Willett et al. 2007; Hansen et al. 2012).*
> *Extreme temperatures have an element of probability. Climate change provides baseline warming that raises the bar on what natural variation can produce. For example, one study found that greenhouse gas pollution caused "over half" of the anomalous U.S. warming of 2006 (Hoerling et al. 2007), and another found that Russia's devastating 2010 heat wave was made over five times more likely by climate change (Watanbe et al. 2013). In recent years, new record-breaking high temperatures have outnumbered new record lows in the U.S. by a ratio of about 2:1 (NCA Chpt 2 Fig 2.18, p.53)."*
> (Climatenexus.org)

Past Occurrences:
There are no extreme heat events in Windham County listed in the National Climate Data Center database.

Extent – Strength or Magnitude
Higher than normal humidity and temperatures can cause an extreme heat event or heat wave to occur. A heat wave is a prolonged period of excessive heat most often in very humid conditions.
The magnitude or intensity of an extreme heat event is measured according to temperature in relation to the percentage of humidity. According to the National Oceanic Atmospheric Administration (NOAA), this relationship is referred to as the "Heat Index". This index measures how hot it feels outside when humidity is combined with high temperatures. Extreme heat can lead to sunstroke, muscle cramps, heat exhaustion or heatstroke. NOAA advises that index levels in the 90s should be treated with "extreme caution" for prolonged exposure or physical activity; as "dangerous" with levels in the 100s and as an "extreme danger" with levels in the hundred and teens.

Probability
The Hazard Mitigation Committee for the town of Brattleboro concludes that extreme is a likely hazard event that will occur annually.

Sources used
http://www.healthvermont.gov/tracking/enviro_climate_moreinfo.aspx; Climatenexus.org; NCDC database.

ASSESSING VULNERABILITY: OVERVIEW

The vulnerability analysis begins with an inventory of possible natural hazards and an assessment of the risk that they pose: what hazards affect the community; how serious the impacts are; how likely the hazard is to occur; and, how these hazards will affect citizens and property. The magnitude (percentage of the community affected) of the impact of the hazard can be classed as follows:

- Negligible: < 1.0% of properties damaged/Minimal disruption to quality of life.
- Limited: 1.0% to < 2.5% of properties damaged/Loss of essential facilities/services for up to 7 days/few (< 1% of population) injuries possible.
- Critical: 2.5% to 5.0% of properties damaged/Loss of essential facilities/services for > 7 days < 14 days/Many (< 10% of population) injuries/few deaths possible.
- Catastrophic: > 5.0% of properties damaged/loss of essential facilities/services for > 14 days/Many (> 10% of population) injuries/multiple deaths possible.

The **frequency** of occurrence (Likelihood) is classified as shown:

- Unlikely: < 1% probability in the next 100 years.
- Possible: 1% to 10% probability in the next year, or at least one chance in the next 100 years.
- Likely: 10% to 100% probability in the next year, or at least one chance in the next 10 years.
- Highly Likely: Near 100% probability in the next year.

Additionally, seasonal patterns that may exist; areas likely to be affected most; the probable duration of the hazard; and the speed of onset are considered.

The combination of the **magnitude** of the hazard and its **frequency** was used to determine the **hazard vulnerability** as HIGH, MODERATE or LOW. For example, a highly likely flood with critical or catastrophic impact receives a vulnerability of HIGH. Another highly likely or likely hazard (at least one chance in the next 10 years) with a limited impact would receive a vulnerability rating of MODERATE. The vulnerability from a possible or unlikely hazard with limited or negligible impact would be LOW.

Likelihood:	Impact:
U = unlikely	N = negligible
P = possible	L = limited
L = likely	CR = critical
HL = highly likely	CA = catastrophic

The Hazard Mitigation Committee reviewed the hazard table as adopted in the Brattleboro, VT *Local Hazard Mitigation Plan Update 2010* annex of the Windham Regional Commission's *Regional All Hazard Mitigation Plan*. The Committee members modified the table based on the past four years' experience, particularly the experience of flooding from Tropical Storm Irene. The Committee members felt the "number of properties damaged" in the 2010 HMP ranking formula versus the actual level of impact on the Town was not realistic given their experience. The "number of properties damaged" to rank impacts as negligible, limited, critical, and catastrophic were far higher than those that would actually cause disruption to the Town that would overwhelm local response. The percentage ranges of "number of properties damaged" was lowered by an order of magnitude to reflect the actual experience of responding to a hazard event with critical impact. The level of impact due to loss of essential facilities and loss of life was considered to be consistent with experience. The Committee reduced the vulnerability rank for 15-50 year flood as community resilience has increased due to the ongoing removal of residences from the SFHA and infrastructure improvements. The vulnerability rank for

Hurricane was increased due to experience with Tropical Storm Irene. Dam failure was ranked higher due to State studies of inundation impacts from a large dam failure. Highway accidents, railroad accidents, and wildfire were all reduced in vulnerability ranking. The first two due to improved infrastructure, which reduces the chance of serious accident and preserves road capacity in case of an accident. Wildfire was reduced as fires can be accessed and surrounded from the rural road network and structures can be protected. School safety issues were ranked higher due to national, state and local events. The Committee's revisions were incorporated into the table. Descriptions of location and extent were clarified.

Participants: Interim Town Manager Patrick Moreland, Police Chief Eugene Wrinn, Police Assistant Chief Michael Fitzgerald, Fire Chief Mike Bucossi, Fire Assistant Chief Peter Lynch, Public Works Director Stephen Barrett, Road and Utilities Supervisor Hannah O'Connell, Planning Director Rod Francis, Zoning Administrator Brian Bannon, Town Assessor Russell Rice

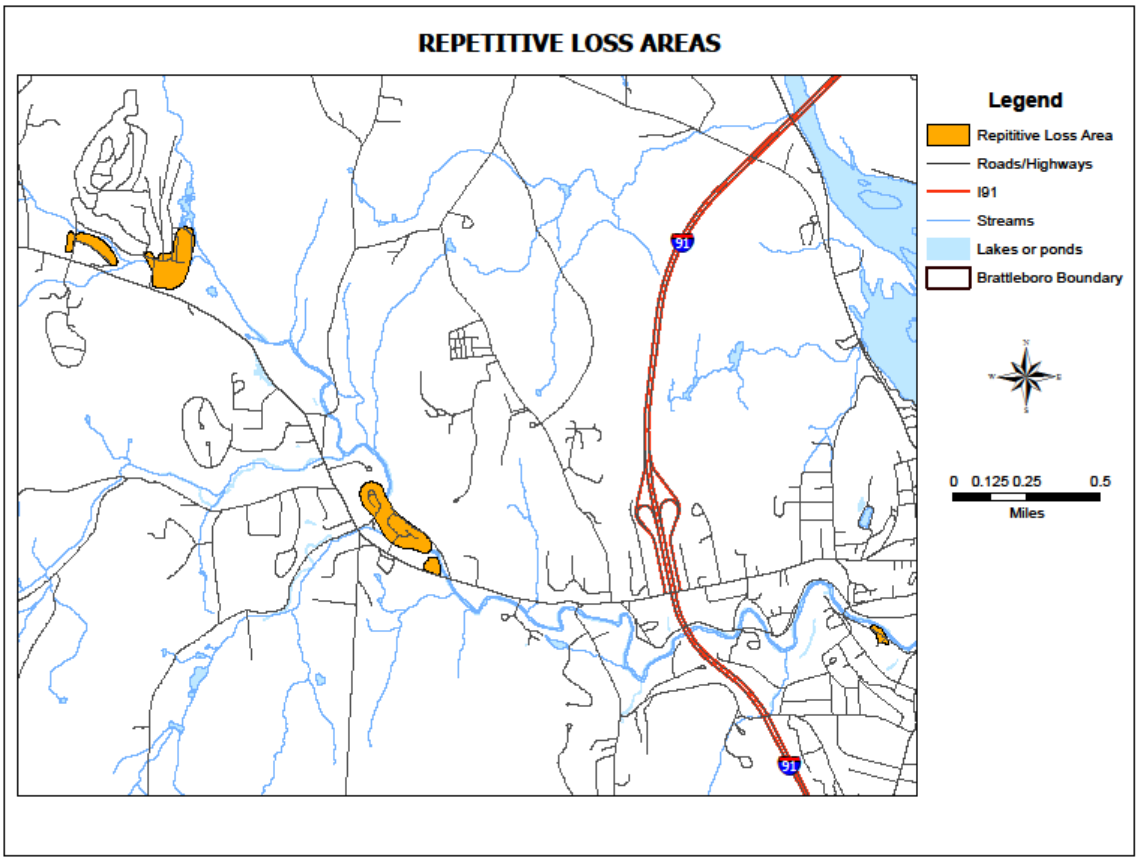
Hazard	Likelihood	Impact	Community Vulnerability	Location	Threatened Persons or Resources	Possible Climate Driven Changes to Risk
25 year – 50 year Flood	L	CR	High	SFHA	Low Income, Senior & Disabled Persons, Roads, Culverts, Bridges, Buildings, Critical Facilities	Risk is likely to increase.
100-year Flood	P	CR	High	SFHA	Low Income, Senior & Disabled Persons, Roads, Culverts, Bridges, Buildings, Critical Facilities	Risk is likely to increase.
Flash flood	HL	CR	High	SFHA, FEHA*	Low Income, Senior & Disabled Persons, Roads, Culverts, Bridges, Buildings, especially in steep slope areas	Risk has and will likely continue to increase with greater frequency and intensity of major rain events.
Winter & Ice Storm	HL	L-CR	High	Town Wide	Town-wide, All Facilities & Populations	Risk may increase due to increase in large snow events and increase in winter mix events.
Drought	L	CR	High	Town Wide	Residences, Farms, Industry, Water Supply	Risk is likely to increase.
Hazardous materials	L	CA	Mod	Waste Water Treatment Plant, Putney Road Industries	Workers	No change likely.
Radiological Incident	P	CR	Mod	Town Wide	Town-wide/All Facilities & Populations	No Change Likely
Hurricane	P	L-CR	Mod	Town Wide	Town-wide, Mobile Homes, SFHA Residents	Unknown
Dam Failures	P	CA	Mod	West, Connecticut Rivers, Pleasant Valley Brook, Chestnut Hill Reservoir	Residents of SFHA, Chestnut Hill and Pleasant Valley	Possible increased risk due to overtopping in extreme rain events, which have increased and are likely to continue to increase
Highway Accidents	HL	L-CR	Mod	Rtes. 5, 9, 30 I-91	Roads, adjacent Businesses, Residences	No Change Likely
School Safety Issues	P	CR	Mod	All Schools	All Schools, Students & Staff	No Change Likely
Infrastructure Catastrophic Failure	P	CR	Mod	Dams, Bridges	Bridges, Culverts	Risk may increase due to extreme weather events, particularly flood and heavy rain events.
Mass Casualty Event	P	CR	Mod	East End	Roads, Large Employers	No Change Likely
Structure Fire	HL	L	Mod	Town Wide	Residences, Businesses	Possible increase due to greater risk of wildfire; possible decreased risk due to reduced use of space heating.
Tornado	P	L	Low	Town Wide	Roads, Bridges, Culverts, Trees, Buildings, Electric Transmission	Unknown
High Wind	HL	L	Low	Town Wide	Mobile Homes, Power	Unknown
Air crash	P	N	Low	Connecticut River, BMH Area	Critical Facilities	No Change Likely

Hazard	Likelihood	Impact	Community Vulnerability	Location	Threatened Persons or Resources	Possible Climate Driven Changes to Risk
Earthquake	U	L	Low	Downtown	Historic Structures, Housing Stock	No Change Likely
Railroad Accidents	P	L	Low	Downtown	Downtown residents	Possible increased risk due to expansion of rails in extreme heat events.
Wildfire	L	L	Low	West Brattleboro	Structures, Rural Roads	Possible increased risk due to drought or soil desiccation due to higher temperatures.
Landslide	L	L	Low	Steep Slope Areas, Brooks	Structures, Roads, Residences	Increased risk due to increase in extreme rain events.
Terrorism	P	L	Low	Population Concentrations	Roads, Bridges, Culverts, Infrastructure, Institutional & Government Structures	No change likely.
Extreme heat	L	L	Low	Town Wide	Low Income, Senior & Disable Persons, Outdoor workers	Increased risk due to increased number of extreme heat days and higher night time lows

* FEHA: Fluvial Erosion Hazard Area.

ASSESSING VULNERABILITY: REPETITIVE LOSS PROPERTIES

According to FEMA, Brattleboro has two repetitive loss properties, both located along the Whetstone Brook. One is a four dwelling unit residence, the other is a 2450 sq. ft. retail with office commercial building. (*Repetitive Loss Data as of December 31, 2011 for Town of Brattleboro, 500126; Grand List)* These two structures face different hazards: flooding with erosion, and inundation flooding. Other, similarly situated structures share a history of repeated flood damage. This history may not be reflected in flood insurance claim data due to a low rate of insured properties or change of ownership



1. Flooding with Erosion: there are three sections of the Whetstone Brook with a history of flood damage due to flooding with erosion: low lying areas of Mountain Home Park and adjacent commercial parcels; Glen Park; and Melrose Terrace. All are located in a Fluvial Erosion Hazard Area as mapped by the Vermont Agency of Natural Resources. All three are primarily developed with affordable and low income housing built in filled flood plains and filled floodways, which was allowed by the town before Brattleboro joined the NFIP. The properties have faced frequent evacuations due to flood warnings or actual flooding. Precautionary evacuations and actual flood events place emergency workers at risk and have been an ongoing expense to the Town. Residents face risks to their lives and property; evacuations cause disruption, economic loss and stress. These areas suffered extensive damage during Hurricane Irene with stream bed migration and heavy erosion damage. The damage to structures was concentrated in the low-lying areas of Mountain Home Park, two adjacent commercial properties, Glen Park, and Melrose Terrace. Nineteen structures were destroyed; ten sustained heavy damage; and over 25 sustained minor non-structural damage.

2. Inundation Flooding: the Frost Street/Place neighborhood is a low lying residential area that sustained lighter inundation damage during Hurricane Irene; no structures were destroyed. Twenty one structures sustained non-structural damage. Additional repetitive inundation has occurred immediately upstream of the Melrose Bridge, damaging two residences.

During Hurricane Irene, additional damage occurred to structures outside of these repetitive loss areas, but the properties have not been subject to repetitive flood damage. Repetitive loss areas may be expanded to include these additional structures if they sustain damage in future flood events or if additional historic or site condition data allow an improved understanding of repetitive loss risk.

The definition of severe repetitive loss (SRL) as applied to this program was established in section 1361A of the National Flood Insurance Act, as amended, 42 U.S.C. 4102a. A SRL property is defined as a **residential property** that is covered under an NFIP flood insurance policy and:

(a) That has at least four NFIP claim payments (including building and contents) over $5,000 each, and the cumulative amount of such claims payments exceeds $20,000; or

(b) For which at least two separate claims payments (building payments only) have been made with the cumulative amount of the building portion of such claims exceeding the market value of the building.

For both (a) and (b) above, at least two of the referenced claims must have occurred within any ten-year period, and must be greater than 10 days apart.

There are no severe repetitive loss properties in Brattleboro. In part this reflects the limited vulnerability to inundation flooding and the highly localized and unpredictable nature of fluvial erosion events.

ASSESSING VULNERABILITY: IDENTIFYING STRUCTURES:

Hazards pose varying risks to public and private structures. Hazard mitigation capital investments can reduce risks from undersized culverts, poor road design and dam breaks. Road, rail, bridge, water and wastewater system conditions can contribute to hazards such as hazardous waste spills, infrastructure catastrophic failure, railroad accidents, water supply contamination, and highway accidents. Other hazards can be addressed with a combination of existing physical resources, policy, training, and equipment. Brattleboro's Hazard Mitigation Plan focuses on establishing higher regulatory and design standards to insure that all new, substantially improved or rebuilt infrastructure are built to resist identified hazards. The Plan seeks to remove residences and critical populations from high risk areas.

(All figures for structures based on *Brattleboro 2014 Grand List and* Public Works Department *Building Layer*; SFHA based on Digital Flood Insurance Rate Maps (DFIRMS) for Town of Brattleboro Community #500126, effective date 9.28.2007*; Repetitive Loss Area Layer* developed by Brattleboro Planning Department based on *Repetitive Loss Data as of December 31, 2011 for Town of Brattleboro, 500126*; NFIP insured properties based on *Repetitive Loss Data as of December 31, 2011 for Town of Brattleboro, 500126*; high risk population based on Brattleboro Fire Department *Special Needs Population Layer* data; bridge & large culvert data based on *State Structures Database for Brattleboro*)

Building Stock:

All Structures in Town, Town Wide Hazards:

●There are 5647 mapped structures valued at $1,214,713,200.00, 111 of which are NFIP insured. (*Public Works Department Building Layer, Brattleboro 2014 Grand List, FEMA Repetitive Loss Data 12.31.2011*)

All Structures in SFHA:
●376 structures, of which 66 accessory structures, 130 mobile home units, 24 multi-family, 55 single family, and 101 commercial or undefined; valued at $58,384,440; 108 of which are NFIP insured with a grand list value of $25,263,040 and insurance coverage of $14,812,800, (*Grand List, FEMA Repetitive Loss Data 12.31.2011, Public Works Department Building Layer*)

Repetitive Loss Structures:
●142 structures of which 8 accessory structures, 100 mobile home units, 18 multi-family, 6 single family, and 10 commercial or undefined; valued at $5,655,312; 35 of which are NFIP insured with a grand list value of $5,404,490 and insurance coverage of $4,985,100 (*Grand List, FEMA Repetitive Loss Data 12.31.2011, Public Works Department Building Layer*)

NOTE: discrepancies in the data may have been introduced during spatial analysis. Property coding was inconsistent across databases.

<u>Critical Facilities in the SFHA and Fluvial Erosion Hazard Area:</u>
Structures:
●Wastewater treatment plant – recently modernized with 7 of 8 buildings receiving improvements; all improved buildings have been floodproofed to BFE+1.
●Spring Tree Sewage Pumping Station – recently modernized with an elevated emergency generator; anchored LP tank; and floodproofed building to BFE+1.
●Linden Street Well Water Treatment Building – elevated pre-FIRM building with flood shields; has not flooded in major flood events, e.g. Hurricanes Floyd and Irene.
Special Needs Populations:
●Melrose Terrace – housing for the elderly and disabled individuals.
●Glen Park – housing for elderly individuals.
●Hayes Court -- housing for the elderly and disabled individuals.
●Mountain Home Park – housing for the elderly and disabled individuals and the general population.

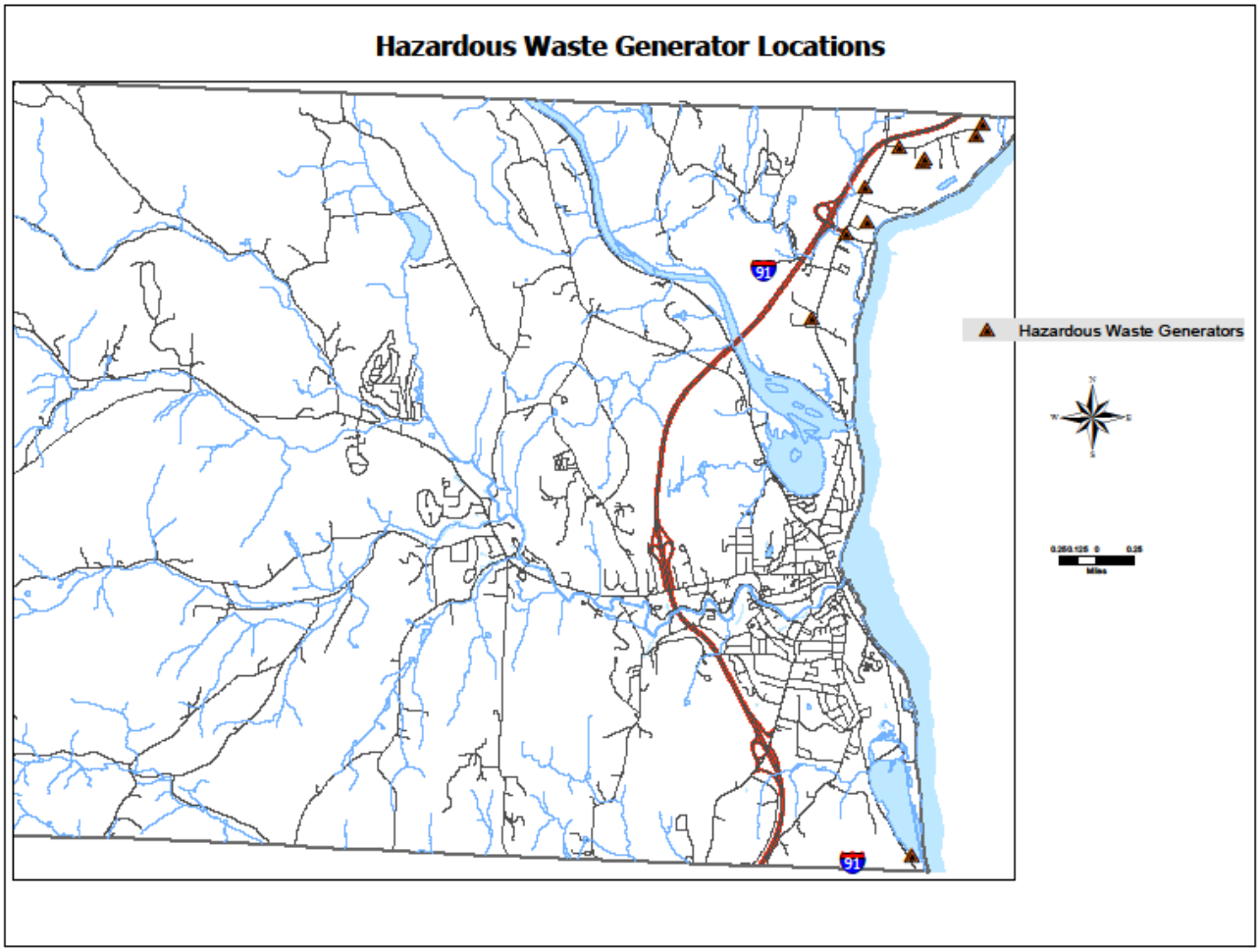
<u>Transportation Systems in the SFHA or Fluvial Erosion Hazard Area:</u>
Roads:
●Route 9
●Route 5
●Route 30
●I-91 Exit 3 ramps and roundabout
Bridges and Large Culverts:
●43 in total of which 3 arch structures, 32 bridges and 8 large culverts; local IDs: 6, 23, 33, 60, 62, 64, 69, 84, 98, 100, 119, 124, 133, 141, 159, 161, 167, 178, 222, 259, 321, 335, 352, 398, 445, 519, 799, 879, 924, 00015001, 0015004, 00150003, 00360002, & 00360003 (*State Structures Database for Brattleboro*)

<u>High Potential Loss Facilities:</u>
●Pleasant Valley Dam
●Chapin Street Dam

<u>Historic, Cultural, Natural Resource Areas located in the SFHA:</u>

●Brattleboro Urban Center Historic District
●West Brattleboro Village Historic District

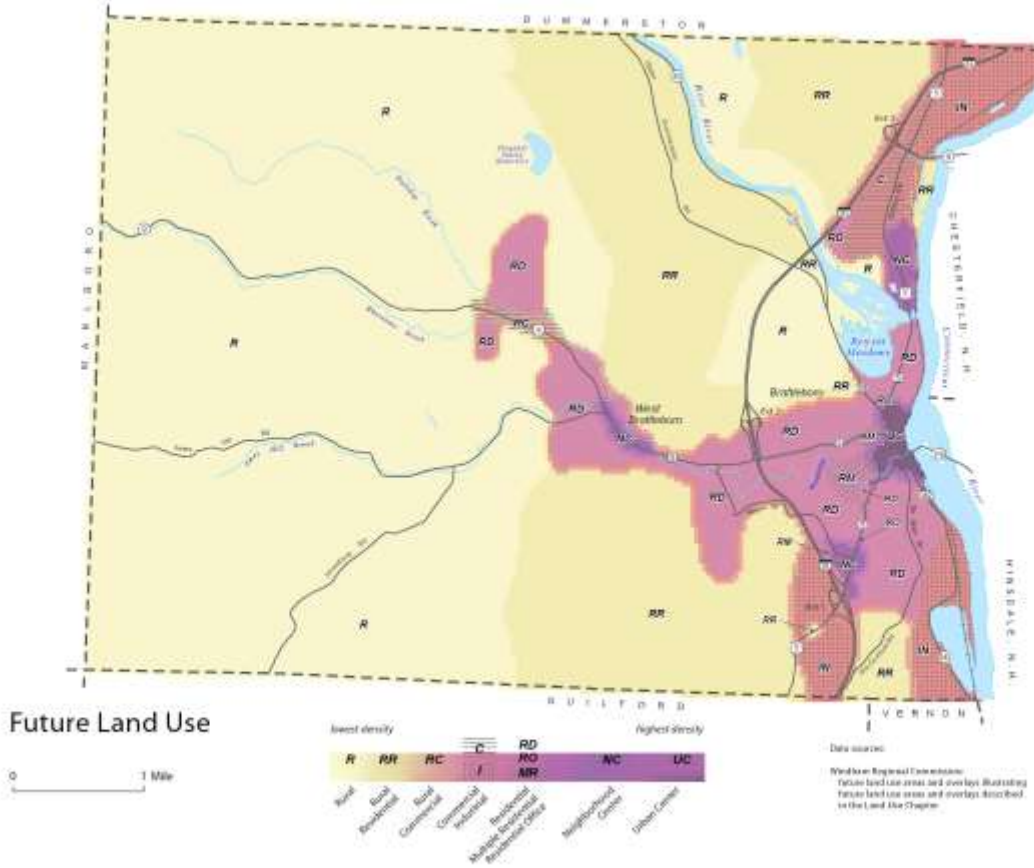
Hazardous Materials Facilities:
● See map below (*Vermont Natural Resource Atlas Hazardous Waste Generators* layer, downloaded 8.14.2014)



ASSESSING VULNERABILITY: ANYALYZING DEVELOPMENT TRENDS
A primary goal of the Town's Future Land Use Plan is to minimize the effects of natural hazards: injuries and loss of life; property and environmental damage; and the social and economic disruption caused by hazard events. The Town's flood control strategy must include directing land development to areas less vulnerable to natural hazard.

The Future Land Use Plan of the Brattleboro Town Plan calls for growth in established areas rather than in outlying areas. The Plan seeks to direct development and redevelopment opportunities to areas where growth will minimize expensive new infrastructure, revitalize developed areas, manage the cost of services for town residents, and avoid natural hazards.

The Plan focuses future growth on low hazard areas that run along a north-south axis. To achieve this development pattern, the Plan calls for reducing and simplifying zoning in the North End area and includes planning for both a mixed-use neighborhood center north of Veterans Bridge (at the confluence of the West and Connecticut Rivers, but well above the SFHA) and for residential development in adjacent areas using the Planned Unit Development process. Traditional residential neighborhoods adjacent to downtown should also attract a degree of redevelopment, resulting in greater densities while achieving well-accepted "smart growth" goals and reducing exposure to future flood damage along the Whetstone/Rt. 9 corridor.



Over the past 10 years, Brattleboro has had very little growth in land development. This is consistent with the flat population growth the Town has experienced. There has been no appreciable shift in the extent or intensity of commercial or industrial land use activity. Any commercial or industrial development has taken place in appropriately zoned districts and met local, state and federal regulations. There has been no new development of industrial facilities in the flat lands of the Special Flood Hazard Area since the 1980s. A kiln was demolished and replaced with a like-sized energy efficient and flood proofed kiln. Otherwise, new industrial facilities have been located in uplands not subject to flooding. They are accessed by roadways not subject to flooding.

Commercial areas are generally located outside of the SFHA except for a small area in West Brattleboro. There have been no new green field commercial development sites since 2005 when a gas station with convenience store and a hardware store were built in the SFHA in West Brattleboro. These buildings and their accessory structures were elevated above BFE; the fuel tanks were anchored against floatation.

None of these buildings were damaged during Tropical Storm Irene although adjacent pre-FIRM buildings were. There is a Hazard Mitigation Grant application to floodproof an adjacent repetitive loss commercial building; the building will be floodproofed with a secondary foundation and flood shields pending approval of the HMP.

In the downtown area, a warehouse with shipping facility was built in the SFHA; a youth theatre was built in a converted industrial building in the SFHA. The buildings used a combination of flood proofing, structural reinforcement to the existing foundations, elevation, and flood shields to meet NFIP requirements. Although surrounding buildings sustained extensive damage and were unusable for a period of weeks or months, these two buildings did not sustain damage and were returned to service within a week as electricity was restored to the area and sediment was removed from roadways and parking lots. A public parking garage with ground floor shops was built in 2002 outside of, but adjacent to the SFHA. While it is elevated above BFE, it sustain moderate flood damage to the retail shops and ground floor mechanical systems.

New development has been minimal since the great recession although the pace of development seems to be increasing. For the period of 2011-2013, changes to development have been driven by the response to Tropical Storm Irene. These changes include the removal of 22 mobile homes from the SFHA due to direct flood damage or due to mold damage following flooding. The mobile home cooperative that owns the two sites where mobile homes were damaged or destroyed entered into an agreement with the Town and State prior to Tropical Storm Irene to seek to remove up to 66 units from the SFHA. The Town helped the cooperative receive grant funding for a management study to help improve the institutional capacity to respond to income loss from reduced lot rents and to improve capacity to manage development of a new park site and mobile home relocation. The park has expressed a desire to continue the process of finding a new site; however, action is constrained by a $6,000,000 debt burden guaranteed by the Town which was used to rebuild the parks' sewer and water systems.

A senior housing complex experienced near substantial damage to 11 structures housing more than 60 residents. An engineering study demonstrated that the damage was less than 50% and the housing was repaired. Replacement housing for 54 units has started construction this spring. A second phase development will remove the remainder of housing from the previously flooded site; there is no site for this development at this time. The units located in the floodway will be demolished. The remaining units could legally be redeveloped, but the Town is working with the landowner and encouraging a buyout of the property and a restoration of the floodplain.

There has been no new residential development in the SFHA. Since the implementation of Biggert Waters 2012, there has been a strong interest in flood proofing existing housing units as they come up for sale. Two houses with walkout basements have moved utilizes above BFE and installed flood vents; areas below the first floor are only used for storage. Houses with full basements have seen a large loss in value.

There has been scattered infill housing development outside of the SFHA. In addition, a new 38 unit subdivision is under construction. It is located in an area of low natural hazard. It is being built with a secondary emergency access for use if the Crosby Brook damages the main access road.

The overall impact of development trends has been a reduction in the number of housing units and residents in the SFHA along with increased use of elevation and floodproofing for commercial development. Rezoning will down-zone natural hazard areas while up-zoning low risk areas.

MITIGATION STRATEGY

HAZARD MITIGATION GOALS

The Hazard Mitigation programs, projects and activities:

- Reduce the loss of life and injury resulting from all hazards.
- Reduce the impact of hazards on water bodies, natural resources, and historic resources.
- Reduce the economic impacts from hazard events.
    - Minimize disruption to the road network and maintain access,
    - Mitigate financial losses incurred by municipal, residential, industrial, agricultural and commercial establishments due to disasters,
    - Decrease future vulnerability by designing new public infrastructure such as roads, bridges, culverts, municipal buildings, etc. to withstand hazards.
- Encourage the incorporation of hazard mitigation planning into other community planning projects, such as the Town Plan, Capital Improvement Plan, and Town Basic Emergency Operation Plan
- Ensure that members of the general public and private organizations continue to be part of the hazard mitigation planning process.

HAZARD MITIGATION OBJECTIVES

Brattleboro faces natural and human hazards, but the risk to life and property is not fixed. A combination of capital and equipment investment, training, higher regulatory and design standards, public information outreach, and support of third party projects can reduce risk to life and property while speeding disaster recovery. Brattleboro seeks to use limited public grant funds to remove persons from areas of highest natural hazard and to reduce risks for areas of moderate hazard by improving infrastructure resilience, meeting higher design standards, retrofitting existing structures to withstand hazards, and minimizing new construction in hazard areas. It is understood that these goals will be achieved in full over a longer time period than is covered by this plan. Brattleboro seeks to reduce risks to persons in hazard areas through better public outreach and improved emergency response achieved through appropriate training and equipment.

EXISTING HAZARD MITIGATION PROGRAMS, PROJECTS AND ACTIVITIES

The following policies, programs and activities related to hazard mitigation are currently in place and/or being implemented in the town of Brattleboro. The Committee analyzed these programs for their effectiveness and noted any improvements needed.

Town services are currently constrained by level –service budgeting; there is a likelihood of level funding budgeting in future, improved services will require better coordination between departments; elimination of redundant services; and improved coordination with third parties. An example of such an effort includes the development of a Program for Public Information (PPI) that addresses shared areas of concern between departments with outreach efforts attached to current mailings, posted on existing town website, and disseminated by private media.

Type of Existing Protection	Description	Effectiveness/Enforcement/Hazard that is addressed	Gaps in Existing Protection/Improvements Needed	Potential Improvements
Town Budget	Authorizes annual town spending and borrowing	Capital and operational projects	Lack of multi-year budgeting	Opportunities to reduce redundancies to increase productivity; better coordination of departments; identify available grant funds; all helping support emergency response, public outreach, and hazard reduction.
Town Capital Planning Matrix	Lists anticipated capital expenses over a multiyear period with approximate project date	Capital Projects	Lack of Capital Plan	Development of plan will allow for project prioritization, including prioritization of infrastructure subject to damage or failure due to natural hazard events; plan will facilitate identifying potential funding sources, including mitigation funding.
Town Plan	Plan for coordinated town-wide planning of land use, municipal facilities, etc.	Flooding, Fluvial Erosion, Steep Slopes, Emergency Response, Infrastructure Vulnerability	Plan adopted February 19, 2013	Existing plan based on extensive public outreach with strong focus on natural hazard; 2018 plan rewrite will address new State flood resilience goal requirements.
Emergency Operations Plan	Municipal procedures for emergency response	All Hazards, Approved Plan in Place	Current	Potential improvement in public outreach; coordination with private partners for citizen education; better department coordination.
School Emergency Response Protocol	School procedures for emergency response	Approved Plan in Place	Continuing training; public information planning	Ongoing training and planning improve interagency coordination; plan spreads NIMS ICS training into participating agencies and town departments.
LEPC 6 Hazardous Materials Plan	Procedures for hazmat emergency response at regional level	LEPC 6 maintains the plan	Continued involvement with the LEPC 6	Continuing development of interagency coordination; inter department coordination helps identify new hazardous material producers for inclusion in plan updates
Mutual Aid – Emergency Services	Agreement for regional coordinated emergency services	Keene (NH) Mutual Aid – written agreement/contract for Fire/Ambulance and HazMat	None identified	Continued interagency training to coordinate response; common provision of training opportunities.
Mutual Aid – Public Works	Agreement for regional coordinated emergency highway maintenance services	Local Roads	Continually Updated	Coordinate equipment sharing; rationalize shared provision of maintenance and emergency services to areas near town boundaries.
Road Standards	Design and construction standards for roads and drainage systems	Vtrans Standards Bridge and Culvert Inventory work	Higher bridge and road standards under discussion	Improve standards to reflect climate change with larger culvert requirements and bridge span length requirements; insure proper bridge alignment with stream bed and abutments secure against erosion.
Subdivision Regulations	Regulates the division of land, standards for site access and utilities, slope protection, and road design	Riparian protection, steep slopes, emergency response, infrastructure, and access	New regulation under public review	Promote conservation subdivision to concentrate development in low hazard areas and protect infrastructure from natural hazard; restrict creation of new parcels in SFHA where possible; insure new parcels can be developed without impacting steep slopes.
Flood Hazard Area Regulations	Regulates development in FEMA flood hazard areas	NFIP, CRS member since the early 1990s	Reviewed as part of Zoning Bylaw rewrite	Prohibit critical facilities in SFHA; examine adopting bfe+2 standard; treat new structures as conditional rather than permitted uses in SFHA.
NFIP CRS Program	Improves Town outreach to individuals for map information, insurance promotion, hazard mitigation technical support and grant funding	Flood Hazard, Flood Hazard Mitigation	Seek recertification at level 7 or 8; currently level 9	Identify streamside parcels appropriate for restoration as natural floodplain function open space; encourage and support buyouts and elevation and floodproofing of structures; develop PIO with other departments to improve outreach while exploiting existing town mailings & webpage and private media.
Site Plan Review (SPR)	Site development standards	Stormwater, access, impervious surfaces, riparian impact	Reviewed as part of Zoning Bylaw rewrite	Require review of impacts of steep slope; implement more rigorous stormwater review; encourage LID; require erosion control.
Conditional Use Review	Regulation of new structures in SFHA	New impacts on SFHA	Current regulations allow development of new structures in flood fringe as permitted uses,	Establish strict standards for CUP for new structures in SFHA.
Zoning enforcement	Insures adherence to site plan, stormwater, erosion control and flood hazard regulations.	Flood, erosion	Training on proper stormwater structure construction and maintenance needed	Improved coordination with public works in evaluating stormwater and infrastructure improvements; coordinate training opportunities.

IDENTIFICATION AND ANALYSIS OF FUTURE MITIGATION ACTIONS

The attendees of the Hazard Mitigation Committee meetings identified the following new hazard mitigation activities based on an evaluation of hazard event vulnerability not addressed by existing hazard mitigation initiatives and on the feasibility of new activities.

Engineering Projects:

1. Relocation of the EOC: the current EOC has unsafe working conditions and poor telecommunications infrastructure. Replacing the center will improve functionality.
2. Police and Fire Communications Upgrade: current communications need to be improved to insure interoperability, reliability, and coverage. Antenna sites have been updated; additional equipment is being acquired.
3. Sunset Lake Road Bridge: the current span is undersized given channel width. This makes the structure more vulnerable to flood damage, increases risk of channel movement, and increases flood heights upstream. The replacement span will be longer, allowing for free passage of high water. The replacement will maintain access to the northwestern-most areas of West Brattleboro and to adjacent towns during emergencies. The roadway can be used as a detour route if other roadways into adjacent towns are damaged.
4. Chestnut Hill Dam improvements: the dam on this former reservoir lacks a spillway structure that would prevent failure during high water events. The improvement project will construct an overflow pipe to bring the dam into conformance with State dam safety regulations.
5. Cooke Road Bridge: this span was destroyed by Hurricane Irene, like the Sunset Lake project, the replacement span will be longer, allowing for free passage of high water. The replacement will help maintain a resilient road network during emergencies if alternate routes are damaged. It can serve as an alternate route to adjacent towns if Route 9 is damaged.
6. Pleasant Valley Toe Drain: the toe drain will monitor any groundwater flow through the earthen dam; sensors will give an alert if flow is detected, bringing the dam into conformance with State dam safety regulations. Dam break inundation mapping will allow for alerting and evacuating residents at risk.
7. Replacement or upgrade of Melrose Bridge: the existing bridge is the sole access to West Brattleboro. It is undersized, overtopped during floods, and causes increased flood elevations as it does not allow the free flow of floodwater volume. The project will include site acquisition to lengthen the span as well as engineering design work. The existing bridge has been evaluated by the Vermont Agency of Natural Resources with results published to the Stream Geomorphic Assessment Structure Database (https://anrweb.vt.gov/DEC/SGA/datasets/structures/reports.aspx?sid=543&option=view&phid=3&did=84) The database notes that the bridge entirely fills the flood plain and suffers poor alignment; it has upstream sediment deposits and is at risk of failure due to ice dams.
8. Main Street, Canal Street, South Main Street and Western Avenue targeted stormwater capacity upgrades: capacity constraints cause street flooding; runoff can cause erosion and road wash outs. The identified locations are vital traffic arteries in the Town-owned and maintained street system. The arteries serve critical private and public facilities. Projects will identify pipe segments and basins that require upgrades, design and implement improvements.
9. Brookside Condominiums/ Living Memorial Park stream bank restoration. The bank adjacent to Living Memorial Park and Brookside condominiums is failing due to fluvial erosion. The bank failure threatens basketball courts, a passive recreation area and a four dwelling unit condominium. The restoration project will alter the angle of recline, rip rap the lower slope, and use geotextile and plant material to stabilize the upper slope.

Third Party Projects:

1. Rail Track Upgrades: reduces risk of derailment and hazardous material spill. While the Town is not involved in this project, it will reduce an important hazard.
2. I-91 Bridge Replacement: this State project will increase road safety and capacity. Road traffic is detoured through Brattleboro when Interstate 91 is closed due to an accident. The bridge improvements will reduce the need for these detours, which slow emergency response times throughout the more populated areas of Town. The safety improvements will reduce the risks of hazardous waste spills and mass casualty events. The bridge replacement is needed to address serious design flaws in the original bridge.
3. Conservation and restoration of open land flood plain function lands in the Whetstone Brook watershed: the Town will support private efforts to buy and restore open space parcels in order to increase flood storage and reduce flood heights. The Town has worked with the Vermont River Conservancy and the West Brattleboro Association in the past to conserve the Locke farm parcel. Restoration projects will restore flood plain access for areas with deeply inscribed stream beds and allow for the restoration of natural meander belts.

Regulations

1. Riparian zone management: explore the benefit cost analysis of augmenting Vermont Agency of Natural Resource's review of fluvial erosion with regulations for smaller scale developments within the mapped Fluvial Erosion Hazard Area (FEHA).
2. Steep Slopes: regulations will direct development away from areas of steep slopes, reducing risks to property and loss due to landslides. Maintaining forest cover on steep slopes prevents increased runoff with the attendant risk of flash flooding.
3. Improved Access: regulations requiring two access roads for any new large development will help insure access during hazard events. Some developments have become inaccessible during emergency events when a lone access was damaged, destroyed or blocked.
4. Higher Standards for Bridges and Culverts: policy change will insure that new or rebuilt structures address storm and floodwater risk. Longer bridge spans allow the free passage of floodwaters, insuring continued emergency access. The free passage of floodwater prevents higher flood elevations upstream. Larger culvert size allows the free passage of stormwater, avoiding damage to property and infrastructure during increasingly frequent severe rain events.
5. Fire ISO recertification: maintaining a high ISO rating requires policies that help insure rapid emergency services to all parts of Town, reducing loss of life and property.
6. CRS recertification at 7 or 8: a higher rating will be accomplished by documenting an improved public information program; supporting buyouts in highest risk areas; preserving public lands as natural flood plain function open space; supporting flood proofing retrofits for flood fringe properties through technical assistance and grant applications; multi-hazard mitigation planning; early warning system; and, protection of open space for recreational purposes.

Buyouts and Relocations:

1. Mountain Home Park mobile home relocations: the Park has more than 70 dwellings located in the Special Flood Hazard Area of the Whetstone Brook. The homes are in repetitive loss and fluvial erosion hazard areas. There is an extensive history of evacuations and flood damage. Removing the homes and restoring the land's flood plain function will reduce risk to life and property in West Brattleboro.
2. Brattleboro Housing Authority Melrose Terrace relocation: Brattleboro Housing Authority has more than 80 semi-detached dwelling units located in the Special Flood Hazard Area of the

Whetstone Brook. The homes are in repetitive loss and a fluvial erosion hazard areas. There is an extensive history of evacuations and flood damage. Removing the homes and restoring the land's flood plain function will reduce risk to life and property in West Brattleboro.

Policies:

1. Identify structures in the dam inundation area for emergency alerts: there is a mapped dam inundation area for dam breaks on the West River. The map also captures inundation risks for most areas of Town for a dam break on the Connecticut River. An inundation wave will take an hour or more to propagate downstream to Brattleboro. The use of the Code Red public mass notification system to alert residents of structures at risk will reduce loss of life.
2. Drought Response Plan: in the past, drought response has been ad hoc. Creating a policy will help identify appropriate conservation actions for given drought conditions. The policy can outline public outreach actions. Adequacy of backup water supplies will be examined.

Training and Equipment:

1. NIMS/ICS training for senior staff and continuing training for emergency responders: training will facilitate coordination of town and multi-agency response to local or regional hazards. Town is coordinating training with other local agencies, including Brattleboro and regional schools.
2. School Crisis Multi-Agency Training: the Town has been facilitating a multi-agency planning effort to update the School Crisis Plan with table top exercises, staff training, and planned drills. The training effort includes identifying, purchasing and staging materials needed for an emergency response.

Program for Public Information:

1. Coordinate efforts of the Fire Department, Public Works, Parks & Recreation, and Planning to increase public awareness of flood event safety in the home and while driving, storm water system maintenance, proper pet waste removal and water quality, flood hazard mitigation, flood insurance promotion and other public information goals as identified in the outreach planning process.

NATIONAL FLOOD INSURANCE PROGRAM (NFIP) COMPLIANCE

The town of Brattleboro is a participating member of the NFIP and the Community Rating Systems (CRS). There are only three communities in the state of Vermont that participate in the CRS and Brattleboro is proud to be one of those three. Brattleboro is rated as a CRS class 9 community, which means that policy holders in Town receive a 5% discount on their flood insurance policies. Brattleboro has been a member of the CRS since September 1992. Brattleboro's participation is based on providing public flood hazard maps and information, insurance promotion, open space conservation, stormwater system maintenance, and structure removal.

●As of 2011, there were 111 flood insurance policies. During the Town's participation in the NFIP, there have been 63 flood insurance claims totaling $1,654,097. Claims were for 7 flood events on 8.30.2011, 8.29.2011, 8.28.2011, 10.7.2005, 10.8.2005, 10.9.2005, 8.30.2004, 8.31.2004, 9.16.1999, 2.11.1981, 5.26.1979, & 5.15.1978

●Brattleboro flood hazard regulations adhere to higher regulatory standards than FEMA minimum requirements; they require one foot of freeboard, prohibit residential development in the floodway and monitor cumulative substantial improvement with a rolling three year period.

●All new and substantially improved structures conform to NFIP standards, using elevation for residential structures and flood proofing or elevation for commercial structures. All repairs or improvements to structures in the SFHA must be permitted and the cost of improvements or repairs is tracked for ongoing compliance.

●Brattleboro participated actively in FEMA's map update for the community, adopting new maps on September 28, 2007.

●Records of all permits, elevation certificates, flood proofing certificates and LOMAs are kept and made available to the public on request.

●Brattleboro supplies map information, technical assistance and support for hazard mitigation grant applications for private land owners and members of the public.

●The Town conducts public information outreach to advertise these services to the public and notify land owners in the SFHA that they are eligible for flood insurance coverage.

●The Town maintains its stormwater system to minimize localized flooding.

●The Town maintains flood plain function open space in the SFHA; has supported private conservation efforts to preserve flood plain function open space; and has required the preservation of flood plain function open space as a condition of Planned Unit Development approvals.

●In addition, the Town maintains open space for recreation use in the SFHA.

●The Town insures that land preserved through structure buyouts remains undeveloped.

●The Town is supporting structure buyouts and structure elevation or floodproofing in the SFHA.

IMPLEMENTATION OF MITIGATION ACTIONS

Implementation of mitigation actions requires commitment of resources including; funds for construction or relocations sufficient trained personnel and, opportunities for coordinating mitigation actions with third parties. Prioritization of mitigation actions are subject to resource availability, damage from future disasters, and ongoing public support.

The Town has made use of the Hazard Mitigation Grant Program (HMGP) and Public Assistance (PA) grant funds to promote buyouts, stream bank stabilization, floodproofing, culvert replacement and bridge reconstruction. Homeland Security funds have been used to secure equipment and training as well as to support multiagency emergency response planning.

Mitigation efforts have been constrained in the past by lack of public acceptance of new regulations; the complexity and long timelines for buyouts and floodproofing grants; the difficulty of coordinating with private partners with complex governance structures; State historic designation findings; and public skepticism of natural hazard risks. In addition, the lack of a record of repetitive loss for properties located in repetitive loss areas make it difficult to justify mitigation actions due to a poor benefit cost analysis.

The town has worked with third parties to achieve mitigation goals, including the West Brattleboro Association, the Brattleboro Housing Authority, the Vermont Agency of Natural Resources, the Vermont River Conservancy, the Vermont Land Trust, Tri-Park Housing Cooperative, Housing Vermont, Inc, the Vermont Department of Housing and Community Development, the Brattleboro Area Farmers' Market and others. These collaborations will continue.

Mitigation activities and projects will draw on the existing administrative capacity of the town, including grant writing, project management, construction, site plan inspections by the Zoning Administrator/CRS coordinator and the Fire Department, and community organizing capacity.

For future projects, the town can draw on town capital funding from taxes, bonding authority, service in kind from town departments, Hazard Mitigation Project Grants, FEMA Public Assistance, Community Development Block Grants, EPA Sustainable Communities grants.

The Whetstone River Corridor plan identifies other potential funding sources that the town will consider for conservation, stormwater, structure relocation, riparian buffers, river restoration and other water quality projects: VT Agency of Agriculture, Food & Markets cost-share programs, ANR budget, Aquatic Nuisance Species Grant-In-Aid Program, American Rivers/National Oceanic & Atmospheric Administration, Better Backroads Program grant – Vtrans, Community Development Block Grant, Conservation Reserve Enhancement Program, State Revolving Loan Fund - Clean Water State Revolving Loan Fund, Environmental Contingency Fund, Vtrans Enhancement grant, Environmental Quality Incentive Program, Ecosystem Restoration Program grant – DEC, FEMA Hazard Mitigation Grant, Green Infrastructure Municipal Outreach Project, Green Mountain National Forest – USFS, Land Acquisition Review Committee – VDFPR, Analytical Services Partnership grants, VT Local Roads Program.

Private commercial and residential landowners will also contribute matching funds for some projects.

Volunteer labor has also been used for river restoration in the past, including the Youth Conservation Corp and members of the Brattleboro Area Farmer's market.

The town will search out additional funding and volunteer resources on a project by project basis.

RANKING OF MITIGATION ACTIONS

Mitigation actions are listed below in priority order, from the most critical needs to least. The following criteria were used by the Committee in establishing project priorities. The ranking of these actions is based on the best available information; some projects are not fully scoped out at this time.

- Does the action reduce damage?
- Does the action contribute to Town Plan goals?
- Does the action meet existing regulations?
- Does the action protect historic structures or structures critical to town operations?
- Can the action be implemented quickly?
- Is the action socially acceptable?
- Is the action technically feasible?
- Is the action administratively possible?
- Is the action politically acceptable?
- Does the action offer reasonable benefits compared to its cost of implementation?
- Is the action environmentally sound?

With the exception of the Chestnut Hill Reservoir project, all projects are new to this plan.

Table of Actions - Costs

High	**= >$100,000**
Medium	**= $25,000 – 100,000**
Low	**= < $25,000**

Table of Actions – Benefits

High	**Public Safety**
Medium	**Infrastructure/General Maintenance**
Low	**Aesthetics/Functionality**

The Table of Actions ranks the priority of the mitigation activities:

HAZARD BEING MITIGATED	VULNERABILITY ADDRESSED	PROJECT	RESPONSIBLE PARTY	TIME FRAME	FUNDING SOURCE	PROJECT PRIORITY	COST / BENEFIT	COMMITTEE RANKING
Flood / Dam Failure	Reduce risk of flood damage to area of low income, senior & disabled housing. Maintain critical infrastructure: the town reservoir.	Pleasant Valley Dam toe drain	Town of Brattleboro	Completed	Capital Utilities	High	H/H	Highest
All Hazard/ Flood/ Landslides/ Infrastructure Catastrophic Failure/ Highway Accidents	Maintain road access; reduce risk of structure failure.	Higher standards for bridges and culverts	Public Works	2014-2016	Department Budget	High	H/H	Highest
Flood	Maintain major artery: Western Avenue; emergency access to all areas of town in flood	Melrose Bridge replacement with design and land acquisition	State of Vermont Town of Brattleboro	2014-2019[1]	TBD	High	H/H	Highest
Flood, Infrastructure Catastrophic failure	Flood risk to persons caused by driving in flooded area, stormwater system failures; water contamination	Public Information Outreach Plan	Town of Brattleboro	2015-2016	Existing department budgets	High	L/H	Highest
All Hazard	Maintain emergency communication; allow inter-agency communication.	Police and Fire communication upgrade	Town of Brattleboro	2013-2015	General Fund VComm Grant Homeland Security Grant	High	H/H	Highest
Flood/ Mass Casualty Event	Remove Senior & Disabled persons from SFHA	Support Brattleboro Housing Authority Melrose Terrace relocation	Brattleboro Housing Authority	2013-2016	TBD HMGP CDBG-DR	High	H/H	High
Flood/ Mass Casualty Event	Remove Low Income, Senior & Disabled persons from SFHA	Support Tri-Park mobile home relocation	Tri-Park Cooperative Housing	2013-2019[2]	TBD HMGP CDBG-DR	High	H/H	High
Flood/ Structure Failure	Maintain critical infrastructure: Sunset Lake Road	Sunset Lake Road Bridge replacement with longer span	Public Works	completed	HMGP	High	H/H	High
Structure Fire	Reduce fire risk to all citizens	Fire ISO recertification	Fire Department	completed	Department Budget	High	L/H	High
Flood/ Landslide	Preserve multiunit housing, & town recreation area; protect residents	Brookside Condo/ Living Memorial Park stream bank restoration	Recreation Department/ Brookside Condominium	2015-2019[3]	HMGP Private Funds	High	H/H	Medium
Flood/Dam Failure	Protect area of dense housing; maintain critical infrastructure: Western Avenue; protect residents	Chestnut Hill Dam improvements	Public Works	2015-2017	Capital Utilities	High	H/H	Medium
Flood/ Landslides	Maintain roadways; prevent damage to housing; protect residents	Targeted stormwater system upgrades	Public Works	2014-2019 ongoing	TBD	High	H/M	Medium
Flood	Protect structures, access and residents	Steep slope regulations	Planning	2015	Planning Grant/ Department budget	High	H/M	Medium
Flood	Improve flood resilience.	CRS recertification at 8 or 7 level	Zoning Administrator	2016	Department Budget	Medium	L/H	Medium

HAZARD BEING MITIGATED	VULNERABILITY ADDRESSED	PROJECT	RESPONSIBLE PARTY	TIME FRAME	FUNDING SOURCE	PROJECT PRIORITY	COST / BENEFIT	COMMITTEE RANKING
All Hazard	Improve town services	Relocate EOC with reliable electric supply and communication links	Town of Brattleboro	2015-2019[4]	Town Bonding	Low	H/M	Low
All Hazard/ Flood	Preserve emergency services access	Improved access regulations	Planning	2015	Department budget	Low	L/H	Low
Flood	Protect water quality	Riparian zone management	Planning	2016-2019	TBD	Low	L/L	Low
Hazardous Materials/ Highway Accidents/ Mass Casualty Events/ Catastrophic infrastructure failure	Maintain emergency services access	I-91 Bridge replacement with improved capacity, safety	State of Vermont	2014-2016	State	NA	NA	NA
Hazardous Materials/ Mass Casualty Events	Protect residents.	Rail track upgrade	Boston & Maine Railroad Company	2013-2015	Private	NA	NA	NA
Flood	Reduce flood heights, protect structures and residents	Conservation of Natural Flood Plain Function parcels in Whetstone Brook Watershed	Private Conservation Organizations	2015-2019 ongoing	State HMGP Private	NA	NA	NA

1. The Town has requested that the project be placed on the State's priority list.
2. The Town has helped Tri-Park to secure funding grants to improve institutional management and finances; relocation will require additional grants. Tri-Park has requested Town assistance to secure grants.
3. This project is linked to a proposed park improvement project; it will not go forward at this time if the park project is abandoned.
4. This project is part of a larger project to replace the Police and Fire facilities; it will not go forward at this time if the larger project is abandoned.

2010 BRATTLEBORO HMP AND POST IRENE MITIGATION ACTIONS PLAN REVIEW

Brattleboro has completed the actions adopted in the 2010 Hazard Mitigation Plan except for the Chestnut Hill Dam Filling Project. That project was rejected by citizens who wished to maintain the reservoir, a historic and scenic resource. The risk reduction goals of the action will be achieved through the construction of an overflow structure; the project is identified as an action in this plan.

Brattleboro reconsidered hazard mitigation activities in light of Hurricane Irene. Reconstruction projects were designed to reduce future risks through higher standards; the Town also supported property buyouts. Replacement bridge spans are longer and new culverts are larger to accommodate high water. Private property owners have been encouraged to incorporate flood resistant repairs as they rebuild. The Town has put renewed support behind removing dwelling units from the SFHA.

Since the 2010 Hazard Mitigation Plan, mitigation efforts have lengthened three bridges; replaced 6 undersized culverts and added 3 culverts to Ames and Barrows Roads to prevent future washouts; removed 22 residences from the SFHA; and, floodproofed critical infrastructure in the SFHA: the Wastewater Treatment Plant and the Spring Tree Pumping Station. These efforts have decreased risk from flood, infrastructure catastrophic failure, and water supply contamination.

The 2010 Brattleboro Hazard Mitigation plan identified the following actions:

Engineering Projects	Status:
Chestnut Hill Dam Filling Project	The project was redesigned to reflect community input and address identified hazard
Water/Wastewater Plant Upgrade	The project is substantially complete; new structures conform to NFIP Standards
Strand Avenue Retaining Wall Project	The project has been completed
Creamery Bridge Replacement	The project has been completed
Equipment Purchase	
Fire Department Pumper Truck Replacement	The pumper truck has been replaced
Policy Changes	
Completion of SGA Phase 3 River Corridor Management Plan	The plan has been completed. A new study to reflect changes caused by Hurricane Irene is planned. Implementation of new regulations is a goal of the Town Plan.

Brattleboro's response to Hurricane Irene reconstruction has included activities to increase future flood resilience:

Engineering Projects	Status:
Creamery Bridge slope stabilization and restoration	Complete
Ames Hill and Barrows Road culvert upsizing and stone lining of ditches	Complete
Stark Road Bridge, reconstruction with longer span	Complete
Cooke Road Bridge, replacement with longer span	Complete
Buyout	
805 Western Avenue, a substantially damaged residence	The buyout is in process
Hazard Mitigation Grant	
427 Marlboro Road, flood proofing of a repetitive loss property	The Town has submitted a HMGP application.
Regulation Implementation	
Flood Hazard ban on reconstruction of residences in floodway	19 homes removed from a repetitive loss area
Flood Hazard substantial improvement	2 structures retrofitted to conform to NFIP standards
Flood Hazard permit requirements	66 structures repaired with flood resistant materials to minimize future flood damage
Tri Park/Town mobile home relocation agreement	3 homes removed from a repetitive loss area
Equipment & Training	
Swiftwater Rescue	New advanced rescue training; purchased cold water rescue raft; joined State Swiftwater Rescue Task Force

PLAN MAINTENANCE PROCESS

MONITORING, EVALUATING, AND UPDATING THE PLAN

An annual review of the plan will be completed by the Town's Hazard Mitigation Committee (comprising Department Heads, the Emergency Management Director and Town Manager). The Plan will be updated in 2016, 2017 and 2018 to reflect the following:

- Progress on implementation of Plan policies, projects and related objectives
- Any FEMA disaster declaration and/or funding received from FEMA
- To record any hazard related events
- To determine if the Town will apply for a hazard mitigation grant
- To review FEMA recommended revisions for an amended plan
- Review Planning Department Annual Progress Report
- Identify structures and engineering projects that can achieve mitigation objectives (e.g. bridge and culvert replacements, road replacement, retrofits or relocations of repetitive loss structures)

All plan review meetings will be warned and open to the public. Public hearings will be held prior to any significant revisions to the plan. The plan and any proposed revisions will be posted on the municipal website with information on how the public can direct questions/comments to the planning team.

Rod Francis, Planning Director will be responsible for preparing the Planning Department Annual Progress Report which will contain a review of completed mitigation actions, changes in physical conditions, changes in FEMA and other policies affecting the Plan and the status and effectiveness of regulatory and grant based projects;. This Annual Progress Report will be circulated publicly and discussed at a regularly warned Planning Commission meeting each year. The public will be encouraged to participate in this review. Brian Bannon, the Zoning Administrator/CRS coordinator, will have responsibility for maintaining updates intended for a 2020 draft plan noting the completion of projects; inclusion of new projects; new data or studies addressing hazard mitigation; changes in funding or town capabilities; and new hazard events.

The Planning Commission monitors the effectiveness of land use regulation and other town policies in meeting hazard mitigation goals and objectives as adopted in the Town Plan implemented by specific projects identified in this plan.

The Planning Department will be responsible for the 2020 update. The Annual Review of 2019 will look back at the progress made over the past three years and identify gaps or changes in approach taking place throughout the life of the Plan. The 2019 review will compile data and look for trends that require a response in the new plan (based on work completed for the amended 2020 Town Plan).

INCORPORATING INTO EXISTING PLANNING MECHANISMS

The following policies, programs and activities related to hazard mitigation are currently in place and/or being implemented in the town of Brattleboro. The Committee analyzed these programs for their effectiveness and noted improvements needed. Brattleboro uses the plans listed below to respond to hazard events within the Town. For example: the Basic Emergency Operation Plan has a contact list that is used to coordinate multi-agency response in the case of a hazard event. The Town Plan directs goals and objectives including those concerning natural resources and land-use. Road standards are followed by the Town and an annual culvert and bridge inventory is maintained. The Town is compliant with the NFIP.

Type of Existing Protection	Description	Hazard that is addressed	Incorporation of Hazard Mitigation Goals
Town Budget	Projects will be incorporated based on emergency needs, capital budget, in-house ability to carry out projects, administrative capacity, and availability of grant funding.	Town Budget	Projects will be incorporated based on emergency needs, capital budget, in-house ability to carry out projects, administrative capacity, and availability of grant funding.
Town Capital Planning Matrix	Projects will be reviewed for compatibility with HMP goals; availability of hazard mitigation funding will help prioritize projects; immediate hazardous conditions are prioritized	Town Capital Planning Matrix	Projects will be reviewed for compatibility with HMP goals; availability of hazard mitigation funding will help prioritize projects; immediate hazardous conditions are prioritized
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, etc.	Flooding, fluvial erosion, steep slopes, municipal facilities, infrastructure failure	The Town Plan revision to be adopted in 2018 will incorporate the new State requirement for a flood resilience plan. Goals from the 2013 Town Plan and the 2015 HMP will be reviewed and updated. Chapters on Economic Development, Natural & Historic Resources, Agriculture, Housing, Municipal Facilities and Land Use are reviewed in part for hazard mitigation opportunities.
Emergency Operations Plan	Municipal procedures for emergency response with multi-agency cooperation	All hazards	HMP based on Town Plan goals and objectives. Town Plan update will incorporate flood resilience planning in accord with revised state requirements. Chapters will incorporate hazard impacts.
School Emergency Response Protocol	Multi agency procedures for emergency response	School crisis	Public Information Outreach included in HMP PIO project. Future equipment and training needs incorporated in HMP updates
LEPC 6 Hazardous Materials Plan	Procedures for hazmat emergency response at regional level	Hazardous materials	Public Information Outreach included in HMP PIO project. Future equipment and training needs incorporated in HMP updates
Mutual Aid – Emergency Services	Agreement for regional coordinated emergency services	Structure fire, hazardous materials, highway accidents	Public Information Outreach included in HMP PIO project. Future equipment and training needs incorporated in HMP updates
Mutual Aid – Public Works	Agreement for regional coordinated emergency highway maintenance services	Winter & ice storm, infrastructure catastrophic failure, water supply contamination	na
Mutual Aid – Water and Waste Water	Vermont Rural Water Association offers training and spare part exchange	Water supply Contamination	State led Emergency response training for personnel of public water supply facilities; parts and material sharing for facilities repair.
Road Standards	Design and construction standards for roads and drainage systems	Flood, infrastructure catastrophic failure,	Updates will be based on evolving understanding of risk changes due to climate change as outlined in Plan
Subdivision Regulations	Regulates the division of land, standards for site access and utilities, slope protection, and road design	Riparian protection, steep slopes, emergency response, infrastructure, and access	Regulations will respond to risks associated with flooding and steep slopes as outlined in Plan
Sewage Regulations	Regulates on-site sewage systems	Water quality	Facility updates include flood proofing. Future replacement or upgrades to sewer pipes will examine risk of flood damage and water contamination.

Type of Existing Protection	Description	Hazard that is addressed	Incorporation of Hazard Mitigation Goals
Flood Hazard Area Regulations	Regulates development in FEMA flood hazard areas	NFIP, CRS member since the early 1990s	Higher standards will be adopted to prohibit new critical facilities in SFHA; fluvial erosion hazard regulations will be considered as outlined in Plan; Flood Hazard review approvals must be compatible with HMP per ordinance
NFIP CRS Program	Improves Town outreach to individuals for map information, insurance promotion, hazard mitigation technical support and grant funding	Flood hazard, flood hazard mitigation	Will include improved public information outreach; improvement to stormwater maintenance record keeping; preservation of open space and open space flood plain function lands, including identification of existing public lands suitable for flood plain restoration as outlined in plan.
Site Plan Review (SPR)	Site development standards	Stormwater, access, impervious surfaces, riparian impact	Implement steep slope regulations improve erosion control and stormwater management, including encouraging LID best management practices
Green Mountain Power Line Maintenance	Tree and brush clearing	Wind, power failure	Encourage relocation of power poles located in SFHA
Conditional Use Review	Approval must meet HMP goals and Town Plan Future Land Use hazard mitigation and Natural Resource protection goals.	Conditional Use Review	Approval must meet HMP goals and Town Plan Future Land Use hazard mitigation and Natural Resource protection goals.
Zoning enforcement	Enforce stricter land use standards called for in the plan	Zoning enforcement	Enforce stricter land use standards called for in the plan

APPENDICES

A. Hazard Mitigation Committee minutes
B. Planning Commission minutes
C. Selectboard hearing minutes.
D. Plan update drafting process
E. Maps
F. Hazard Mitigation Projects
G. EPA Smart Growth Implementation Project; Brattleboro letter of interest

Appendix A:

Hazard Mitigation Committee
June 5, 2014
11:00 A.M. Meeting

Present: Patrick Moreland, Michael Fitzgerald, Michael Bucossi, Peter Lynch, Rod Francis, Brian Bannon
Public: none.

1. **Meeting called to Order**

Francis called the meeting to order and asked for comments on the June 4th draft circulated before the meeting.

2. **Hazard Mitigation Programs, Projects and Activities**

The group reviewed mitigation activities from the 2010 plan to update their status. Hazard mitigation activities taken in response to Hurricane Irene were identified. Activities in development or planned for the period of the new plan were identified; detailed descriptions were given.
The group reviewed the Incorporating into Existing Planning Mechanisms grid from the 2010 plan. Activity descriptions were clarified and given detail. Hazard addressed was pulled out as a separate field to simplify the grid.
The group agreed that edits would be circulated and reviewed by email and changes incorporated into the draft.

3. **Adjourn**

The meeting was adjourned at 12:45

Hazard Mitigation Committee
August 20, 2014
11:00 A.M. Meeting

Present: Patrick Moreland, Michael Fitzgerald, Michael Bucossi, Peter Lynch, Rod Francis, Brian Bannon
Public: none.

1. **Meeting called to Order**

Francis called the meeting to order and asked for comments on the working draft dated 6.5.2014 circulated before the meeting. Some minor changes were suggested.

2. **Hazard Mitigation Programs, Projects and Activities, Ranking.**

The group reviewed mitigation activities draft grid and detailed description from the 2014 plan. Additional activities were identified. The group discussed ranking methodology, funding sources, responsible entity, and project completion time. The group offered rankings for the identified activities based on departmental expertise. There was broad consensus. The group discussed barriers to implementation and alternative activities. The group discussion was based on a benefit cost calculation with costs based on staff time, direct project costs, and costs to the public. Most projects identified were aimed at life safety improvements. Some were operational improvements, which were seen as of secondary importance. Communications upgrades could be viewed as an operational improvement, but it was felt that the communications failures were a life safety concern.
Comments on the Incorporating into Existing Planning Mechanisms grid 2014 draft were made.
The group agreed that edits would be circulated and reviewed by email and changes incorporated into the draft.

3. **Adjourn**

The meeting was adjourned at 1:00

Appendix B: Planning Commission Minutes

Brattleboro Planning Commission
Monday, June 30, 2014
Selectboard Meeting Room
6:00 PM

Present: David Cadran, Liz McLoughlin, Karolina Oleksiw, James Valente, Timberly Hund (arrived 6:30)
Public: Kathy Urffer
Staff: Rod Francis, Brian Bannon Acting Police Chief Michael Fitzgerald Fire Chief Michael Bucossi and Interim Town Manager Patrick Moreland

A. Meeting called to Order
Mr. Valente called the meeting to order at 6:04PM.

B. Approve Minutes of June 17, 2014
Ms. Oleksiw moved approval of the June 17 2014 minutes. Ms. McLoughlin seconded the motion. Pass 4-0

C. Announcements
None

D. Public Comment
None

E. Hazard Mitigation Plan
Mr. Valente introduced Mr. Francis to discuss the Draft Hazard Mitigation Plan (HMP). Mr. Francis spoke to a memo prepared for Commissioners (see packet) that addressed the reasons why the Town maintains a HMP including:

- The fiscal benefits deriving from a plan recognized by the Vermont Division of Emergency Management and Homeland Security (DEMHS) and the Federal Emergency Management Agency (FEMA) by earning eligibility for the VT Emergency Relief and Assistance Fund (ERAF). This reduces the cost to the Town for incidents receiving a federal declaration in recognition of ongoing mitigation efforts.
- Reducing impacts of natural and human-caused hazards through changing behaviors, investing in appropriate physical infrastructure, and using long-term land use and capital planning to avoid exposure to risk.

Mr. Francis explained that the Planning Commission has through its work on the 2103 Town Plan identified land use regulations and long term development patterns that needed to be amended in light of lessons from TS Irene and experience with the topography and settlement patterns of Brattleboro. Amending policies and changing the settlement patterns long term will reduce the amount of land development in the Special Flood hazard Area (SFHA), reduce development on steep slopes and reduce demands on Emergency Services (thus reducing risk to Personnel) While positively contributing to water quality efforts. Development to minimize cost of emergency services, reduce development in SFHA, protect steep slopes, stormwater standards.

Mr. Francis reviewed the plan for the Commission noting that it closely follows a State template:

1. Risk identification and ranking

2. Documentation of public participation
3. Repetitive loss area
4. Mitigation goals
5. Polices and projects

McLoughlin asked about the level 3 Stream Geomorphic Assessment (SGA) river corridor plan. Mr. Francis explained that this was a follow-up to an earlier SGA to determine changes to stream conditions caused by Hurricane Irene.

Mr. Moreland remarked on the importance of getting the plan completed to insure State and Federal emergency support; and noted that Town Departments worked to identify hazards specific to their areas of responsibility.

Mr. Francis explained that the Town needed to submit the HMP to maintain ERAF eligibility, which occurs upon submission to DEMHS. FEMA may take up to 18 months to approve plan due to backlogs at the Region 1 office in Boston. If accepted, plan is in effect for 5 years.

Chief Bucossi remarked that the Town's location at the center of a network of converging highways introduces regional scale into local crisis identification and response.

Ms. Oleksiw asked why wildfire was not a risk; Chief Bucossi responded that the Town does not have the urban/forest wildfire interface of some areas and has a safer mix of vegetation. Fire accessibility was also addressed: State resources like helicopters are available. Most forest areas are surrounded on all sides by Town roads; the ability to establish a perimeter is enough to contain fires even if getting into the centers of the forest blocks can be difficult.

Mr. Valente asked about a radiological emergency; Chief Bucossi reminded Commissioners that there is a federally required Radiological Emergency Response Plan (RERP) through the Nuclear Regulatory Commission (NRC) which establishes procedures and protocols and is drilled on regularly. Chief Bucossi noted that such an incident has a lower probability than emergencies such as a train derailment with a hazardous materials involvement.

Mr. Cadran asked if it were possible to mitigate against mass shooting events; Acting Chief Fitzgerald noted that they could occur as a mass casualty or school crisis event; he discussed community outreach to work with businesses on security planning. The Town reviews security plans for large businesses. The Town adopts known best practices and shares this information with private entities.

Mr. Valente asked if the plan should focus on the Brattleboro Retreat Hospital. Acting Chief Fitzgerald responded that officers are trained to focus on actions and behaviors not the identities of individuals present at an incident and noted that all officers are trained in responding to a mental health crisis, and domestic violence.

Mr. Cadran asked about how the public is notified in an emergency—is it still sirens? Mr. Moreland replied that the Town has the Brattleboro Emergency Notification Systems (BENS) which has the ability to 'push out' targeted messages based on address or personal information and that the Public Announcement through local media and other sources are effective.

Ms. Oleksiw asked why the winter storm/ice storms of 2009 was not included. Mr. Francis noted that the plan draws on National Oceanic and Atmospheric Administration (NOAA) weather event almanac of declared disasters to establish patterns and assign risk.

McLoughlin made a motion to recommend the Hazard Mitigation Plan to the Select Board with changes made as noted; Cadran seconded the motion. The motion passed 5-0-0

D: Adjournment
Ms. Oleksiw moved to adjourn the meeting at 7:20PM. Ms. McLoughlin seconded the motion. Pass 5-0-0

Respectfully submitted: R Francis

Appendix C: Selectboard Minutes (excerpt)

BRATTLEBORO SELECTBOARD
TUESDAY, SEPTEMBER 2, 2014
EXECUTIVE SESSION – 5:15PM
REGULAR MEETING – 6:15PM
MINUTES

Selectboard members present: David Gartenstein, Kate O'Connor, David Schoales, John Allen, and Donna Macomber.

Staff present: Interim Town Manager Patrick Moreland, Town Attorney Robert Fisher, Recreation & Parks Director Carol Lolatte, Planning Services Director Rod Francis, Police Chief Mike Fitzgerald, Dispatch Supervisor Wayne Stires, and Executive Secretary Jan Anderson.

Media present: Tim Johnson representing WTSA, Howard Weiss-Tisman representing the Brattleboro Reformer, and Olga Peters representing The Commons.

Others present: Patty Fitzgerald, Marty Fitzgerald, Francine Vallario, Richard Guthrie, Marjorie Guthrie, Melissa Clark, Jeff Clark, Ken Vitale, Jane Rosser, Les Montgomery, Simrin Socci, Christine Riccio, Jane Sonntag, Christian Hanby, Tom Robertson, Lester Humphreys, Betsy Gentile, Kathy Andrew, Ralph Palmer, Claudia Jacobs, Aaron Goodfellow, Andrea Watkins, Scott Dixon, Andrew Davis, Paul Cameron, Jacob Roberts, Jim Latchis, Joe Bushey, Fric Spruyt, Christian Evard, Cathy Andrew, ASL Interpreters Elizabeth Bjerke and Janet Dickinson, BCTV staff and volunteers, and others who did not sign the attendance sheet.

Chair Gartenstein called the meeting to order at 5:16pm in the Selectboard meeting room. He confirmed that the meeting was properly warned.

MOTION BY DAVID GARTENSTEIN TO ENTER EXECUTIVE SESSION TO DISCUSS CONTRACTS, MEDIATION, PROBABLE CIVIL LITIGATION TO WHICH THE PUBLIC BODY MAY BE A PARTY, CONFIDENTIAL ATTORNEY-CLIENT COMMUNICATIONS MADE FOR THE PURPOSE OF PROVIDING PROFESSIONAL LEGAL SERVICES TO THE TOWN AND SELECTBOARD, AND THE APPOINTMENT OR EMPLOYMENT OR EVALUATION OF A PUBLIC OFFICER OR EMPLOYEE, AND AS TO ALL OF THOSE A FINDING THAT PREMATURE GENERAL PUBLIC KNOWLEDGE WOULD CLEARLY PLACE THE TOWN AND THE PEOPLE INVOLVED IN THE PROCESS AT A SUBSTANTIAL DISADVANTAGE. THE INTERIM TOWN MANAGER, THE TOWN ATTORNEY, AND POLICE CHIEF MIKE FITZGERALD WERE INVITED INTO SOME BUT NOT ALL OF THE EXECUTIVE SESSION. MOTION CARRIED 5-0.

Chair Gartenstein reconvened the meeting at 6:15pm.

APPROVE MINUTES

MOTION BY JOHN ALLEN TO APPROVE THE MINUTES FROM AUGUST 19, AUGUST 21, AND AUGUST 26, 2014, AS PRESENTED. MOTION CARRIED 5-0.

CHAIR'S REMARKS

Chair Gartenstein noted that several paving projects had been completed and asked that drivers follow the speed limits and exercise caution on the improved roads, particularly with schools in session. He discussed traffic safety improvements near Academy School that had been completed and other projects that would be completed in the future. He said that the Brooks House was re-opening after being refurbished, and he welcomed CCV and Vermont Technical College to their new locations in the Brooks House. He noted that the Board continued to work on four ongoing projects, including the Town Manager search, skatepark site selection, Police-Fire project, and Police Chief search, and said that the Board would soon decide some of those matters. Gartenstein announced that former Police Captain Mike Fitzgerald had been selected by the Interim Town Manager to fill the Police Chief position. He reviewed the interview and hiring process, and wished Chief Fitzgerald well in his new position.

MANAGER'S COMMENTS

Interim Town Manager Moreland congratulated Mike Fitzgerald as the newly appointed Police Chief. Moreland discussed the interview process and he thanked the four Police Chief Search committees, being the Community Committee, Selectboard and Staff Committee, Police Officers Committee, and Evaluations Committee, for their valuable input into the selection of the chief. Moreland said that Chief Fitzgerald was born in Brattleboro and graduated from BUHS. He said that after graduation, Fitzgerald entered the Marine Corps and retired as Gunnery Sergeant after a distinguished twenty-year career. He said that Fitzgerald then returned to Brattleboro, was hired as police officer, and worked his way up to Captain in eight years. Moreland said that through the interview process, Fitzgerald articulated a clear and concise vision for the role of the police department within the community, which was consistent with community's desire. He encouraged the public to meet Chief Fitzgerald and welcome him to his new position.

SELECTBOARD COMMENTS AND COMMITTEE REPORTS

O'Connor thanked Police Chief Fitzgerald for his recent communications with the downtown merchants. Schoales said that he suggested that the nutrition and education grant group, to which he was appointed by the Selectboard, invite Police Chief Fitzgerald to become involved. Schoales also discussed joint efforts between the School District and Town to promote safety in the area of Academy School with the purchase and installation of new radar signs and the purchase of a LED button activated crosswalk sign that would be installed soon.

PUBLIC PARTICIPATION

Retired Police Chief Richard Guthrie congratulated Police Chief Fitzgerald on his appointment as Police Chief. Guthrie said that remembered Fitzgerald when he was a student in Brattleboro, and that he continues to visit students at the Career Center and encourage them to contribute to the community after graduation. He thanked Chief Fitzgerald for his years of service to his country and the Brattleboro community.

Lester Humphreys, Chair of the Energy Committee, and Paul Cameron, Energy Coordinator, were in attendance to present two awards to the Town. Humphreys said that the first award, from the Vermont Energy and Climate Action Network, was the 2013 Best Overall Energy Committee award. He said that the award was the result of a group effort between the Energy Committee, Energy Coordinator, Selectboard, Town Manager, and staff. He read the accomplishments noted in the award. Cameron said that it was a pleasure working with the passionate and dedicated members of the Energy Committee. He said that the second award was being presented to Brattleboro for its participation in the Vermont Home Energy Challenge, a year-long project to encourage weatherization efforts in homes. He said that the award came with a $10,000 grant to be used for an energy efficiency projects in town facilities or buildings, and that would be addressed later in the meeting.

Jane Rosser spoke to request that speakers identify themselves and the towns in which they reside.

NEW BUSINESS

Approve Hazard Mitigation Plan – *Planning Services.* Planning Director Francis said that the Board was asked to approve the All Hazard Mitigation Plan for the Town. He said that the Town was recently notified by FEMA that its 2009 Hazard Mitigation Plan would no longer be acceptable due to changes in Federal regulations. He discussed the need for the plan and the financial effects on the Town by having such as plan. There was some discussion by the Board about the Plan and the need for it. Gartenstein said that he had minor edits to the Plan which he would provide to Francis and asked that the edits be incorporated before finalizing the Plan.

MOTION BY DONNA MACOMBER TO APPROVE THE 2014 BRATTLEBORO HAZARD MITIGATION PLAN. MOTION CARRIED 5-0.

Accept and Appropriate Grant – *Bulletproof Vest Partnership Grant, Brattleboro Police Department.* Police Chief Fitzgerald said that the Board was asked to accept and appropriate a grant in the amount of $1,863.95 from the Bureau of Justice Assistance to purchase six new bullet proof vests for the Police Department. There was no discussion by the Board.

Appendix D: Plan Update Drafting Process

1. UPDATES TO 2010 HMP

The 2010 Local Hazard Mitigation Plan was an annex to the Windham Regional Commission Multi-Jurisdictional Plan. The Multi-Jurisdictional Plan expired in 2012 as did the annexes. The Town based this new 2014 plan on the 2010 Local HMP annex. In addition, the plan relies heavily on the 2013 Brattleboro Town Plan, which engaged in extensive consideration of natural hazard and public policy. The Brattleboro Planning Department took the lead role in drafting the update. Drafts were reviewed by the larger Hazard Mitigation Committee and subject to review by the public, the Brattleboro Planning Commission, and the Brattleboro Select Board. In addition, targeted stakeholder interviews were held with Department heads. The plan was discussed with key private partners planning hazard mitigation efforts in the 2014 HMP's time span; these discussions included State personnel where possible.

The Hazard Mitigation Committee reviewed a working draft, with comments integrated into the plan in two major revisions.

The plan was circulated for public comment; no comments were received.

The Planning Commission and Select Board noted some drafting errors that were corrected.

The final draft was reviewed by the Hazard Mitigation Committee (HMC), reviewed and approved by the Planning Commission, and reviewed and approved by the Selectboard.

The following details revisions, additions or replacements made to the 2010 HMP:

INTRODUCTION AND PURPOSE *revised by Planning Department, reviewed by HMC*
BRATTLEBORO GEOPGRAPHY & TOWN PROFILE *excerpted, Brattleboro Town Plan*

PREQUISITES

Adoption by the Local Governing Body *updated by Planning Department, reviewed by HMC*

PLANNING PROCESS

Planning Participation, *new, drafted by Planning, reviewed by HMC*
Documentation of the Planning Process *new, drafted by Planning, reviewed by HMC*
Public Participation *new, drafted by Planning, reviewed by HMC*

RISK ASSESSMENT

Identifying & Profiling Hazards, *the HMC reviewed the 2010 HMP, making minor changes and additions.*
Assessing Vulnerability: Overview, *"The Hazard Mitigation Committee reviewed the hazard table as adopted in the Brattleboro, VT Local Hazard Mitigation Plan Update 2010 annex of the Windham Regional Commission's Regional All Hazard Mitigation Plan. The Committee members modified the table based on the past four years' experience, particularly the experience of flooding from Hurricane Irene. The Committee members felt the "number of properties damaged" in the ranking formula versus the level of impact on the Town was not realistic given their experience."*
Assessing Vulnerability: Addressing Repetitive Loss Properties, *new, drafted by Planning from FEMA data, HMC reviewed*.

Assessing Vulnerability: Identifying Structures, *new, drafted by planning, FEMA and local data, HMC reviewed.*
Assessing Vulnerability: Analyzing Development Trends, *new, Brattleboro Town Plan data, drafted by Planning, reviewed by HMC*

MITIGATION STRATEGY

Hazard Mitigation Goals, revised 2010 HMP
Hazard Mitigation Objectives, *new HMC*
Existing Hazard Mitigation Programs, Projects and Activities, *revised and updated, "The Committee analyzed these programs for their effectiveness and noted any improvements needed*."
Identification and Analysis of Mitigation Actions, *new "The attendees of the Hazard Mitigation Committee meetings identified the following new hazard mitigation activities based on an evaluation of hazard event vulnerability not addressed by existing hazard mitigation initiatives and the feasibility of new activities."*

National Flood Insurance Program (NFIP) Compliance *new, based on CRS program participation certification documents, target interview, drafted, Planning, reviewed by HMC*

Implementation of Mitigation Actions, *barriers to implementation, resources, benefit cost analysis based on HMC discussion and comments; extensive excerpt from town plan.*

PLAN MAINTENANCE PROCESS

Monitoring, Evaluating, and Updating the Plan *drafted by Planning based on review and revision HMC.*
Incorporation into Existing Planning Mechanisms *revised by HMC "The Committee analyzed these programs for their effectiveness and noted improvements needed"*

2. WINDHAM REGIONAL REVIEW

The draft plan was reviewed by Alyssa Sabetto of the Windham Regional Commission; she suggested elaborating on Town Plan goals that support hazard mitigation, barriers to or resources for mitigation, expanded discussion of the vulnerability assessment, and additional information on impact of development on vulnerability.

3. FEMA REVIEW AND REVISIONS

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or**	**Met**	**Not Met**
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Planning Process, pp. 8-10; App. A, pp. 41-43; App. B, pp. 44-46; App. C, pp. 47-48; App. D, pp. 49-50	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Planning Process, pp. 8-10; App. A, pp. 41-43; App. B, pp. 44-46; App. C, pp. 47-48; App. D, pp. 49-50	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Public Participation, pp. 9-10; App. A, pp. 41-43; App. B, pp. 44-46; App. C, pp. 47-48; App. D, pp. 49-50		**X**
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Citations mostly on maps (but are legible) – missing other info		**X**
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Monitoring, Evaluating, and Updating the Plan, p. 38	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Monitoring, Evaluating, and Updating the Plan, p. 38		**X**

ELEMENT A: REQUIRED REVISIONS

A3: Although the plan documents how the public was given the opportunity to be involved in the planning process, there is no description of their how their feedback was incorporated into the plan. **Describe how any submitted comments or feedback from the public were incorporated into the plan.** If no feedback was received during the planning process, the plan must state this. p. 7, last paragraph

A4. Document what information was used to develop the risk assessment. For example, there is no indication that national weather data or historical records or geologic information was reviewed and incorporated to develop and update the risk assessment. P. 5, Review of Supporting Materials
Suggestion: Consider adding a narrative to the planning process for the review and incorporation of plans, studies, reports, and technical information by the planning team. Add additional citations or notes to what the sources were in the risk assessment text for the previous occurrence information and any other relevant reports significant to note such fluvial erosion studies.

A6. The section on Monitoring, Evaluating, and Updating the Plan on page 38 **needs additional information**. Clarify if and how the annual monitoring will track the implementation over time; how will the evaluation or assessment the effectiveness of the plan at achieving its stated purpose and goals; and who, when and how will the 5 year plan update occur.
p. 33

ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Identifying and Profiling Hazards, pp. 10-19; Assessing Vulnerability, pp. 19-21, 23, 25		**X**

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or	**Met**	**Not Met**
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Identifying and Profiling Hazards, pp. 11-19; Assessing Vulnerability, pp. 19-21		**X**
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Identifying and Profiling Hazards, pp. 11-19; Assessing Vulnerability, 19-21	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Assessing Vulnerability, pp. 22-23		**X**

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met

ELEMENT B: REQUIRED REVISIONS

B1: The plan states that the hazards wildfire and tornados are not profiled since these are in the State Mitigation Plan. Clarify whether these natural hazards are commonly recognized to affect the jurisdiction and how that provides the rationale for its omission in this Town's risk assessment. Other natural hazards that are included in the State Mitigation Plan that were not addressed in this Town's risk assessment are:hail, extreme temperatures (cold), landslides/rockslides/rockcuts. These must be addressed with either the risk information or the rationale for the omission. p. 15 Wildfire; p. 12, Tornado.

Extent is misunderstood in the Risk/Vulnerability Assessment which is describing the impacts rather than the strength and magnitude of each hazard which it does label. **Provide the extent information for the identified hazards for within the Town.** Snowfall has been met (high winds of a severe winter storm such as a Nor'easter has not) Corrected

Suggestions:
Define the hazard **strength or magnitude** (extent) in terms of specific measurements, such as with the Enhanced Fujita Scale for tornados, Saffir-Simpson Scale for hurricanes and tropical storms, and Richter scale for earthquakes. Wildfire and landslide magnitude can be defined by potential acreages. Explain Drought extent, which can be done by either noting duration, through indicators of rainfall, snowpack, streamflow, etc., and/or by a scientific scale, for example using the Palmer Drought Severity Index. Snow storm magnitude can be explained in estimated inches per storm; Ice storm magnitude in inches accumulated. If historical events are used to estimate extent, make sure to explain the magnitude.

B2: The hazards descriptions do not provide a history of previous occurrence for all the identified hazards. Flood hazard has the events that have occurred since the last plan was updated but has no events before that time (the history). Ice jams were stated to have occurred but not when. Dam failure does not state whether there is any history of such an event. Winter storms will be accepted as met. High wind/tropical storm/hurricane needs additional information to clarify what 70 windstorms in the past 46 years means, and what the history is to the Town. Tornados were addressed for the Town (although not clear if the F3 was the only one on record for the Town or in the county). Drought is met. Corrected.

Clarify what "Regional" means in the risk assessment. Is this within a county or a planning or New England? p. 9

The **general probability descriptors** of highly likely, likely, not likely in the narrative sections of hazards do not align with the "Likelihood" in the table on pages 20-21. The likelihood term and definitions are not connected to the probabilities in the narratives earlier in the section. Also, in the narrative there is no indication what is meant by flooding is highly likely. Clarify if this is the same as defined on page 19 and in the table. The probability as indicated in the narrative is too broad to cover all together high wind/tropical storm/hurricane (and does this cover from Nor'easter winds?) hazards. Corrected

B4: Although the plan identifies the number and general location of repetitive loss properties within the Town, the plan does not identify the types of properties. Describe the types (e.g., residential, commercial, institutional, etc.) of the identified repetitive loss properties. Corrected, p. 21

ELEMENT C. MITIGATION STRATEGY

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Existing Hazard Mitigation Programs, Projects and Activities, pp. 28-29		**X**

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	NFIP Compliance, p. 32; Incorporating into Existing Planning Mechanisms, pp. 38-39	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Hazard Mitigation Goals, p. 27	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Identification and Analysis of Future Mitigation Actions, pp. 29-31; Implementation of Mitigation Actions, pp. 32-36; Appendix F, p. 52	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Implementation of Mitigation Actions, pp. 32-36; Appendix F, p. 52		**X**
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Incorporating into Existing Planning Mechanisms, pp. 38-39		**X**

ELEMENT C: REQUIRED REVISIONS

C1. Document the town's ability to expand on and improve the described existing policies and programs. This is more than noting a lack of town services and the need to revise ordinances (Gaps in Existing Protection/Improvements needed, pages 28-29, 39), nor the capability of the town to manage during hazard events (preparedness/response).

Suggestion: Create a table highlighting each of the already described Town's capabilities (authorities, policies, programs, resources) and add some statements that indicate the Town's ability to expand or improve these capabilities. See additional Review Assessment comments in Section 2 below. p 24-26

C5. Timeframes are required and must have a starting point along with an end or target point. To say "1 year" or "5 year" does not define when mitigation activities (pages 35-37) will occur within the 5 year planning period. Corrected p 30-31

C6: Although the plan identifies existing planning mechanisms into which the mitigation plan can be integrated, the plan does not describe how the mitigation plan will be incorporated into those mechanisms. Describe the process **(*how*)** the Town will use to integrate data, information, and hazard mitigation goals and actions into existing planning mechanisms. p 26

Also, the plan update does not describe how the mitigation plan has been incorporated into the existing planning mechanisms since the plan was previously approved in 2010. Explain how the Town has incorporated the mitigation plan, when appropriate, into other planning mechanisms to demonstrate progress in local mitigation efforts. p 5 incorporated into and superseded by Town Plan

ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Development Trends, pp. 5-6; Assessing Vulnerability, pp. 26-27	X	

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or	**Met**	**Not Met**
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	2010 Brattleboro HMP, pp. 37-38	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	Mitigation Strategy, pp. 27-28 Implementation of Mitigation Actions, pp. 35-36; Post-Irene Mitigation Actions, pp. 37-38; Appendix F, pp. 49-50	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Prerequisites, p. 7		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))		N/A	

ELEMENT E: REQUIRED REVISIONS
NOTE: Ensure that the Plan's Title is the same title used in the adoption resolution. It currently is a bit different.
• Recommend contacting Misha Bailey with the VT Emergency Management Office for a suggested local VT example of an adoption resolution. For example, improvements can be made to include language that makes note of the public and stakeholder participation or that the plan was developed during a public planning process. Also, that it is a plan update and demonstrates a continued commitment towards meeting its mitigation goals for long term risk reduction. Have done so; will incorporate new resolution before adoption.
• On receipt of the FEMA Approval Pending Adoption (APA) notice, the submitted plan must be adopted within one year by the jurisdiction for FEMA approval.
• The adopted Final Plan must then be submitted to FEMA with the signed local adoption resolution (preferably inserted into the Final Plan).
  ○ The Final Plan is the submitted plan that received the APA notice with only the following adjustments. Any other modifications to the final plan that received an APA may require the plan to be reviewed and adopted again.
  ○ The Final Plan submitted electronically to FEMA should be complete, including any attachments such as appendices and maps.
  ○ Ensure that "DRAFT" notations are removed from the document.
  ○ Adjust the plan date to reflect the final submission and the plan's adoption date.			

ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or	Met	Not Met
ELEMENT F: REQUIRED REVISIONS			

4. The Plan was revised in response to comments by Misha Baily, State Hazard Mitigation Planner II. Changes were made to incorporation of public comments, adding detail to plan maintenance, assessing vulnerability for hail and extreme cold and history of ice dams.

Appendix E. Maps

p. 5 Existing Transportation System, Brattleboro Town Plan, produced by Jeff Nugent, Windham Regional Commission, 2013
p.. 15 Whetstone Brook Corridor Project Area, EPA Smart Growth Implementation Assistance Project, Brattleboro Town Plan, produced by Rita Johnson, Brattleboro Planning Department, 2015
p.16 Tropical Storm Irene Damage, Whetstone Brook, Brattleboro, VT, produced by Jeff Nugent, Windham Regional Commission, 2013
p.19 Fluvial Erosion Hazard, produced by Rita Johnson with data from the Agency of Natural Resource's Stream Geomorphic Assessment for the Whetstone Brook, 2.19.2008 & Stream Geomorphic Assessment for the Crosby Brook, 8.26.2008, Brattleboro Planning Department, 2014
p. 20 Special Flood Hazard Area Brattleboro Town Plan, produced by Jeff Nugent, Windham Regional Commission, 2013
p. 36 Slopes, Brattleboro Town Plan, produced by Jeff Nugent, Windham Regional Commission, 2013
p. 43 Repetitive Loss Area, produced by Rita Johnson with data from the FEMA Repetitive Loss Data as of 12.31.2011, Brattleboro Planning Department, 2014
p. 46 Hazardous Waste Generator Locations, produced by Brian Bannon with data from the Vermont Agency of Natural Resources Atlas Hazardous Waste Generators layer, downloaded 8.14.2014, Brattleboro Planning Department, 2014
p. 47 Future Land Use, Brattleboro Town Plan, produced by Jeff Nugent, Windham Regional Commission, 2013

Appendix F. Hazard Mitigation Projects

Engineering Projects:

2. Relocation of the EOC: the current EOC has unsafe working conditions and poor telecommunications infrastructure. Replacing the center will improve functionality.
3. Police and Fire Communications Upgrade: current communications need to be improved to insure interoperability, reliability, and coverage. Antenna sites have been updated; additional equipment is being acquired.
4. Sunset Lake Road Bridge: the current span is undersized given channel width. This makes the structure more vulnerable to flood damage, increases risk of channel movement, and increases flood heights upstream. The replacement span will be longer, allowing for free passage of high water. The replacement will maintain access to the northwestern-most areas of West Brattleboro and to adjacent towns during emergencies. The roadway can be used as a detour route if other roadways into adjacent towns are damaged.
5. Chestnut Hill Dam improvements: the dam on this former reservoir lacks a spillway structure that would prevent failure during high water events. The improvement project will construct an overflow pipe to bring the dam into conformance with State dam safety regulations.
6. Cooke Road Bridge: this span was destroyed by Hurricane Irene, like the Sunset Lake project, the replacement span will be longer, allowing for free passage of high water. The replacement will help maintain a resilient road network during emergencies if alternate routes are damaged. It can serve as an alternate route to adjacent towns if Route 9 is damaged.
7. Pleasant Valley Toe Drain: the toe drain will monitor any groundwater flow through the earthen dam; sensors will give an alert if flow is detected, bringing the dam into conformance with State dam safety regulations. Dam break inundation mapping will allow for alerting and evacuating residents at risk.
8. Replacement or upgrade of Melrose Bridge: the existing bridge is the sole access to West Brattleboro. It is undersized, overtopped during floods, and causes increased flood elevations as it does not allow the free flow of floodwater volume. The project will include site acquisition to lengthen the span as well as engineering design work. The existing bridge has been evaluated by the Vermont Agency of Natural Resources with results published to the Stream Geomorphic Assessment Structure Database (https://anrweb.vt.gov/DEC/SGA/datasets/structures/reports.aspx?sid=543&option=view&phid=3&did=84) The database notes that the bridge entirely fills the flood plain and suffers poor alignment; it has upstream sediment deposits and is at risk of failure due to ice dams.
9. Main Street, Canal Street, South Main Street and Western Avenue targeted stormwater capacity upgrades: capacity constraints cause street flooding; runoff can cause erosion and road wash outs. The identified locations are vital traffic arteries in the Town-owned and maintained street system. The arteries serve critical private and public facilities. Projects will identify pipe segments and basins that require upgrades, design and implement improvements.
10. Brookside Condominiums/ Living Memorial Park stream bank restoration. The bank adjacent to Living Memorial Park and Brookside condominiums is failing due to fluvial erosion. The bank failure threatens basketball courts, a passive recreation area and a four dwelling unit condominium. The restoration project will alter the angle of recline, rip rap the lower slope, and use geotextile and plant material to stabilize the upper slope.

Buyouts and Relocations:

1. Mountain Home Park mobile home relocations: the Park has more than 70 dwellings located in the Special Flood Hazard Area of the Whetstone Brook. The homes are in repetitive loss and fluvial erosion hazard areas. There is an extensive history of evacuations and flood damage. Removing the homes and restoring the land's flood plain function will reduce risk to life and property in West Brattleboro.
2. Brattleboro Housing Authority Melrose Terrace relocation: Brattleboro Housing Authority has more than 80 semi-detached dwelling units located in the Special Flood Hazard Area of the Whetstone Brook. The homes are in repetitive loss and a fluvial erosion hazard areas. There is an extensive history of evacuations and flood damage. Removing the homes and restoring the land's flood plain function will reduce risk to life and property in West Brattleboro.

Open Space Acquisition and Restoration:
Work with Vermont River Conservancy, West Brattleboro Association and other third parties to identify open space parcels in the Whetstone Brook watershed suitable for conservation and restoration. Projects would restore channel access to the flood plain and allow for the restoration of natural meander patterns.

TOWN OF BRATTLEBORO
Town Manager's Office
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Brattleboro, VT 05301
Phone (802) 251-8151
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April 8, 2015

US Environmental Protection Agency Region 1
Attn: Rosemary Monahan, Ph.D.
5 Post Office Square
Boston, MA 02109-3912

Re: Letter of Interest for EPA Smart Growth Implementation Assistance

Dear Dr. Monahan:

The Town of Brattleboro, Vermont is pleased to submit for your consideration this letter of interest to pursue technical assistance through EPA's Smart Growth Implementation Assistance program:

1. **PROJECT CONTACT:**
   Rod Francis, Planning Services Director
   Town of Brattleboro
   230 Main Street, Suite 202
   Brattleboro, VT 05301
   Phone: 802-251-8110 Email: rfrancis@brattleboro.org

2. **DESCRIPTION OF SMART GROWTH CHALLENGE:** Brattleboro's proposal addresses redevelopment of a corridor while preparing for and adapting to climate change. This project will also promote green infrastructure for multiple community benefits.

   Many of Vermont's historic downtowns are located in flood hazard areas because they developed when waterways were sources of power, transportation routes, and conveyors of untreated waste. Brattleboro's 2013 Town Plan identifies the major natural and built form assets in downtown and discusses Smart Growth strategies to enhance our downtown. The State encourages investments in downtown through statutory planning goals and policy. The smart growth challenge for Brattleboro is how to maintain this historic mixed use settlement pattern while improving resilience to ensure 21st century relevance.

   A particularly challenging area for Brattleboro is the Whetstone Brook Corridor, an area stretching from the Interstate 91 bridge overpass east to the Connecticut River (see attached maps). It's an area of dense, compact development within walking distance of downtown. The low-lying structures and public infrastructure are vulnerable to climate change that will result in increasingly severe and more frequent storm events. Many of these properties are located in the National Flood Insurance Program's (NFIP)

Special Flood Hazard Area (SFHA). This will likely serve as a barrier to future development as increasing flood insurance rates may affect market values of real estate and chill the market.

3. **PROJECT AREA:** The project area that we would like assistance with is the Whetstone Brook Corridor. It is approximately 1.5 miles long and stretches along the Brook from the Interstate 91 bridge overpass to the Connecticut River. The land is heavily developed with buildings, flood controls, and utility infrastructure. It is comprised of the following neighborhood areas:
    - **Williams Street**: This neighborhood is primarily residential. It experienced extensive damage to infrastructure and private property during Tropical Storm Irene.
    - **Frost Street/Place:** This is a low-lying, densely settled residential area that sustained inundation flooding damage during Tropical Storm Irene; no homes were destroyed but twenty-one structures sustained damage.
    - **Flat/Elm Street:** This is an area of dense, mixed-use development. There are several town-owned parking lots and parcels of land that are adjacent to the Brook. There was severe flooding at the height of Tropical Storm Irene. In 2013, the Elm Street Bridge suffered $92,371.09 in damage during a rain burst event.
    - **Lower Main Street:** This is a mixed use area in the central business district. There is municipally-owned land. The stormwater collection system that serves this portion of the Downtown is old and undersized.

The project area lies within Census Tract 9685. This tract, while encompassing land outside of the corridor, is home to 5,807 people, which is roughly 48% of Brattleboro's population.[1] This Census Tract has a high poverty rate with 15.2% of the population living below the poverty level.[2] The median family income is below 80% of the statewide median income therefore making it eligible for New Market Tax Credits. In Census Tract 9685, 55% of the housing units are rental units, much higher than the national average of 35%.

There are several environmental, public health, and social challenges present in the project area:
- **Environmental:** The Whetstone Brook through this project area is already impaired with bacteria and has an EPA-approved total maximum daily load (TMDL). It is also at risk for contamination from brownfield sites as surface water discharges into the Brook during storms.
- **Public Health:** There are two public health issues in the project area. Due to historic development patterns there is a legacy of industrial uses in the project area and therefore there are several brownfield sites. Based on assessment work on other sites, typical contaminants found include solvents, petroleum products, PAHs, PCBs, arsenic, lead, metals, VOCs, and asbestos; all potential public health threats to this densely developed area. Due to the dense urban form in the project area, there is limited access to open space and outdoor recreation. Based on a Community Health Needs Assessment, Brattleboro Memorial Hospital set a goal to improve the health indicators of the community with a focus on diabetes and obesity.[3]
- **Social:** Vandalism, drug abuse and dealing, and assaults have all been documented in the project area. Criminal activity including drug use and loitering is frequent on municipally-owned land under the Elm Street Bridge. Police have responded to 585 incidents in the three block area of Elm Street over the last five years.[4]

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[1] Data is from the 2010 U.S. Census available at http://www.census.gov
[2] *Ibid.*
[3] Brattleboro Memorial Hospital, Grace Cottage Hospital, Brattleboro Retreat. *Community Health Needs Assessment of Windham County, VT.* (2012). *http://www.flipsnack.com/586758587A/fztkfzr4.html*
[4] Brattleboro Police Department. Incidents reported 2010-2014.

4. **ROLE OF EPA-LED TEAM:** We seek assistance from a multi-disciplinary professional team that can help Brattleboro's businesses, policymakers, and residents envision redevelopment that addresses climate change and socio-economic conditions. The resultant conceptual plan will meet our Smart Growth challenge by:
    - connecting Brattleboro residents and visitors to the Whetstone Brook through a series of multi-functional spaces;
    - protecting water quality with green infrastructure elements to capture and filter stormwater;
    - offering opportunities for infill development; and
    - lowering the potential for future damage from flooding.

    Town staff seek national expertise on accessing resources, planning neighborhoods for climate change, and working with diverse stakeholders to undertake this work. An important goal of this project will be to take input from the community and combine it with the team's knowledge of contemporary design principles to visualize the area as a resilient urban landscape with high amenity. A multi-disciplinary team can suggest innovative projects that resolve conflicts between natural hazards and the built form in ways that improve resilience by reducing risk and strengthening community.

5. **POTENTIAL IMPACT OF PROJECT AND LIKELIHOOD OF IMPLEMENTATION:** A redeveloped Whetstone Brook Corridor that responds to Climate Change will **reduce the impact of flooding and erosion** and support the existing neighborhoods by **preserving the traditional built form**. Green infrastructure will **provide open spaces** and offer opportunities to engage with the brook. It will **improve stormwater management** and **improve water quality,** and **improve air quality.**

    We anticipate the technical assistance will result in at least three different types of projects: infill development, green stormwater, and stream bank open space. We will use a variety of tools to implement projects.
    - **Land Use Regulations:** Brattleboro is currently working on new land use regulations with adoption expected in summer 2015. Key environmental protections include stream setbacks and improvements to stormwater requirements. The regulations require stormwater retrofits and provide for the use of Green Infrastructure. These land use regulations will provide some of a regulatory mechanism to require work on properties as property changes are made
    - **Leveraging Public Funds:** The Town will use its experience leveraging funds from a variety of sources to make projects financially feasible. This tool can be used to implement both infill and land conservation projects.
    - **Partnerships:** We will build partnerships with public and private stakeholder groups to capitalize on opportunities for infill development and develop stream bank open space.
    - **Municipal Resources:** The municipality is committed to implementing projects where feasible. We will explore public and private grants and work within our operating and capital budgets to facilitate projects.

6. **COMMUNITY NEED AND ENGAGEMENT:** Support from EPA Smart Growth Implementation Assistance will serve Whetstone Brook Corridor residents by offering stakeholders the opportunity to create a **shared vision** that addresses the challenges in their neighborhood. There is the potential for dual purpose projects that can **improve resiliency** during a flood and **provide opportunities for passive recreational or community space** when not flooded. Additionally, there is a potential for infill development within the project area. Infill development will **improve the value of surrounding properties** by eliminating vacant lots and abandoned buildings, which are crime and public health hazards. It will also create an incentive for other property owners to **reinvest**.

We will intentionally target community members to participate with this project so that they can benefit from the decisions that will shape their neighborhood. We will identify a wide range of stakeholders with interests in community health and wellness, affordable housing, economic development, and neighborhood improvement to protect a wide variety of interests.

The work of the project will be guided by the Planning Commission. This is a seven member citizen board appointed by the Selectboard. Their most recent projects include writing the Town Plan and new land use regulations, both of which used a variety of public outreach techniques. Walking tours, booths at community events, and neighborhood meetings have been effective at getting the public involved. Both traditional media (print, cable, and radio) and social media (in accordance with Town Policy) will be used to publicize and report on events and progress.

7. **POLITICAL AND PUBLIC SUPPORT:** There is both political and community support to undertake this project. The following is a list of community organizations which will support the work of this project and help Brattleboro implement it:
    - Building a Better Brattleboro: Supports and nurtures the economic, cultural, residential, and educational environment of downtown Brattleboro.
    - Brattleboro Area Chamber of Commerce: Provides resources and support for the interests of its membership to sustain a vibrant community.
    - Connecticut River Joint Commissions: Preserves and protects the resources of the Connecticut River Valley and guides its growth in development.

    In addition, we have been working closely on Tropical Storm Irene recovery projects with the Windham Regional Commission (our regional planning commission), Vermont Agency of Commerce and Community Development, and the Vermont Department of Environmental Conservation. These state and regional agencies also support the project and will assist us with implementation where possible.

This assistance will complement the work of our Town departments and Planning Commission. At a time when we are facing budget constraints, this type of assistance is deeply valued. We appreciate the educational opportunity and the innovative solutions that the project will offer.

The Town of Brattleboro looks forward to working with EPA to find ways to encourage redevelopment and strengthen our resilience.

Sincerely,

Peter B. Elwell
Town Manager

PBE:SF