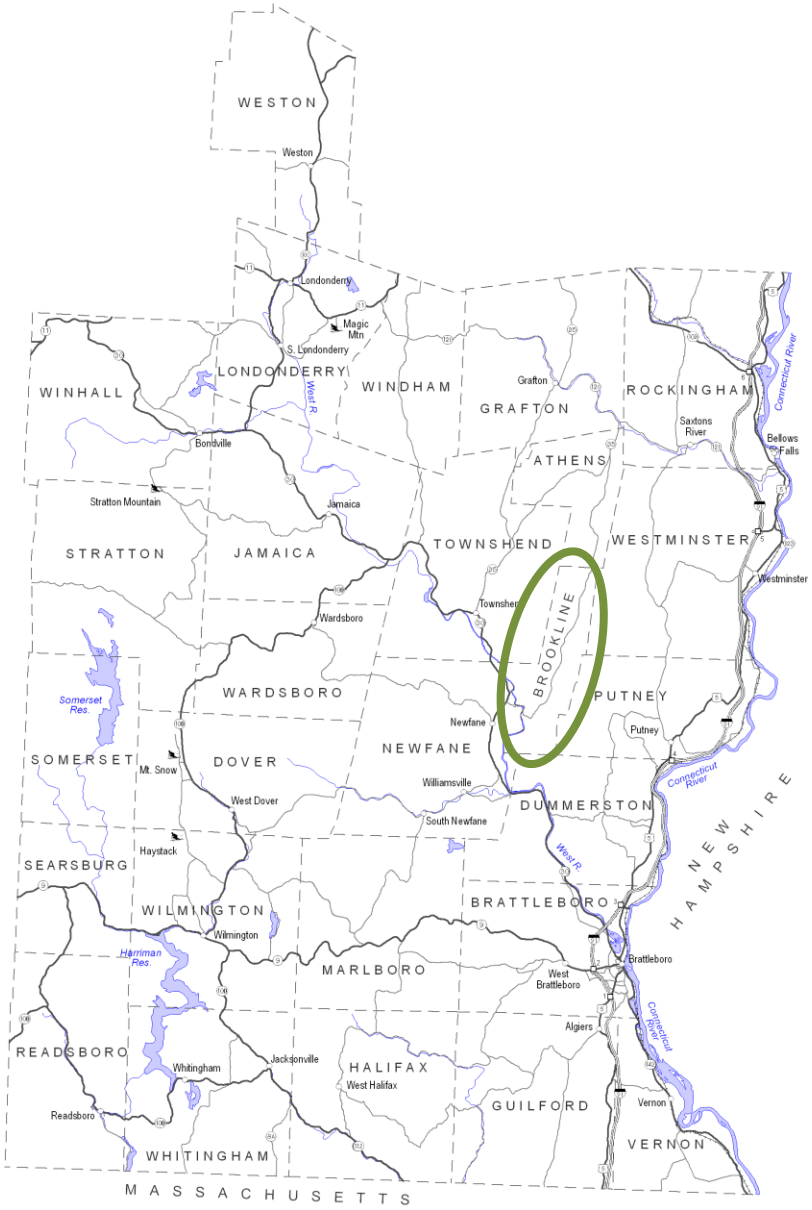
Town of Brookline
Local Hazard Mitigation Plan



Adopted January 18, 2017
FEMA Final Approved January 30, 2017

Prepared for the Town of Brookline
By the Windham Regional Commission

WINDHAM REGIONAL COMMISSION

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INTRODUCTION AND PURPOSE

This Single Jurisdiction Hazard Mitigation Plan is NEW, and has never been approved by FEMA or adopted by the Town of Brookline.

The purpose of this plan is to assist the Town of Brookline in identifying all of the hazards facing the town and to identify new and continuing strategies to reduce risks from identified hazards.

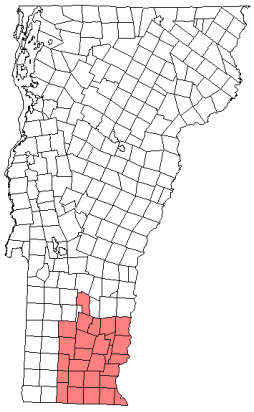
Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous Project Impact efforts, FEMA and state agencies have come to recognize that it is less expensive to prevent damage from disasters than to repeatedly repair damage after a disaster has struck. This plan recognizes that communities also 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 what local actions can be taken to reduce the severity of hazard-related damage.

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; adapting to the hazard by modifying structures or standards; or avoiding the hazard by stopping or limiting development. Mitigation 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
- Planning for land use for floodplains and other flood-prone areas
- Proper road maintenance and construction
- Ensuring critical facilities are safely located
- Establishing and enforcing appropriate building codes
- Public information

WINDHAM REGION GEOGRAPHY

Situated in Vermont's southeastern corner, the Windham Region consists of 23 towns in Windham County, the neighboring towns of Readsboro, Searsburg, and Winhall in Bennington County, and Weston in Windsor County. The region is bordered by Massachusetts to the south and New Hampshire to the east. At over 920 square miles (590,000 acres), the region accounts for roughly 9.6% of the State's total land area. The Windham Region has several distinctive identities, largely defined by the diverse natural environment.



The Region's topography is relatively flat or gently rolling land in the Connecticut River valley in the east, while the western part of the region is characterized by the Green Mountain ridges and peaks with narrow stream valleys. Stratton Mountain is the highest point in the region at 3,936 feet. The lowest point is along the Connecticut River in Vernon, at 200 feet.

In addition to the Connecticut, other major rivers of the region are the Deerfield, Green, North, Saxtons, West, and Williams, all tributaries of the Connecticut. There are two major flood control reservoirs on the West River, Ball Mountain and Townshend, and two major storage reservoirs for hydropower generation on the Deerfield River, Somerset and Harriman.

BROOKLINE GEOGRAPHY & TOWN PROFILE

The Town of Brookline is the smallest town geographically in the Windham Region at 8,256 acres or 12.9 square miles. The Town runs along the valley of Grassy Brook for 9½ miles, forming Grassy Brook Valley, and is bordered on the east by Putney Mountain. There is no town center, and not many businesses in Brookline. Over the years farming has played an important role in Brookline's land use and local economy. Many farms have ceased to operate and at this time there is only one produce farm and one stable, in addition to several home businesses and enterprises throughout the town. These are for web design, graphic design, artisans, small construction businesses, a CSA, child care facilities, riding stables, and various professional services. As far as employment opportunities, Brookline serves mostly as a residential community relying on the commerce and industry of surrounding towns[1]. The Round School House, perhaps Brookline's best-known historic site, was built in 1822 and fully restored in 2005. It sits across the street from the Town Office.

Brookline is bordered to the north by Athens, to the west by Townshend and Newfane, to the east by Westminster and Putney, and to the south by Dummerston. Grassy Brook Road is the main road through Brookline and is a paved Class 2 roadway until the northern stretch that runs into Athens which is unpaved. Grassy Brook Road runs along Grassy Brook and through the narrow river valley that runs along the spine of the town. The majority of the offshoot roads are unpaved. Cell phone service is limited in Brookline. The town is very rural, consisting mainly of forestland with some farmland in the valley. Development is constrained by the mountainous topography of the area on both sides of Grassy Brook Road, with Putney Mountain being the largest point in town (1,683 feet). Steep slopes, those greater than 25%, present challenges for siting residential development and providing on-site waste disposal. Putney Mountain Road is a rural dirt road that is open seasonally but impassable to vehicles in winter months. Several large parcels in Town have been conserved through public conservation efforts (Putney Town Forest, Silvio Conte Reserve) and private conservation efforts (Putney Mountain Association and the Windmill Hill Pinnacle Association). The unique and interesting topography of Brookline is beautiful to drive through, with the mountains rising on either side of you as to drive Grassy Brook Road.

The climate is generally temperate with moderately cool summers and cold winters, as in the rest of Vermont. The weather is unpredictable, and large variations in temperature, precipitation, and other conditions may occur both within and between seasons. The topography of Brookline can influence some interesting weather dynamics, such as isolated high wind events, also called microbursts, and serves to create some inherent vulnerability for the town—including isolation.

Residential development has occurred over the past twenty years such that concentration of residential (year round, seasonal and vacation) properties line Grassy Brook Road for most of its length, with the largest concentration in southern portion of the town. The large parcels of undeveloped land along the hillsides of the Town provide a great scenic resource to the residents and contrast with the relatively concentrated linear development pattern occurring along the roadways. This type of development pattern differs slightly from the more concentrated core village pattern typical of rural Vermont towns. There are no public water or wastewater systems in Brookline.

Brookline is connected to Route 30 and the Town of Newfane by a bridge over the West River. This is the primary (and the only paved) road into and out of Brookline. In November 1927, this bridge was

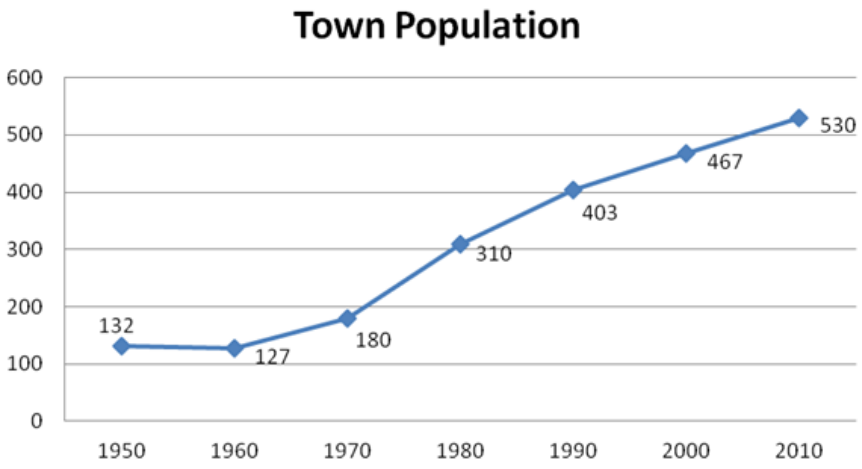
[1] Brookline Town website. Accessed 5/17/16. <http://www.brooklinevt.com/history>

washed out in a flood, and in the spring of 1928, the present iron bridge was built. Again, in 1936 and 1938, there were floods causing substantial damage to the structure.

The West River forms the southwest border of Brookline. Grassy Brook is stream flowing north south through the entire length of the town. Greer Swamp is the largest waterbody in Brookline and lies off Greer Road. Beaver dams are present in this swamp.

Development Trends

As the following table and graph show, Brookline has been steadily gaining population since 1960. As the bottom chart shows, between 2000 and 2010, population increased 14% in Brookline, which is only exceeded by northern neighbor Athens.



Population Trends in Surrounding Towns

Town	1990	2000	2010	% Change 1990-2000	% Change 2000-2010
Brookline	403	467	530	16%	14%
Athens	313	340	442	9%	30%
Townshend	1,019	1,149	1,232	13%	7%
Newfane	1,555	1,680	1,726	8%	3%
Dummerston	1,863	1,915	1,864	3%	-3%
Putney	2,352	2,634	2,702	12%	3%
Westminster	3,026	3,210	3,178	6%	-1%

Residents giving input to this play say they haven't seen a lot of changes in town. There hasn't been much new building for the past 10 or so years (since 2005). Some former camps have been modified into full time residences, but there hasn't been much other development. The scenic rural character of the town is an attractor for new residents.

Emergency Services

"Brookline supports emergency planning and disaster preparedness. Planning and preparedness may help to reduce the risk to life and health, the damage to public and private property and the environmental

damage that often occurs as a result of a disaster"[2]. Brookline does not have a fire department or emergency services of its own. The Town is served by the Newbrook Volunteer Fire Department located in neighboring Newfane. Newbrook Volunteer Fire Department provides fire, rescue, and EMS support for Brookline. Many of the Newbrook Volunteer firefighters are Brookline residents. Brookline has a contract with the Vermont State Police for police protection. Southwestern New Hampshire Mutual Aid provides dispatch for Brookline. Rescue Inc. also provides EMS support. The nearest hospital to Brookline is Grace Cottage Hospital in Townshend, or Brattleboro Memorial Hospital in Brattleboro. The Brookline Elementary School is a Red Cross certified emergency shelter. There are no reported Tier II hazardous material storage sites in Brookline.

Though there is high speed internet and recently there has been an increase in cell coverage, there are still areas of the town where cell coverage is inadequate which makes it difficult to get emergency help if needed, depending on where you are. This is a concern for the town and opportunities to remedy it should be seriously considered.

[2] 2013 Brookline Town Plan, page 20 <http://www.brooklinevt.com/documents/2013-town-plan>

Existing Land Use

Town of Brookline, Vt.

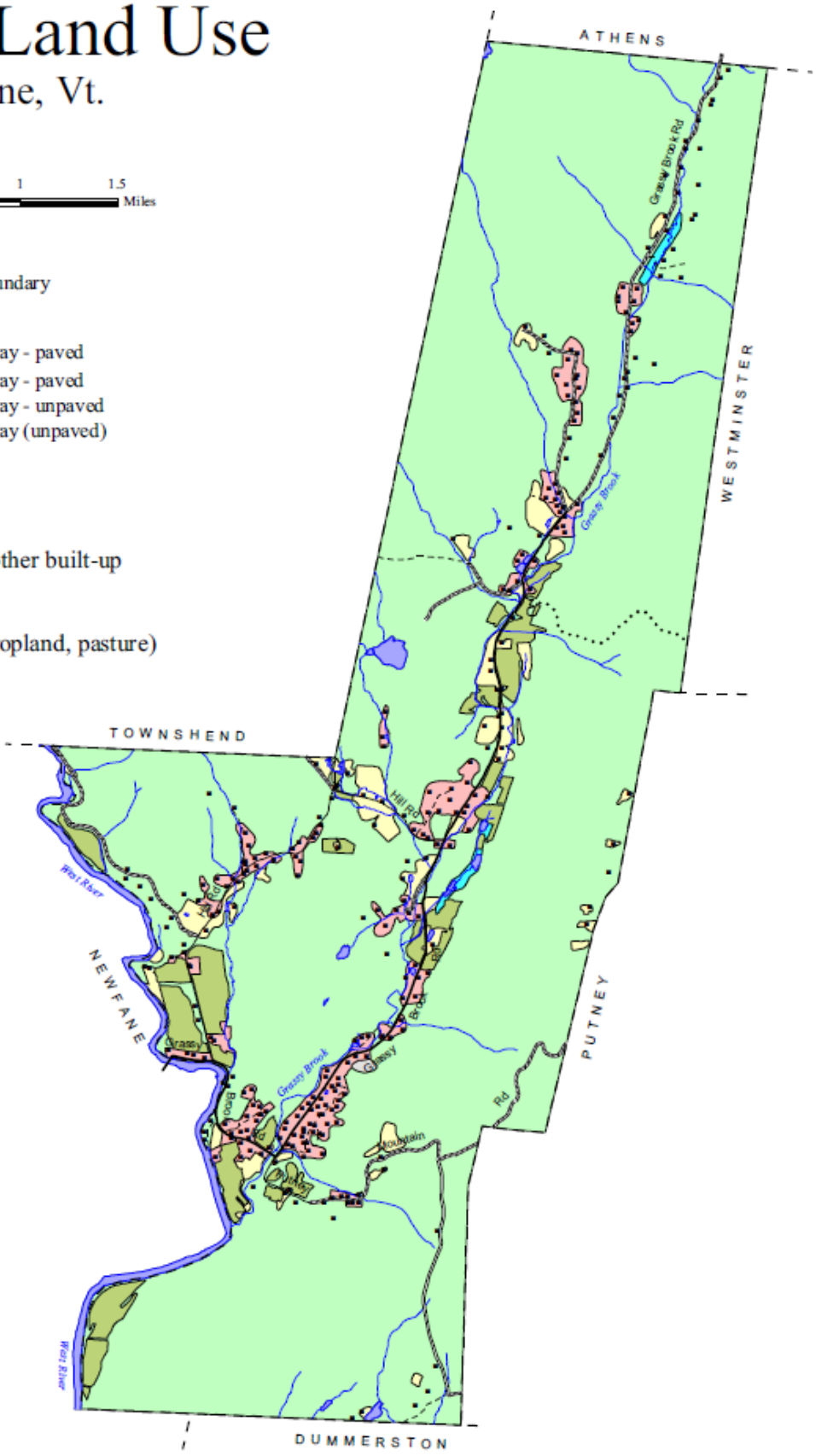
April 2005

0.5 0 0.5 1 1.5 Miles

scale 1:48,000

Town boundary
Stream
Class 2 town highway - paved
Class 3 town highway - paved
Class 3 town highway - unpaved
Class 4 town highway (unpaved)
Private road/drive

Structures
Residential or other built-up
Open
Agricultural (cropland, pasture)
Forest
Water
Wetland
Barren



PLANNING PROCESS

Town residents who took part in the planning process for developing the Local Hazard Mitigation Plan for Brookline tend to be affiliated with more than one association for the town. In rural areas of Vermont, it is typical that people who are most interested in the safety, health and welfare of their community will preside on more than one board and may for example, hold the role of Fire Chief, or school teacher, or be a small business owner, in addition to owning personal property in the town. Therefore, although the meeting may not have as many people in attendance as a more populated community would, those present at the meeting are representing not only a variety of roles, but many roles that would be held by numerous individuals in a more populated area.

Documentation of the Planning Process

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Past Process

In 2010, representatives from Brookline participated in a regional public participation planning event held by the Local Emergency Planning Commission (LEPC 6). Since the Windham Regional Commission was writing Hazard Mitigation Plans for 20 towns within its region, two public participation events were scheduled as "joint events" to be held at the September and October monthly meetings of the LEPC 6. These events were meant to educate the towns about the hazard mitigation planning process and identify hazards in their towns. A presentation was made at the September meeting explaining the process and the meaning of a hazard analysis, with time for questions. The October meeting provided an informal map exercise where numerous maps were posted for each town, and comment sheets provided for participants to write ideas/comments about areas in their towns facing potential negative impacts from hazards.

Brookline began the process of developing this plan by holding a meeting on the evening of November 9, 2010. The event had representation from numerous residents of Brookline and was led by the Windham Regional Commissioner Cynthia Nau. This meeting at the Town Offices involved a discussion/work group on vulnerability analysis, risk assessment, and thinking about mitigation strategies. Those present at the meeting included members of the Planning Commission and Selectboard members.

The following meetings were held:

- September 21 and October 19, 2010 LEPC 6 meetings – Brattleboro Fire Department and Brattleboro Retreat – Topics: Pre-Disaster Hazard Mitigation Plans Overview and Interactive Map Viewing and Hazard Analysis Comments from Local Jurisdictions
- November 9, 2010 – Brookline Town Offices, Brookline, VT
- September 8, 2011 – Phone conversations with Selectboard and Road Foreman
- February 21, 2012 – Phone conversations with Selectboard and Road Foreman

A plan was drafted from the information collected at these meetings, but was never completed or submitted for FEMA review. This was primarily because of Tropical Storm Irene. Just after TS Irene, Brookline was busy with many visits by the Vermont Agency of Natural Resources (ANR), NRCS, VT Fish & Wildlife (VT F&W), and VTrans. ANR made site visits to discuss major woody debris piles in streams; bridges and embankment stabilization near homes; how to plan for debris piling up under bridges; and erosion issues. NRCS made site visits regarding embankment stabilization to determine if homes would qualify for the Emergency Watershed Protection Program. VT F&W made site visits to determine impacts of erosion of riparian habitat along streams. The State agencies worked with Brookline and looked at their problems to make sure the improvements are sustainable mitigation efforts for the long term.

Although Brookline suffered damage from Tropical Storm Irene, other towns in the Windham region suffered more significant damage and had properties with buyouts. This required prioritization of developing hazard mitigation plans, which pushed Brookline's hazard mitigation plan timeline back. The Town commenced the planning process again, after Tropical Storm Irene, but still a draft was not completed or submitted to VT DEMHS or FEMA.

Current Process

The Town commenced the planning process in September 2015. Alyssa Sabetto, Emergency Planner for the Windham Regional Commission, worked with Town Clerk Guy Tanza to set up a meeting of a hazard mitigation planning committee. The Hazard Mitigation Planning participants later convened on September 24, 2015 at the Brookline Town Office and met with Alyssa. Guy invited these attendees directly, and they formed the core planning team. The meeting was also advertised and open to the public.[3] It lasted for several hours and involved:

- a review of the draft document with discussion of more recent hazard events,
- completion of hazard analysis and discussion of what hazards the town wants the plan to focus on
- progress made in mitigation efforts that were noted several years ago,
- development of new hazard mitigation projects, and
- review of mapping of the town to note where hazard events are causing repeated or large scale damage.

Alyssa used what she could of the previously drafted plan, but she wrote an entirely new plan to meet the current standards and guidelines of FEMA for hazard mitigation plans. She took the information from the September 24, 2015 meeting, along with follow-up information gathered in several conversations with the Road Foreman, Town Clerk, and Planning Commission Chair, and assembled a new draft plan. Alyssa also reviewed and utilized the data sources noted and cited throughout this plan to gather further information. The draft was presented for internal

[3] See appendices 7 and 8 for sign in sheet and meeting agenda.

town review by the Committee, town personnel, Planning Commission and Selectboard on August 9, 2016. This internal town review period was from August 9-22. Pictures were received back from former Road Commissioner, Thomas Staats. Alyssa added the pictures, and made some final additions and revisions to finalize the draft for public comment. The public comment draft plan was brought up at the September 7, 2016 Selectboard meeting. There were comments received from the Brookline Selectboard and Planning Commission, and they were incorporated.

The revised draft plan was put out for public comment on August 23, 2016. This was done by posting an electronic copy on the town website and having a hard copy of the plan advertised and made available at the town office for public review and comment. Flyers were posted around town advertising its availability for review and comment. Several comments were received from the public during the over two week comment period and they were incorporated. Five members of the public offered minor comments or corrections to the draft plan. These revisions were made by the plan developer and the revised plan was presented back to the Committee for review. It was simultaneously distributed to the adjacent towns of: Newfane, Townshend, Athens, Westminster, Putney and Dummerston for comment via email.[4] There were comments received from the the surrounding towns of Dummerston and Newfane that were incorporated. The plan was finalized by Alyssa Sabetto for submittal to VT Division of Emergency Management and Homeland Security (DEMHS). This submittal allows DEMHS to make suggested revisions on the draft, and allow for any revisions to be made before the final draft is submitted to the Federal Emergency Management Agency Region 1 (FEMA) for review.

The following people were involved in the current hazard mitigation planning process:

Committee (2015)	Affiliations	Home
Guy Tanza	Town Clerk	Brookline
E. Mark Bills	Part-time Road Foreman / Tree Warden	Wardsboro
Stanley Noga, Jr.	Selectman	Brookline
Archie Clark	Road Commissioner	Brookline
Barbara Bourne	Planning Commission member	Brookline
Tom Kavet	Planning Commission Chair	Brookline
Dot Maggio	Selectboard	Brookline
Helen Samuels	Resident	Brookline
Alyssa Sabetto	Planner, Windham Regional Commission	Brattleboro

Public Involvement and Input from Neighboring Communities

Making the Brookline Hazard Mitigation Plan available for public comment included the following efforts:

- All of the meetings discussed in the above sections were advertised and open to the public.[5]
- Between 2010 and mid 2014, the Brookline Draft Plan was posted on the Windham Regional Commission website for public review and comment. No comments were received during this time.
- The primary hazard mitigation planning meeting took place on September 24, 2015 and was open to the public.
- The draft hazard mitigation plan was brought to the September 7, 2016 Selectboard meeting for review and comment by the Selectboard members and the public.
- The draft hazard mitigation plan was brought to the September 14, 2016 Brookline Planning Commission meeting for review and comment by the Planning Commission and the public.
- The draft plan was made available in hard copy for public review and comment at the town office from August 23, 2016 through September 6, 2016.
- A draft of the plan was posted from August 23, 2016 through September 6, 2016 on the town website for public comment.[6]

[4] See appendix 3 for reach-out and response.
[5] See appendix 6 for town website advertisement of September 24, 2015 meeting.
[6] See appendix 2.

- Flyers were put up around town for public comment on the draft.[7]
- On August 23, 2016, an invitation was extended via email to neighboring towns to provide a means and opportunity to review and comment on the draft Brookline Hazard Mitigation Plan.[8] Responses were received back from Dummerston, Newfane, and Athens.[9] Inter-town communication will repeat for future revisions of this Plan.

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 requires local municipalities to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Methodology

A **vulnerability analysis** for each community begins with an inventory of possible hazards and an assessment of the risk that they pose. These are the questions to be answered. What hazards can affect your community? How bad can it get? What is the likelihood of future events occurring? What areas of your town are most vulnerable to these hazards? How does climate change impact your town currently and what are you worried about for future impacts? Information collected from the core planning team went into this vulnerability assessment to identify the hazards the town feels most vulnerable to.

The **Potential Impact** (percentage of the community affected) or magnitude of the impact of the hazard can be classed as follows:

1 = Negligible	Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries
2 = Minor	Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries
3 = Moderate	Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and/or injuries or fatalities
4 = Major	Severe property damage on a town-wide or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities

Probability of Future Events: This is the likelihood of future events occurring, taking into account how often events have occurred in the past as well as development trends the town is experiencing. This also takes into account the affects of climate change and the community's knowledge of those potential impacts.

[7] See appendix 4.
[8] See appendix 3.
[9] See appendix 3 for responses from Dummerston and Newfane. Athens gave a response over the phone.

1 = Unlikely <1% probability of occurrence in the next 100 years (less than 1 occurrence in 100 years)
2 = Occasionally 1–10% probability of occurrence per year
3 = Likely >10% but <100% probability per year (at least 1 chance in next 10 years)
4 = Highly Likely 100% probable in a year (an annual occurrence)

Warning Time: Amount of time generally given to alert people to hazard
1 = More than 12 hours
2 = 6–12 hours
3 = 3–6 hours
4 = None–Minimal

Additionally, seasonal patterns that may exist are considered, what areas are likely to be affected most, the probable duration of the hazard, the speed of onset (amount of warning time, considered with existing warning systems).

The combination of the Potential Impact, Probability of Future Events, and Warning Time was used to determine the hazard ranking score for each hazard.

The **Potential Impact, Probability of Future Events and Warning Time** for each hazard was discussed at the September 22, 2015 Hazard Mitigation Plan meeting. There was also a review of what was developed in 2007; however, the below table, which the participants developed at the most recent meeting was more detailed in terms of areas of vulnerability and current in terms of what has happened in recent years. The participants discussed each potential hazard in detail and ranked each element for each hazard. The numbers were combined to give each hazard a hazard score. This score was used to determine which hazards the plan would address.

While all hazards were considered by the Hazard Mitigation Planning participants for inclusion in this plan, it is not feasible to study each in depth. For hazards that are not profiled in this plan, the reader is directed to the Vermont State Hazard Mitigation Plan. The rationale for not addressing all of the hazards is that Brookline has a low level of risk associated with them and/or the town does not choose to mitigate for them at this time. This plan will only focus on the hazards that Brookline has decided are pertinent to their community and they have chosen to mitigate for at this time, which are Flooding and Fluvial Erosion. Though fluvial erosion is caused by flooding events, the impacts are significantly different than the impacts of flooding, so the town wishes to address them separately. The below table shows the hazards in terms of their hazard ranking score as determined by the Hazard Mitigation Planning participants.

Possible Hazard	Probability of Future Events	Warning Time	Potential Impact	Score	Most vulnerable facilities and populations
Beaver dam failure	4	4	3	11	15 acres of water are contained in Greer Swamp on private property. This is a significant concern for the town, as the dam has let go twice before (2003 and 2013) and caused public and private property damage.
Power Failure	4	4	2	10	Winter time is more of a concern for this. GMP has lessened the number of outages by doing better tree maintenance in recent years.
Tornado/Microburst	3	4	3	10	High ridges are most susceptible. Wind sheer in 1994 took out several miles of trees on a ridge top.
Highway Accidents	3	4	2	9	Corner near Papoose Bridge.

Possible Hazard	Probability of Future Events	Warning Time	Potential Impact	Score	Most vulnerable facilities and populations
Structure Fire	3	4	2	9	
Dam Failure	1	4	4	9	Major dams upstream (Townshend and Ball Mountain) are hazards. No dams in Brookline.
Flood	4	1	3	8	The intersection of Parker Road and Grassy Brook Road is susceptible. Hazard Mitigation Committee representatives say they believe climate change is linked to the more frequent and greater intensity rain events in town, and this is of concern to them. TS Irene in 2011 took away a lot of vegetation that used to control flooding and erosion.
Fluvial Erosion	4	1	3	8	Homes and properties near Grassy Brook are most vulnerable. TS Irene in 2011 took away a lot of vegetation that used to control flooding and erosion.
Winter & Ice Storm	4	2	2	8	Hazard Mitigation Committee members say that climate change is changing the type of snow; There is more heavy wet rain/snow combos, and less light fluffy cold dry snow.
Wildfire	2	4	2	8	Lots of open wilderness areas and hiking trails on Windmill Hill.
Invasive Species / Infestation	4	1	3	8	Hemlock wooly adelgid and several other invasives are present in Brookline. They have recently discovered Poison parsnip, along with Japanese knotweed, and Multiflora rose all up and down Grassy Brook Road, which is spread through roadside mowing and flood debris.
Water Supply Contamination	3	4	1	8	No public water supply. Private well contamination is a risk. Floodwaters did compromise some private wells after TS Irene.
School Safety Issues	1	4	2	7	Evacuation plan in place, but not school crisis plan.
Air crash	1	4	2	7	There was helicopter that crashed in Brookline years ago.
Terrorism	1	4	2	7	
Earthquake	2	4	1	7	
Hazardous material spill	1	4	2	7	No reported Tier II hazardous material storage facilities are present in Brookline.
Extreme Cold	4	1	2	7	
High Wind	4	1	1	6	
Hurricane	2	1	3	6	
Radiological Incident	1	1	4	6	VY is shut down at this point and Brookline is outside of the EPZ.
Ice Jams	3	1	2	6	Spring jams; houses along Grassy Brook
Landslide	2	1	2	5	
Hail Storm	2	1	2	5	
Drought	2	1	2	5	
Extreme Heat	1	1	1	3	
Railroad Accidents				0	No railroad in Brookline.

Tsunami				0	
Volcano				0	

Though the above table shows vulnerability to some natural hazards, such as: tornado/microburst, winter/ice storms, wildfire, water supply contamination earthquake and extreme cold, Brookline—due to their small size and limited resources—at this point in time doesn't feel that the risk posed by these hazards is high enough to justify the cost it would take to mitigate for them. High wind, hurricane, ice jam, landslide, hail storm, drought, extreme heat, tsunami and volcano are all low-ranking natural hazards, that Brookline has low vulnerability for, or not applicable to Brookline, according to the Hazard Mitigation Planning participants. This plan addresses the fluvial erosion impacts of flooding events, as this is the biggest hazard facing Brookline most often. Beaver dams are addressed, but keep in mind that mitigation is limited as the threat is either not within town borders or is on private land. The Hazard Mitigation Committee did develop two actions for control of invasive species and that hazard is addressed in this plan. Brookline may choose to mitigate for hazards other than what this plan addresses if resources enable them to do so or if their level of vulnerability changes in the future. For hazards not covered in this plan, the reader is referred to the State All Hazards Mitigation Plan. Winter and ice storms are not being addressed in this plan because they are a way of life in Vermont and they are handled well by Brookline and VTrans. Brookline does not currently have ways of mitigating for winter weather events or extreme cold other than what is currently being done, including having an emergency shelter with a generator heat source. Current methods are deemed adequate at this time, though the town may choose to address these hazards in the future.

Identifying and Profiling Hazards

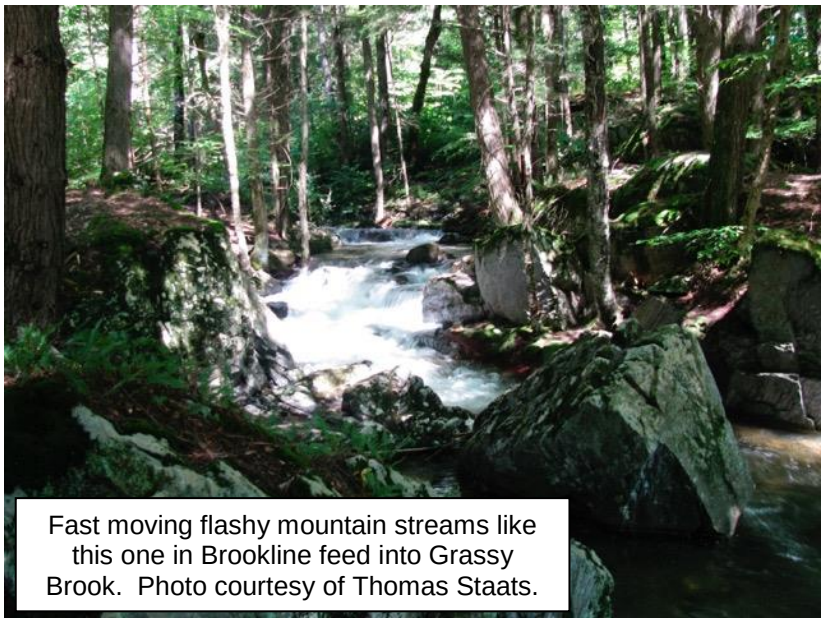
The following sections include a narrative with a Description, Geographic Area of the Hazard, Impact, Extent, Probability, and discussion of Past Occurrences of the two highest ranking natural hazards affecting Brookline.

Fluvial Erosion

Description and Impact

Brookline is primarily impacted by two waterways and their tributaries. The majority of the town is set in a small defined valley through which flows the Grassy Brook. The headwater tributaries coming off of the mountains into Grassy Brook are generally smaller, have narrower floodplains, and flow at faster rates than rivers in wide flat valleys. This can lead to flashy flows on the Grassy Brook and its tributaries, as there isn't much floodplain, and no mapped FEMA floodplain on the Grassy Brook other than where it flattens out and meets the West River in southwestern Brookline. The southwestern edge of Brookline is bordered by the West River and the terrain is more of a wide valley, and this is where the FEMA floodplain is present.

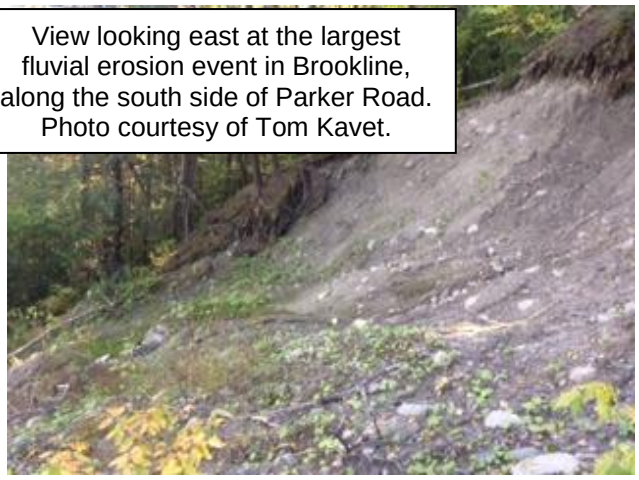
Because there isn't much low lying floodplain area, floodwaters are usually moving when they are present. This is why most of the destruction from flooding events in Brookline is due to fluvial erosion rather than inundation, which is the type of flooding targeted through the NFIP. Fluvial erosion is the destruction of river banks caused by the movement of rivers and streams, when stream power overcomes resistance of bed and bank material. This can range from gradual bank erosion to catastrophic changes in river channel location and dimension during flood events. This occurs when the stream has more energy than is needed to transport its sediment load, due to channel alterations or runoff events that increase water speed in the channel, leading to erosion. Fluvial erosion hazard mapping was released by the VT Agency of Natural Resources in early December 2014. This mapping assists municipalities in identifying at risk areas and developing bylaws and effective mitigation strategies to regulate development within these fluvial erosion hazard zones. Brookline does not currently have a fluvial erosion bylaw, but should consider developing one.



Fast moving flashy mountain streams like this one in Brookline feed into Grassy Brook. Photo courtesy of Thomas Staats.

Gravity and water power are the forces driving fluvial erosion. Factors that allow the force of gravity to overcome the resistance of earth material to erosion include: saturation by water, steepening of slopes by erosion or construction, alternate freezing or thawing, removal of trees and other vegetation and earthquake shaking. Major erosion events 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. Associated issues in Brookline are related to road cutting and bank erosion for the most part, areas where roads have been built between steep slopes on one side of the road, and slopes to a river or brook on the opposite side. Existing homes are dotted on the landscape along these roads which have existed for 200 years or more, so cannot be easily closed or relocated.

Geographic Area of Hazard/Location



View looking east at the largest fluvial erosion event in Brookline, along the south side of Parker Road. Photo courtesy of Tom Kavet.

In some instances stabilization/mitigation projects in Brookline have helped. In other areas throughout Brookline, issues remain. The river Corridor mapping (included in this plan) shows the ANR defined River Corridors, which are likely to have fluvial erosion. River Corridor lies all along Grassy Brook, and in fact this area does see fluvial erosion. The Road Foreman says that people are losing their property all along the Grassy Brook due to fluvial erosion. The map also points out some of the issues discussed in the text of particular problem spots. The south-side of Parker Road is the worst area of fluvial erosion in Brookline. This is on private land, and along a class 4 road. Additionally, Dutton fields on Hill Road, between Grassy Brook Road and Kirsch Road, are significantly eroded. This really began when water that came from the beaver dam blowout on Greer Pond. Now, during high water events, trees are taken down and the brook is getting eaten away. However, the greatest area of concern for fluvial erosion along Grassy Brook is near where Grassy Brook intersects the West River on a bend. There are also issues in some of the tributaries to Grassy Brook. There is more erosion on the tributaries than is seen along Grassy Brook, which is more of a wider expanse that flood waters can expand into.

TS Irene didn't cause that much damage to Brookline, but with just a bit more power it could have caused extensive damage.

There are two main areas of concern for fluvial erosion in Brookline: (1) Parker Road adjacent to the small unnamed tributary to Grassy Brook; and (2) near where Grassy Brook intersects the West River on the bend where they intersect.

Probability
Fluvial erosion is highly likely and exists in Brookline, especially due to the damage caused by TS Irene in 2011, where fluvial erosion hazard flooding de-stabilized many steep-sloped areas and washed out riparian zones next to roads and streams.


View looking west at the largest fluvial erosion event in Brookline, along the south side of Parker Road. Photo courtesy of Tom Kavet.

Extent
Extent for fluvial erosion: The biggest area of fluvial erosion an approximately 100 feet wide and 100 feet high event along a tributary that runs on the south side of Parker Road near the Townshend line down to Grassy Brook. There is no bank stabilization in place for this event. It is on private land.

The extent of a flood event can vary from a minor event due to a typical rain event or could be a major event as a result of rapid snow melt in spring, rain on frozen ground, or as a result of a tropical depression or storm. Town historians claim that the extent of flooding is such that brooks may breach their banks and flow onto land and down roads.

The Grassy Brook feeds into the West River, which is a tributary to the Connecticut River. The closest gauge on the West River is in Jamaica. The highest recorded measurement there was 14.87 feet, which was measured on December 31, 1948.[10] Average height for this reach is about 6.13 feet.

Extent for thunderstorms/heavy rain events: The table below shows the top 10 rain events at the Windham County National Weather Service Cooperative station at Ball Mountain Lake (in the Town of Jamaica). Most stations take their observations in the morning (7 and 8am are the most common times), so the precipitation would have fallen between 7am on the previous date to 7 am on the date listed in the table below. To give context to the below data, for a 1-day period a 50-year event is 3.96-6.15 inches, a 100-year event is 4.40-7.49 inches, a 200-year event is 4.89-9.11 inches, and a 500-year event is 5.63-11.84 inches. If we base on lower confidence limits, the below listed # 1 event that occurred in 1973 is a 500-year event and TS Irene, which is #2 in the table is a 200-year event. It is important to remember that precipitation levels vary throughout the region.

Maximum 1-Day Total Precipitation[11] for BALL MTN LAKE (north of Brookline)		
Rank	Value (inches)	Ending Date
1	5.6	1973-06-30
2	4.9	2011-08-29
3	4.36	1999-09-17
4	3.97	2005-10-09
5	3.32	1987-06-23
6	3.3	1975-08-08
7	3.21	2003-08-02
8	3.14	1988-04-29
9	3.07	2010-10-01
10	3.02	2000-12-18
Period of record: 1969-05-01 to 2016-06-13		

[10] USGS Stream gauge 01155500 Tributary to West River Tributary near Jamaica, VT <http://waterwatch.usgs.gov/index.php>
[11] Data provided by the NOAA, Northeast Regional Climate Center at Cornell University. http://scacis.rcc-acis.org/.

A closer stream gauge to Brookline (downstream of the Ball Mountain dam gauge) that doesn't exist anymore, but did until 1981, was in Newfane on the West River. This gauge began collecting in 1930 thus giving further historical perspective for events. Of particular note is the that the highest event recorded in Newfane (4.9 inches) in 1935 is the same as the TS Irene event recorded at the Ball Mountain gauge in 2011. As well, the 1973 event was significantly higher at Ball Mountain dam than it was by the time it reached Newfane. This shows the flood control aspect of the dam.

Maximum 1-Day Total Precipitation For Newfane (south of Brookline)		
Rank	Value (inches)	Ending Date
1	4.90	1935-07-06
2	4.35	1973-06-30
3	4.28	1937-11-13
4	4.18	1969-07-29
5	3.62	1960-09-13
6	3.45	1936-03-18
7	3.41	1934-04-12
8	3.29	1938-09-21
9	3.16	1937-10-20
10	3.03	1968-04-25
Period of record: 1930-05-01 to 1981-06-30		

Past Occurrences

Since 1996, when National Climatic Data Center detailed records start, there have been 35 flood events in Windham County, Vermont. Brookline experiences routine spring flooding, but this is not always documented. There have been 15 Presidential Disaster Declarations in Windham County since 1953. Of these, 6 were severe storms, 5 were floods, 2 hurricanes, 1 snow event and 1 severe ice storm.[12]

Disaster Declarations for Windham County, VT

Disaster Number	Incident Begin Date	Incident End Date	Declaration Date	Incident Type	Title	Disaster Close Out Date
4043	5/20/2011	5/20/2011	11/8/2011	Severe Storm(s)	SEVERE STORMS AND FLOODING	
4022	8/27/2011	9/2/2011	9/1/2011	Hurricane	TROPICAL STORM IRENE	
3338	8/26/2011	9/2/2011	8/29/2011	Hurricane	HURRICANE IRENE	3/10/2014
1816	12/11/2008	12/18/2008	1/14/2009	Severe Ice Storm	SEVERE WINTER STORM	10/15/2014
1698	4/15/2007	4/21/2007	5/4/2007	Severe Storm(s)	SEVERE STORMS AND FLOODING	3/13/2013
1559	8/12/2004	9/12/2004	9/23/2004	Severe Storm(s)	SEVERE STORMS AND FLOODING	1/4/2011
1488	7/21/2003	8/18/2003	9/12/2003	Severe Storm(s)	SEVERE STORMS AND FLOODING	1/4/2011
3167	3/5/2001	3/7/2001	4/10/2001	Snow	SNOW	2/28/2005
1336	7/14/2000	7/18/2000	7/27/2000	Severe Storm(s)	SEVERE STORMS AND FLOODING	6/30/2008
1307	9/16/1999	9/21/1999	11/10/1999	Severe Storm(s)	TROPICAL STORM FLOYD	6/30/2008
1124	6/12/1996	6/14/1996	6/27/1996	Flood	EXTREME RAINFALL AND FLOODING	2/23/2005
1101	1/19/1996	2/2/1996	2/13/1996	Flood	ICE JAMS AND FLOODING	2/17/2005
518	8/5/1976	8/5/1976	8/5/1976	Flood	SEVERE STORMS, HIGH WINDS & FLOODING	4/16/1981
397	7/6/1973	7/6/1973	7/6/1973	Flood	SEVERE STORMS, FLOODING, &	11/12/1976

[12] FEMA tool: Data Visualization: Disaster Declarations for States and Counties: Windham County, VT http://www.fema.gov/data-visualization-disaster-declarations-states-and-counties Accessed 10/16/15

					LANDSLIDES	
277	8/30/1969	8/30/1969	8/30/1969	Flood	SEVERE STORMS & FLOODING	5/26/1972

Detail on Specific Flooding Events that have Affected Brookline:

July 10, 2013 - Warm moist air over the northeast provided the ingredients for heavy rainfall, and saturated ground from record May and June rainfall made the region vulnerable to flooding. Showers and thunderstorms developed during the afternoon and evening of July 2 2013, producing heavy rainfall moved repeatedly across southeast Vermont, with isolated flash flooding. This event caused the Greer Pond beaver dam to let go. Resulting flooding took out Hill Road (luckily the box culvert that was installed in 2010 held up during this flooding). Flood water got into some residences basements, two bridges were damaged, there was farm damage, and a driveway was eroded. Flood waters connected with Grassy Brook.

Tropical Storm Irene – August 28, 2011 – Brookline fared better than a number of nearby towns. A couple of culverts were lost. The river beds were opened up, vegetation was stripped out, and debris blocked smaller culverts. The water receded pretty quickly. There were a couple of buildings in the northern end of town that received minor damage. There was more damage along Grassy Brook than the West River, though the water got high on the West River. There was not catastrophic damage anywhere in town. Flooding in Brookline is shown in this video https://www.youtube.com/watch?v=7ui8figRJXY and in photos in appendix 11.

The area around this undersized culvert on Grassy Brook Road was washed away by TS Irene flood waters. Photo courtesy of Thomas Staats.

August 5, 2008 - The passage of a strong upper level disturbance, combined with a moist and unstable air mass in place, led to the development of numerous thunderstorms across southern Vermont during Thursday afternoon on August 7th, some of which contained large hail. In addition, locally very heavy rainfall led to flash flooding in some areas.

April 15-21, 2007 - Flash floods and inundation flooding over a period of several days - The Town of Halifax got 8 inches of snow in the morning of April 15, followed by 6-8 inches of rain. The snow caused a berm at the Town Offices holding in the rainwater which caused a lot of inundation flooding. Rain and snow caused damage to roads and utility lines across Windham County and Halifax. Across the state, nearly $3.6 million was obligated as part of the FEMA Public Assistance Program. There were washouts on Putney Mountain Road in Brookline.

October 8, 2005 - 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.

August 30, 2004 - Flash flooding resulted in washouts of small bridges at Ames Hill, Hescock and Cook Roads. Canoe Brook Road in Dummerston impassable, with a culvert washed away, and a 20-foot wide by 20-foot deep hole in the road. Presidential Disaster Declaration DR – 1559.

October 29, 2003 – Areas of low pressure moved northeast along a frontal boundary across New York and western New England from Sunday night, October 26th into Monday night, October 27th. Rainfall ranged from 1 1/2 to 2 1/2 inches with the greatest amounts in and east of the Green Mountains.

August 3, 2003 – A tropical air mass was in place over southern Vermont on August 3. With a strong disturbance over the Great Lakes adding weak lift to a very unstable atmosphere, scattered showers and thunderstorms erupted during the afternoon hours. A slow moving storm over Windham County produced doppler radar estimated rainfalls of 3 to 4 inches in about four hours time. The torrential rains took a toll, washing out roads in the city of Londonderry. County Highway 121 was washed out in the Town of Windham. Massive flooding occurred in the city of Grafton at the base of Fire Pond and Hinkley Brook roads, where water, debris and mud washed those roads out. The raging debris knocked a house off its foundation and damaged several other ones. This was the same area affected by the infamous Flood of 96 which was even more severe. Heavy rains also washed away a small covered bridge in Grafton. FEMA Declaration DR – 1488 was associated with this event. In Brookline, this event caused the Greer Pond beaver dam to let go. Resulting flooding took out part of Hill Road. Flood water got into some residences basements, two bridges were damaged, there was farm damage, and a driveway was eroded. Flood waters connected with Grassy Brook.

September 28, 2002 - The remnants of Tropical Storm Isidore moved northeast from the Ohio Valley on Friday, September 27th into New York state during the afternoon of the 27th and across central Vermont during Friday night, September 27th. Heavy rain accompanied this system with generally between 1 1/2 and 2 inches of rainfall reported. Amounts were locally higher in the mountains. Earlier in the month, September 14-15, the remnants of Tropical Storm Hannah resulted in rainfall of around an inch across the same area. No flooding was reported with either event.

September 17, 1999 - 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 bank full. Water from the Millbrook in Weathersfield washed away a portion of State Route 5. The World's Fair in Tunbridge was cancelled for the first time in many years. Winds from the passage of Floyd were estimated to have gusted to over 60 mph, especially over hill towns. The combination of the wind and very saturated ground, produce widespread downing of trees and power lines across much of Southern Vermont. A woman was injured on Tavern Hill in Putney, Windham County when a tree came crashing down on her Volvo, destroying the vehicle. Some trees fell on vehicles and houses. The rain and wind produced power outages across the region. As many as 2,000 people lost power in Southern Vermont.

June 19, 1998 - Thunderstorms with torrential downpours produced flash floods across parts of Windham County. Shoulders of routes 100 and 112 were washed out near Jacksonville and Halifax. Flooding also occurred in the Putney area and at Rawsonville. Several mountain roads were washed out throughout the County.

In 1996, Between Saturday morning July 13 and Sunday morning July 14 rainfall from three to five inches was common across southern Vermont resulting in significant damage and a Presidential Declaration of Emergency. Flooding occurred throughout New England causing millions of dollars in damage. The remnants of Hurricane Bertha tracked from the Mid-Atlantic region northeast to Quebec, Canada. Several roads and streams were flooded throughout the region, including low-land flooding along the Hoosic River in Bennington County. Scattered power outages also occurred over the area, when strong winds downed water-laden tree branches onto wires.

During 1976, flooding occurred throughout New England, as result of Hurricane Belle, causing millions of dollars in damage.

In 1973 there was an extreme rainfall event from June 28-30 that affected all areas of Vermont except the northwest section. Rainfall amounts as much as 6 inches in 24 hours in some locations. This was the largest rain event since the 1927 flood. Highway damage was extensive in the south-central, southeastern, and northeastern areas of the State. Three persons were killed in the 1973 flood, and damage was estimated at $64 million. Sizable crop loss was reported, and damage to State highways was estimated to be $10 million. The entire State was declared a disaster area.[13] The Rock River experienced major flooding. After this event, there was extensive dredging, berming and windrowing in an attempt to control channel location and reduce future flood impacts.

The Vermont Flood of 1927 was the deadliest flooding event in the history of the State; eighty-four people were killed with over $28 million in property damage.

The Spring Floods of 1938, which had an effect on all of New England, caused $113 million in damage, killed 24 people and made 77,000 people homeless. During this flood alone, the main street of Hooksett, New Hampshire was 18 to 20 feet underwater.

June 20, 1821 marks the day of greatest freshet recorded in Brookline. This excerpt “The June Freshet” was taken from “The Local History of Brookline, VT.”[14]:

> *In the morning the heavens were clear and sunshmy, a little past noon, around the summit of Lily Pond hill, the sky became dark and heavj", and soon ter-rific peals of thunder vibrated the air, and the rain came down in such torrents as to cover tlie ground with a complete sheet of water. To use the words of BarziUai Sticlniey, who witnessed it : — " It seemed as though the heavens met the earth, and instantly, a mighty, bil-lowy sea came rushing down, carrying rocks, stones and trees to the vaUe be-low." About one half the deluge came down through Grassy Brook, the other north wai'd through Athens into Saxtou's River. Every bridge was swept away. The Valley road in many places was completely destroyed, and many acres of the rich,, loamy meadows made beds of stones and gravel . Hugh stones were lifted up and carried like pebbles; near-ly all growing crops in the Valley were destroyed.*
>
> *The scholars in District No. 2, hear-ing the tumult, came out on the bridge just north of the school-house to see how rapid the water came, not appre-hending danger; Dr. Wm. Peny living near seeing the impending danger, rush-ed out and drove the scholars back. As he stepped from the bridge, a huge swell of water carried it off and Mr. Perry was seperated from his family for the night ; but the lives of several of the scholars were undoubtedly saved.*
>
> *So destitute were several families after his visitation that aid was sent to them by the people of Putney.*
>
> *So large and rapid was the torrent of the water, at Saxton's River, a distance of 9 miles, it was with gi-eat effort, that the help in the factory there were res-cued. Sarah Perham, the mother of the writer, was carried on the shoulders of men who waded waist-deep in water.*
>
> *The brick had been left for the Round school house, upon the north side, but so powerful was the deluge they were* taken up and carried to the south side, upon a higher ground, where the house*

[13] USGS “Vermont Floods and Droughts” information page http://md.water.usgs.gov/publications/wsp-2375/vt/. Accessed 4/3/15.
[14] Excerpt from "The local history of Brookline, VT: The general history of the town”. By Stickney, Charles Perham. Published 1886, Chicago. https://archive.org/stream/cu31924028837859/cu31924028837859_djvu.txt Accessed 6/14/16.

now stands. To give a vivid conception of the deluge, large logs floated past C. P. Stickney's house in the road.

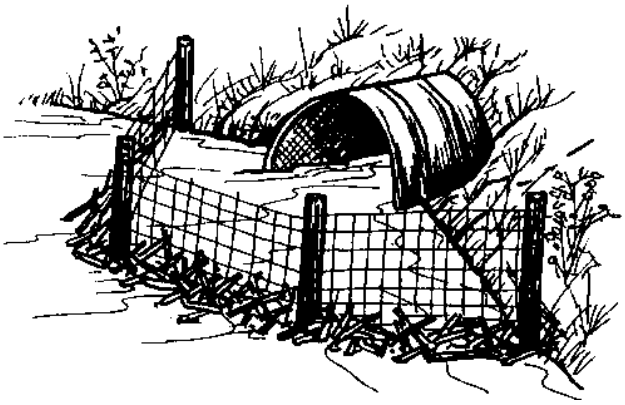
The people felt the ^Dressure of the damage done: the thoroughfare acrost the hills ceased, the stores were closed, small farms were sold, and the hillsides being deserted the population decreas-ed. The building of roads up West River, helped also to bring about this result.

Sources used
Local knowledge of areas of concern and impacts, Discussions and emails with Town Clerk Guy Tanza, members of the Hazard Mitigation Planning Committee and Planning Commission Chair Tom Kavet in June 2016

Beaver Dam Failure

Damage to Hill Road from 2013 failure of Greer Pond beaver dam. Picture courtesy of Thomas Staats

This section will be a brief overview of beaver dams and the hazard that they can cause when they fail. There are a couple of areas in and nearby Brookline that are frequented by beavers, who have created dams. The primary area of concern for beaver dams in Brookline is at Greer Swamp, which is privately owned and thus not actively managed by the Town. The second main area of concern is actually in the southern portion of Athens, upstream of Brookline. Additionally, at times beavers plug culverts around Town. Beavers are a controversy in the town because some want to save them and others want them gone. It is a balancing act with beavers. Left unmanaged, the beavers could potentially cause a lot of damage to town infrastructure the next time a dam broke. Likewise, without the beavers to maintain their dams, which create wetland habitat and have big ecological value, the dams would likely fail within 2-3 years causing washouts and flooding. So it is a careful balance to ensure the beavers have an area and are able to maintain their role in the ecosystem, while not negatively affecting the town's infrastructure.



The schematic above shows a beaver fence. Devises like this are allowing beavers and humans to live together in peace.
Image source: www.usroads.com

One potential remedy that should be explored by Brookline is beaver fencing. These fences are effective, non-lethal defenses that end decade long conflicts while allowing for the possibility of keeping live beavers in ecosystems. They have worked well in towns throughout the Windham Region and Vermont.

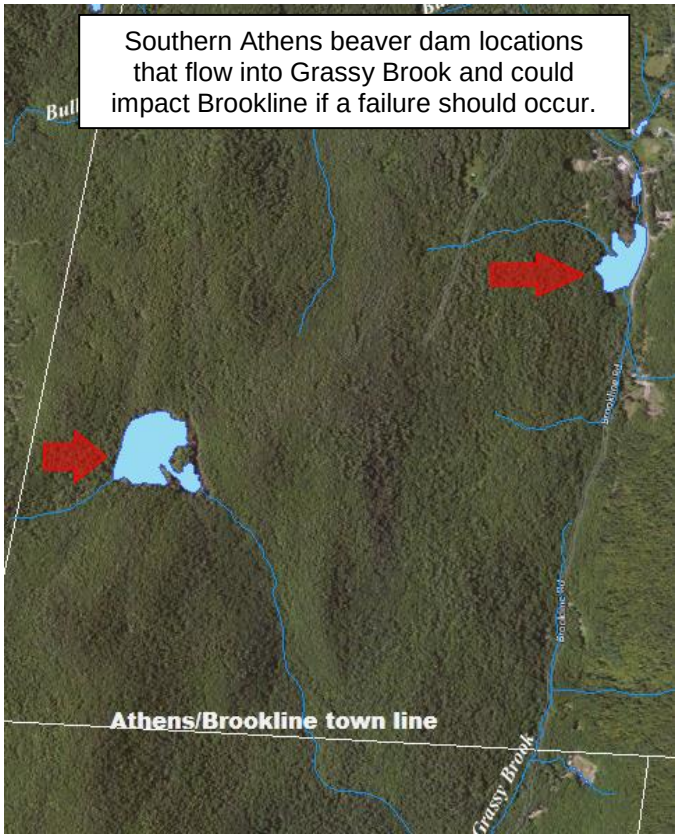
Greer Pond dam: This pond is located on private land and is far back from the public road. The Pond is really a large swamp. The beaver management that is occurring is through trapping of the animals. The trapper has permission from the property owner to hunt and trap beaver on the property. The Town has little knowledge of the site dynamics, even though they impact a large area should a beaver dam fail again, as it has on multiple occasions in the past. The Road Foreman feels that more communication

with the property owner and the Town regularly monitoring the dams in the Pond, with permission from the landowner, would be an optimal solution. The monitor would be looking at the size of the setback. At one point the dam had gotten to be 10 feet high and built up a large amount of water behind it. Controlling the beaver population can control the size of the dam, but there are other ways to mitigate for damage from beaver dams that might be appropriate at the site. The Road Foreman would need to inspect the dam to see if a baffle would be useful. Information gathering through a site inspection is the necessary first step to see what a remedy could be.

Greer Pond has about 12-17 acres in it that let go when a failure occurs. This part of the landscape, due to the terrain, collects water from a number of basins. A previous failure in 2013 took out Hill road and damaged Grassy Brook Road. Pictures are shown here and in the appendix of this plan[15]. A lot of the repairs were needed as a result of the damage. Greer Pond in Brookline is pointed out on the SFHA / River Corridor maps in the "Flooding and Fluvial Erosion Mapping" section of this plan.

2013 damage to Hill Road, showing dam washout material on upstream culvert, from failure of Greer Pond beaver dam. Picture courtesy of Thomas Staats

<u>Southern Athens beaver dams:</u>
There are several ponds with beaver dams present in southern Athens (arrows on picture to the right point these ponds out), not far north of the Brookline town line. Grassy Brook flows south from Athens to Brookline along Grassy Brook Road. The Road Foreman is concerned about these dams impacting Brookline, should they fail. They held during TS Irene, which is the largest storm in memory of the townspeople, although the water coming off the dams was white water, according to the Road Foreman. The terrain there is narrow that the stream lies in that these dams are along, so the water volume is less but it can reach a high velocity. There was some damage done from this water to the road around culverts and private bridges, but nothing compared to what could have occurred had the dams failed. The Town has not spoken with Athens about this concern.



Southern Athens beaver dam locations that flow into Grassy Brook and could impact Brookline if a failure should occur.

<u>Location / Special Flood Hazard Area and River Corridor Mapping</u>
FEMA has mapped "A" zones and "AE" zones Brookline. "A" zones do not have Base Flood Elevations determined AE zones do. There is no mapped floodway in Brookline. These zones comprise the Special Flood Hazard Area (SFHA). Properties within the SFHA, that have a mortgage, are required to purchase flood insurance. Brookline's participation in the NFIP gives

[15] See appendix 10.

residents access to discount flood insurance through the NFIP. The Flood Hazard Summary Sheets on FloodReady Vermont's website says there are 19 structures in the Special Flood Hazard Area and 5% of these structures have flood insurance.[16]

Tropical Storm Irene flooding of a residence in the unmapped floodplain area along Grassy Brook. Photo courtesy of Thomas Staats.

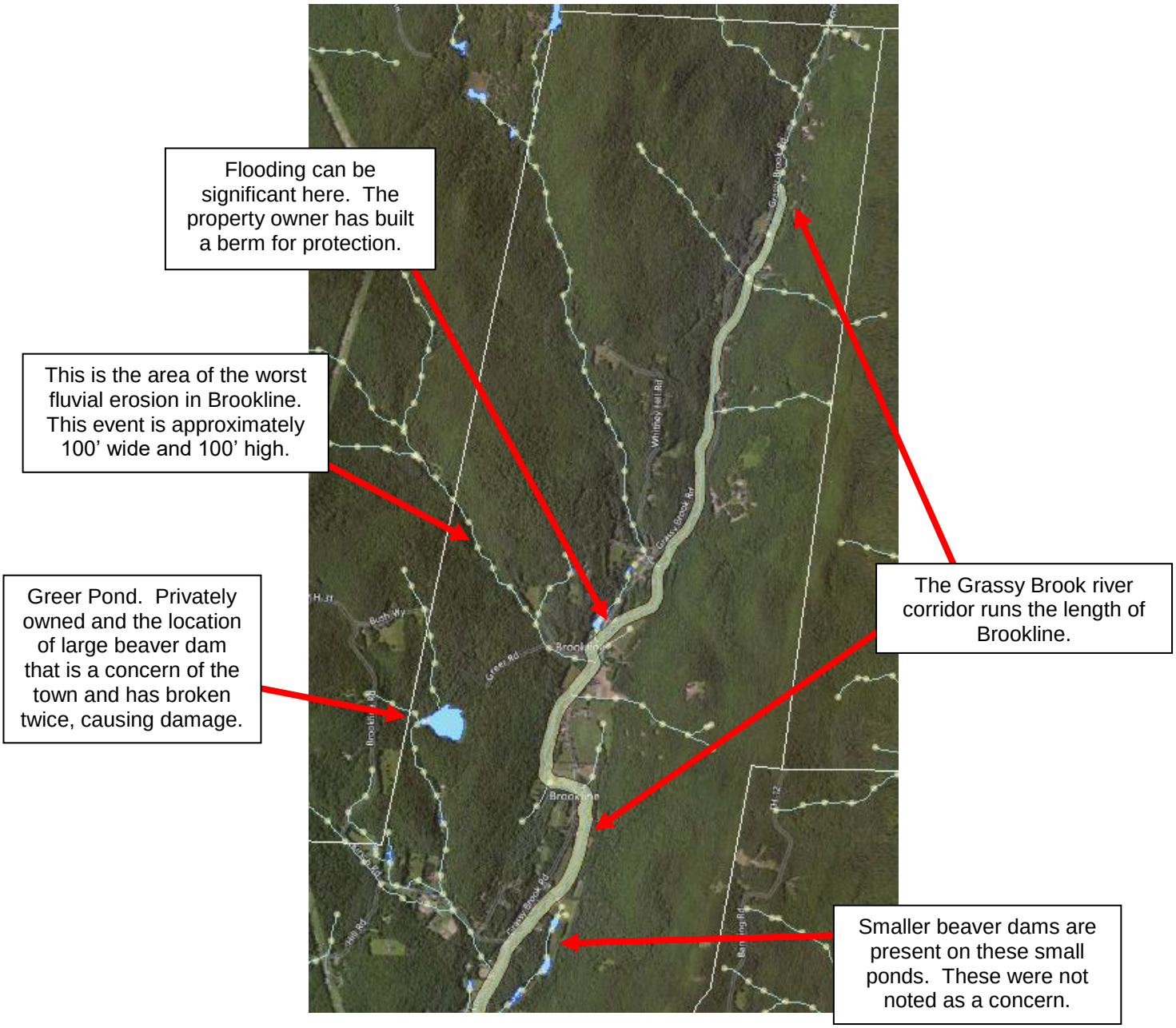
The maps on the following pages were created using the Vermont Agency of Natural Resources 'Natural Resources Atlas' which is an online mapping tool. These maps are snips showing all of the special flood hazard areas (SFHAs) that FEMA has designated in Brookline. They are shown in orange, red and red hatching. The floodplains shown in these maps are based on the FEMA Flood Insurance Rate Maps (FIRMs) available through the FEMA Map Service Center.[17] The map effective date for the latest FIRMs for Windham County is 9/28/2007. The map also shows the River Corridors that Vermont Agency of Natural Resources (ANR) has mapped. River Corridors encompass an area around the present channel where fluvial erosion, channel evolution and down-valley meander migration are most likely to occur. The mapped river corridor includes this area and a 50-foot buffer on either side to allow for the recommended setback and zone of avoidance to protect the riparian/fluvial erosion hazard corridor. The ANR defined River Corridor also includes a 50 foot buffer on all streams shown on the Vermont Hydrologic dataset. The mapped River Corridors are for streams with a watershed of two square miles or greater, the white shaded streams with the dots have a regulated 50 foot small streams buffer, which is also regulated as the River Corridor is. Though Brookline does not currently have a floodplain bylaw that locally regulates the River Corridor, for any state permits the buffer would be considered and regulated as such. It is a mitigation goal for Brookline to update their floodplain bylaw to include regulation of River Corridors.

There is a strong correlation between waterways areas and the transportation routes in Brookline, with the main travel road being along Grassy Brook. This can lead to road washouts and culvert issues during storm events. Brookline has done a number of stabilization projects in areas subject to fluvial erosion. Some issues are more difficult to deal with because they are on private land. Specific projects are discussed in the mitigation section of this plan. Flooding and fluvial erosion are both issues along the northern section of Grassy Brook, however the below map shows that this area is not within the FEMA

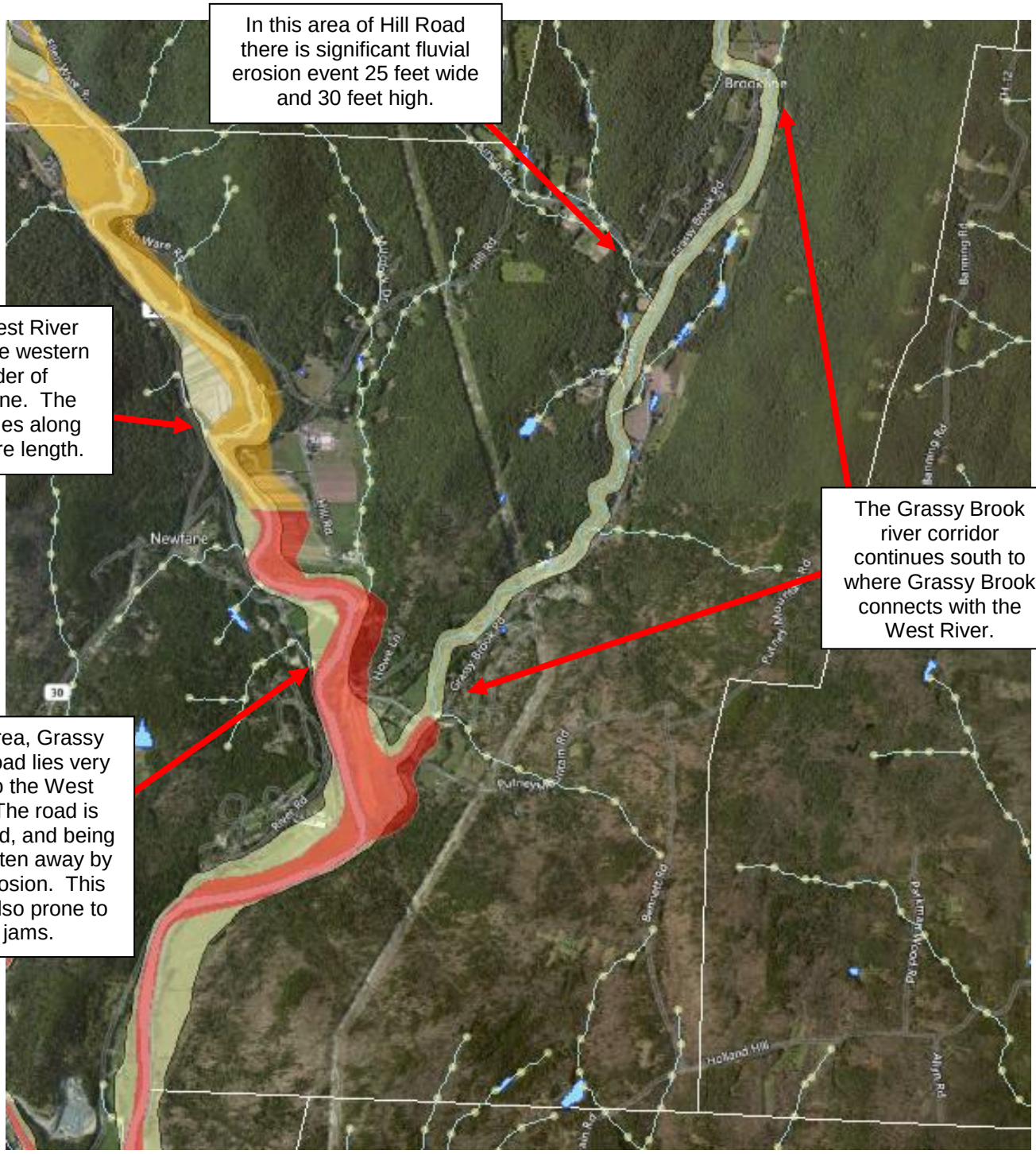
[16] Flood Hazard Summary Report for Brookline, accessed 6/9/16 <https://anrweb.vt.gov/DEC/FoFReports/DisplayFloodHazardReport.aspx?SC=&SMN=Brookline&SRPC=&SSA=N>
[17] FEMA Map Service Center https://msc.fema.gov/portal

defined Special Flood Hazard Area. Floodplain mapping alone is not a determination of what areas will or will not experience flooding.

The below map shows the Special Flood Hazard Areas (SFHAs) in orange (A zone) and red (AE zones), and the River Corridors in white, for the northern portion of Brookline. There is no FEMA SFHA in the northern section of Brookline. The Grassy Brook river corridor runs the length of the town. The small stream buffer (which has the small white dots along it) is also considered as river corridor, and it lies along many small streams throughout Brookline. Greer Pond, the largest water body in Brookline, lies on the below map.



The below map shows the Special Flood Hazard Areas (SFHAs) in orange (A zones) and red (AE zones), and the River Corridors in white, for the southern portion of Brookline. SFHAs are along the West River forming the western border of Brookline. The River Corridor also follows the West River. The River Corridor additionally follows the Grassy Brook the length of Brookline. The small stream buffer (which has the small white dots along it) is also considered as river corridor, and it lies along many small streams throughout Brookline.



Invasive Species

Invasive species are a region-wide hazard, however each location will be confronted with a distinct mix of invasive species that thrive under the ecological conditions of that place. Each invasive species has a different potential to spread to other areas based on the rate at which it spreads and the ecological suitability of the ecosystem that it is expanding into.

Many species of plants and animals have been introduced into our ecosystem for various uses; these exotic species have varying propensities for becoming invasive. An invasive species is an exotic species whose introduction into an ecosystem in which the species is not native causes or is likely to cause environmental or economic harm or harm to human health. Many species of invasive plants and animals are currently affecting Southeastern Vermont and can have significant levels of impact to the native flora and fauna.

Invasive Plant Species

In the absence or near absence of natural predators or controls, invasive non-native plants are able to spread quickly and outcompete native plants. Invasive plant species can create monocultures, which often provide poor habitat for native animals that have not evolved with the non-native species, resulting in degraded habitat value and increased vulnerability. The invasive plant issue really escalated in the early 1990's. Invasive plants tend to thrive in disturbed areas. Within the Windham region, they are more prolific in the towns along the Connecticut River than to the west because these towns are more populated, contain major transportation routes such as I-91, which serve as vectors for their expansion, and tend to have significant land disturbance.

Some of these plants were originally planted because of their positive aspects such as their ability to grow in difficult growing conditions, long growing season length, their large seed production and their ornamental value. These same reasons are a big part of why they have become invasive plants. Some varieties of invasive plants were also brought here inadvertently through the importation of goods from overseas. In the Windham region, Deerpark Road, in Halifax, is a particular example of an area with a lot of Asiatic honeysuckle that is impeding growth of other native plants.

Preventing the spread of invasive plants is something that everyone can assist with. The first step is to not plant non-native plants on your property and to remove invasives that exist. Additionally, it is important that when soil is disturbed, to plant native cover before invasives have a chance to establish themselves. Proper disposal of non-native vegetation is critical to avoid its spread, safely burning the material when possible. Avoid transporting non-native plants, including firewood, as this critical to prevent the spread of non-native seeds and insects.

The below is a list of invasive plants that the Vermont Fish and Wildlife Department have on the watch list.[18]

[18] Vermont Fish and Wildlife Department: Wildlife Action Plan. Developed 11/22/05. Accessed 3/2/15. http://www.vtfishandwildlife.com/library/reports_and_documents/vermonts_wildlife_action_plan/_/_report/7_appendix/k_invasive_exotic_and_pest_species.pdf

List of Watch Species in Vermont

Scientific Name	Common Name
Acer ginnala Maxim.	Amur maple
Acer platanoides L.	Norway maple
Alnus glutinosa (L.) Gaertner	European black alder
Amorpha fruticosa L.	False indigo
Ampelopsis brevipedunculata (Maxim.) Trautv.	Porcelainberry
Anthriscus sylvestris (L.) Hoffm.	Wild chervil
Berberis thunbergii DC.	Japanese barberry
Berberis vulgaris L.	Common barberry
Callitriche stagnalis Scop.	Pond water-starwort
Cardamine impatiens L.	Narrowleaf bittercress
Centaurea maculosa L. Syn.: *Centaurea biebersteinii* DC	Spotted knapweed
Elaeagnus angustifolia L.	Russian olive
Elaeagnus umbellata Thunb.	Autumn olive
Euonymus alata (Thunb.) Sieb.	Winged euonymus
Euphorbia cyparissias L.	Cypress spurge
Glyceria maxima (Hartman) Holmberg	Reed mannagrass
Hesperis matronalis L.	Dame's rocket
Iris pseudacorus L.	Yellow iris
Ligustrum obtusifolium Sieb. & Zucc.	Border privet
Lonicera xylosteum L.	Dwarf honeysuckle
Lysimachia vulgaris L.	Garden Loosestrife
Marsilea quadrifolia L.	European waterclover
Microstegium vimineum (Trin.) A. Camus	Japanese stilt grass
Najas minor Allioni	Brittle waternymph
Paulownia tomentosa (Thunb.) Sieb & Zucc. Ex Ste.	Princess tree
Phalaris arundinacea L.	Reed canary grass
Polygonum perfoliatum L.	Mile-a-minute vine
Polygonum sachalinense F. Schmidt ex Maxim. Syn: *Fallopia sachalinensis* (F. Schmidt ex Maxim.) Dcne.	Giant knotweed
Populus alba L.	White poplar
Robinia pseudoacacia L.	Black locust
Rorripa nasturtium-aquaticum (L.) Hayek Syn: *Nasturtium officinale* Ait. f.	Watercress
Rosa multiflora Thunb. ex Murr.	Multiflora rose

Top Invasive Forest Pests and their Impacts

Non-native invasive species cause irreversible impacts on tree health, forest composition, and biodiversity. Three non-native insects which currently threaten Vermont are the emerald ash borer (EAB), Asian longhorned beetle (ALB) and hemlock wooly adelgid (HWA). Only hemlock wooly adelgid is currently present in the state; emerald ash borer and Asian longhorned beetle are within fifty miles of Vermont's border. Over half of the trees in Vermont are host species of one of these three insects.[19]

Hemlock woolly adelgid (shown below to right)

The hemlock woolly adelgid (HWA), *Adelges tsugae*, is a tiny insect from east Asia that attacks forest and ornamental hemlock trees. It feeds on young twigs, causing needles to dry out and drop prematurely. Trees may die in four to six years. Some survive, but with sparse foliage, losing value as shelter for wildlife and their ability to shade streams.

[19] vtinvasives.org (accessed 2/20/15)

The HWA first arrived in the southeast U.S. and spread to the northeast through the Long Island Sound. Sustained cold leads to kill off of the adelgid insects. Mortality rates of even 91%, however, can still lead to population growth through the warm season because they reproduce asexually so it only takes one for the population to expand.

The HWA mortality rate shifts each year based on temperature patterns throughout the year, especially cold winter temperatures that cause die off. In 2014 the mortality rate was only 40%, whereas in 2015 the expected mortality rate is 98-99% because it has been an especially cold winter. Populations build back up in warmer months.

HWA has been found on private property in Brookline. In the Windham region, it was initially found in Brattleboro and the Guilford area. It is now found in 14-15 Windham Towns, and has been recently found in Springfield in Windsor County. It has not yet been found in Weston, Winhall, Somerset, Searsburg or Readsboro.

Hemlock trees and even whole stands are showing signs of decline, but trees in Vermont have not been reported to have been killed from HWA alone. Foresters have been watching infested trees for eight years, and the trees haven't been killed yet most likely because winter temperatures kill off enough of the HWA to give the tree a temporary reprieve. HWA does weaken the trees to the point that other secondary stresses, such as funguses and disease, may result in their mortality. Another pest, Hemlock elongate scale was found recently for the first time in Guilford, Vernon and Brattleboro. Brookline has not identified or trained any First Detectors for the town.

Asian longhorned beetle (shown to right)

The Asian longhorned beetle (ALB), *Anoplophora glabripennis*, is an invasive insect that feeds on certain species of hardwood trees, eventually killing them. Also known as the Starry Sky or Sky Beetle, the ALB is native to eastern Japan, and Korea. It was brought to the US, to New York City first, in packing material from Asia. ALB attacks a variety of native hardwood species, including maple, birch, elm, poplar, horse chestnut and willow. ALB prefers maples and does not like trees in the oak family. Upon hatching, the larvae tunnel through the heartwood of a host tree until fully grown. They then burrow out of the trunk as adult beetles. This process weakens the wood, making it prone to breakage, and can cause tree health to decline. Outbreaks of this beetle pose a severe threat to even perfectly healthy trees in both forests and urban and suburban landscapes. The beetle has caused tens of thousands of trees to be destroyed in Illinois, Massachusetts, New Jersey, New York and Ohio. Trees that aren't destroyed by people trying to prevent the spread are usually killed by the pest within a couple years. About half of Vermont's trees are susceptible to Asian longhorned beetle. This insect will have a major impact if it becomes established in Vermont.

The closest area to the Windham region that has the pest is Worchester County, Massachusetts. And they have an active quarantine and public notification campaign about the pest.[20] They are having to destroy every host tree, infected or not, and will be replanting in the oaks. Boston had a small outbreak

[20] http://www.worcesterma.gov/city-manager/asian-longhorned-beetles. Accessed 3/2/15.

which they believe was caught in time. New York and Ohio also have quarantines in affect in their boundaries to prevent the spread. ALB has not been detected in upstate NY or in NH. It is difficult to spot infected trees from the ground, so inspectors need to climb trees. To treat wood for transport it needs to be heated to at least 160 degrees for longer than 75 minutes.

Emerald ash borer (shown to right)

Emerald ash borer (EAB), *Agrilus planipennis*, is an exotic beetle that was discovered in southeastern Michigan near Detroit in the summer of 2002. The larvae feed in the cambium between the bark and wood, producing S-shaped galleries that girdle and kill branches and trees. Emerald ash borer probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. It first came into Detroit and killed off all the ash trees in the city, which had been planted after the city's elm trees had been killed by Dutch elm disease. The United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) does inspections at ports and terminals, but only inspects about 7% of materials coming into the US. Emerald ash borer has spread rapidly in the United States, killing millions of trees, and is expected to reach Vermont. It is currently present in 23 states. The closest infestations are in south-central NH (now present in 4 counties in NH – first found there 2 years ago near Concord), Berkshire County Massachusetts, New York's Hudson Valley, and just 30 miles north of the Vermont border (near Highgate) in Quebec. This means Vermont is essentially surrounded. There are no known populations in Maine as of now.

Blonding with pecked holes on ash trees is a sign of EAB infestation.

White ash is one of the ten most common tree species in Vermont, so this insect will have a major impact when it becomes established in the state. EAB only feeds on Ash trees, but that is 7% of Vermont's tree species. EAB can travel faster than ALB. EAB is often moved around on firewood that people transport. Eradicating the insect on wood requires heating it to at least 140 degrees or higher for greater than 60 minutes.

EAB essentially girdles the ash trees, killing them. It lives between the inner bark and the wood, so it isn't that deep. Woodpeckers like feeding on EAB, but the woodpecker population isn't large enough to significantly impact the EAB population. Also the woodpeckers don't generally detect the insects in the trees until they have been present for about two years, which is too late to save the tree. One of the best diagnostic methods for detecting EAB is called "blonding". "Blonding" is a clear symptom of EAB infestation. It occurs when woodpeckers, while foraging for the succulent EAB larvae, flake off outer layers of bark, revealing the lighter or blond-colored inner layers of bark.[21]

A native ground-nesting wasp, *Cerceris fumipennis*, is providing a handy solution to our beetle detection problem. This wasp will prey on the adult emerald ash borers (as well as related native beetles) and carry them, paralyzed, back to its burrow. The paralyzed beetle is then stored underground as food for the wasp's larva. It is unknown to Brookline whether ANR set out purple traps in Brookline to catch the beetles for early detection. None have been seen. Some informed residents know to contact ANR when they find anything suspicious. There is a high awareness of invasives in the town residents, according to a recent town survey done in

[21] University of New Hampshire Cooperative Extension – Blonding on Ash trees information sheet. < http://extension.unh.edu/resources/files/Resource004103_Rep5824.pdf> Accessed 3/2/15.

March 2016 (they conduct town survey every 5 years to gauge citizen concerns and invasive species has been added to their question list as of this year. It is a growing concern.[22]

Impact
The impacts of invasive species have ripple effects that go on and on. Hemlock is a foundation tree species, and when it goes away invasive plant species tend to take over, causing wildlife habitat and water quality decrease. Deer use hemlock stands to winter over in because of the cover a healthy tree provides, so there could be a detrimental impact to the deer population, and hunting, caused by the loss of hemlock. Hemlocks provide shade to waterways, so their loss could mean warmer streams and lower water quality, potentially impacting aquatic life. The hemlock isn't a comparatively very valuable wood product, but it is used for logging and wood products, so there are economic threats to its loss.

Ash logs are more valuable than hemlock logs, but the bigger concern with the loss of ash is the cascading ecological impacts. There are over 40 arthropod obligate species that are threatened by the loss of ash trees (they depend on ash for their survival), and ripple effects of the loss of these arthropods and the interrelationships aren't even fully known at this point. Ash is a valuable tree for wood products and logging, so the economic impacts could be severe. Not to mention, the cost to towns for removing dead or dying trees, and the aesthetic and community open space impacts caused by their loss. Ash trees are about 12% of the forest cover in Vermont, and there are pockets of lots of ash in Brookline. The Town of Brookline should host a first detector training and do an inventory of ash trees along roadways.

The loss of maple trees to ALB, could mean a devastation to the maple industry, which is a big industry in Vermont, including in Brookline. A lot of people sugar in Brookline, not all commercially, but it is a big activity in town. Economic impacts could be great. Sap can't be used once a maple is treated with insecticide, and the lag time before it can be used again is unknown. Fall foliage tourism is a big draw for visitors to Vermont and this would be big loss of "leaf peepers" who are a big driver of the economy for the area.

Probability
As mentioned earlier in this section, only hemlock wooly adelgid is currently known to be present in the state of Vermont; confirmed populations of emerald ash borer and Asian longhorned beetle have been found within fifty miles of Vermont's border. EAB surrounds Vermont and some believe it is already in the state, but hasn't yet been detected. So the probability is high that EAB and ALB will affect the region. HWA has been confirmed in 14-15 towns in the Windham region, though as of last report by Vermont Invasives, that number wasn't increasing. This may be due partly to winter mortality rates exceeding the 91-92% threshold which so far tests show seems to halt the infestations spread. Despite this good news, Brookline should continue to be aware of its vulnerability and encourage people to not transport firewood and to report sightings to the town and/or state ANR. Additionally, certain invasive plant species are present in every town in the region.

Extent
Over half of the trees in Vermont are host species of one of these three main pests, so the potential impact is great. EAB only feeds on Ash trees, which are 7% of Vermont's tree species and a strong component of beech/birch forest stands. Southeastern Vermont has primarily white ash and green ash, while black ash are less common here, they are found more so to the north. Green ash is common in urban environments because they are good shade trees and do well in an urban setting. Newfane is an example of a town in the Windham region that has planted a lot of green ash trees, so they are particularly vulnerable to EAB.

Ash planted on roadside rights of way have the highest potential for infestation of EAB. There is the potential for hundreds of dead Ash trees along roadways throughout the state and near extinction of Ash trees. The current mortality rate is 99.8% of trees. Cutting dead trees is a very hazardous activity and the potential for a lot of dead trees along road ways is a concern for protecting public safety and infrastructure.

[22] Phone interview with Planning Commission Chair Tom Kavet on 6/16/16.

Being proactive is key for stopping, or at least curtailing, the spread when pests are detected. Inventories of roadside ash trees are a good thing for towns to do now. Training for road crews in identification and who to alert of outbreaks is also a good idea. Numerous towns (including Brattleboro) in Vermont have developed EAB preparedness plans. Ash trees can be treated to prevent EAB, and weighing the cost of proactive treatment versus removal of dead trees and replacement is something a community must weigh.

There are EAB insecticides that are registered for use in VT and they are fairly effective at protecting trees, but they have to be applied to each tree individually so this isn't practical to protect all ash trees in a forest environment, but is good option for an urban tree canopy. Additionally trees have to be retreated every one to two years because of the insects life cycle. ALB eradication is to cut and chip all the trees that are infested. There is another insecticide that works for ALB, but it is only effective if the tree is treated before the larvae burrow too deeply into the wood beyond the tree's vascular system. The ALB larvae spend a lot of its time in the interior wood, out of the systemic system of the tree so they aren't exposed to the insecticide.

The worst example of the potential impact of ALB infestation in the U.S. is Worchester County, Massachusetts. This problem has been going on for about seven years. It was well established before discovery, as much as 15 years went by before it was discovered. It had gotten out of the Worchester City and into the surrounding natural landscapes around the city, which has made eradication difficult.

ALB can be eradicated when discovered early. It is usually found in industrial settings, because it usually arrives in pallets from an Asian shipment. ALB is now being moved around through human activities, especially through the movement of firewood. It is easier to detect ALB than EAB because the ALB is larger.

Invasive plants are also a threat to the ecology and economy of Brookline. Invasive plants are present in Brookline. The Hazard Mitigation Committee noted that private land near Parker Road was noted during a recent visit by Current Use Forester, Rose Beatty, to have barberry, honeysuckle and buckthorn present. As well, the Road Foreman noted that poison parsnip is growing along Grassy Brook Road in many places. The Road Foreman does weed whacking and brush cutting along the Road to try and control the poison parsnip as he sees it. It is basically just on the roadsides on the town right of ways. Everywhere that the road salt gets put down has poison parsnip growing. The Committee felt the poison parsnip issue is due to the distribution of seeds in the road salt (which has been imported from South America)[23]. Poison ivy and Japanese knotweed are also problem invasives in Brookline. The Road Foreman is concerned about Japanese knotweeds impact to the bridge abutments on the Green Iron Bridge as the plant can get into cracks in concrete and expand them, weakening a structure. Japanese knotweed root systems can go 25 feet in any direction, so mowing doesn't help control its spread. Poisoning knotweed regularly for years is a remedy, but a lot of people don't want to use harsh chemicals on the land.

> Japanese knotweed is very fast growing and hard to control. It's a constant battle to keep it out of the roads. It's a large problem on all of the roads that I travel. – Mark Bills, Brookline Road Foreman

There are more and more invasive plants moving up along roadways and waterways from lowland areas. All threaten forest regeneration, and multi-flora rose and Asiatic bittersweet can destroy mature trees. Smaller invasive plants such as garlic mustard, purple loosestrife, and goutweed present a threat to native herbaceous plants. The health threat posed by Japanese barberry should be noted: According to Jeffrey Ward, Chief Scientist at the Connecticut Agricultural Experiment Station, a forest infested with Japanese barberry harbors an average of 120 black-legged ticks per acre while a forest without barberry harbors an average of only 10 black-legged ticks per acre. Black-legged ticks are known to transmit the causal agents of several diseases, including Lyme disease. TS Irene spread a lot of invasive plants around the region through the transport of seed

[23] This list is not exhaustive. Species were noted by Hazard Mitigation Plan participants at the September 24, 2015 public meeting.

material from various sources, including flood waters. Logging, and particularly clear cutting, create areas that are particularly susceptible to invasives. Logging is occurring in Brookline.

VTinvasives.org is a great resource for towns interested in engaging in activities around invasives, including using their template to develop a custom invasive species plan for your town.[24] The idea is to continue to create as much awareness as you can so residents know who to call when they see things. The sooner an outbreak is found, the better the chances of containment. Bio-controls are being worked out currently but aren't yet a solution. No one in Brookline is a trained first detector. Insect pests are often found first by concerned citizens who pay attention to these things, rarely by professionals.

Sources Used
Interview with Windham County forester Bill Guenther on 3/2/15 (802-257-7967 or bill.guenther@state.vt.us); Interview with VT State Forester Jim Esden on 3/4/15 (802-885-8822 or jim.esden@state.vt.us); Interview with First Detector Jordan Fletcher on 4/29/15; Interview with Brookline Planning Commission Chair Tom Kavet on 6/16/16; VT Fish and Wildlife website; VTinvasives.org; Cerceris.info webpage; Images courtesy of Google images.

Power Outages
Power failure is a common condition associated with high winds, ice storms, downed trees, and other hazards. It can occur anywhere in town. Power failures are typically the result of power lines damaged by high winds or heavy snow/ice storms. Power failures may also result from disruptions in the New England or National Power grid, as indicated by the widespread power outages in 2003. Dead or dying trees in close proximity to power lines pose a particular threat for power failure. Green Mountain Power serves Brookline. Power outages can be viewed on their website.[25]

There are a number of businesses that don't have generators, particularly inns and lodges. Extended power outage would be a problem if there were a lot of tourists that couldn't leave the area. There is a need for tourists to be alerted not to come to town when bad weather is expected. Residents that don't have access to a generator are of concern in winter months if there is no alternate heat source other than electric. The need to educate residents about the proper installation and use of generators to prevent accidents was acknowledged.

There are only a couple of buildings (residences) in Brookline that are served by their individual renewable power generators, solar and wind, and these buildings will be more resilient during power outages. Promotion of small scale renewable power generation at homes and businesses is advantageous so as to increase individual resiliency and decrease reliance on the grid. This also means less reliance on generators which produce harmful emissions and are a safety concern if not properly used.

TS Irene in 2011 and the December 2008 ice storm were major weather events that caused extended power loss. Some areas were out of power for 10 days. There was another long power outage when widespread severe weather outbreak hit Vermont during the morning hours of July 15, 1995. 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. Locals say power was out for four days from this event.

Potential loss estimates from power failures are difficult to predict, as they typically are isolated in geographic area and short in duration. Therefore, they often have only minimal impact to people and property. Power failures usually result in minor inconveniences to residents; however, longer duration events can result in the loss of perishable items and business losses. Power outages in winter months can result in the loss of home heating, bursting water pipes and resulting structural water damage.

[24] < http://www.vtinvasives.org/tree-pests/community-preparedness>
[25] https://wss.greenmountainpower.com/customers/outages/

ASSESSING VULNERABILITY

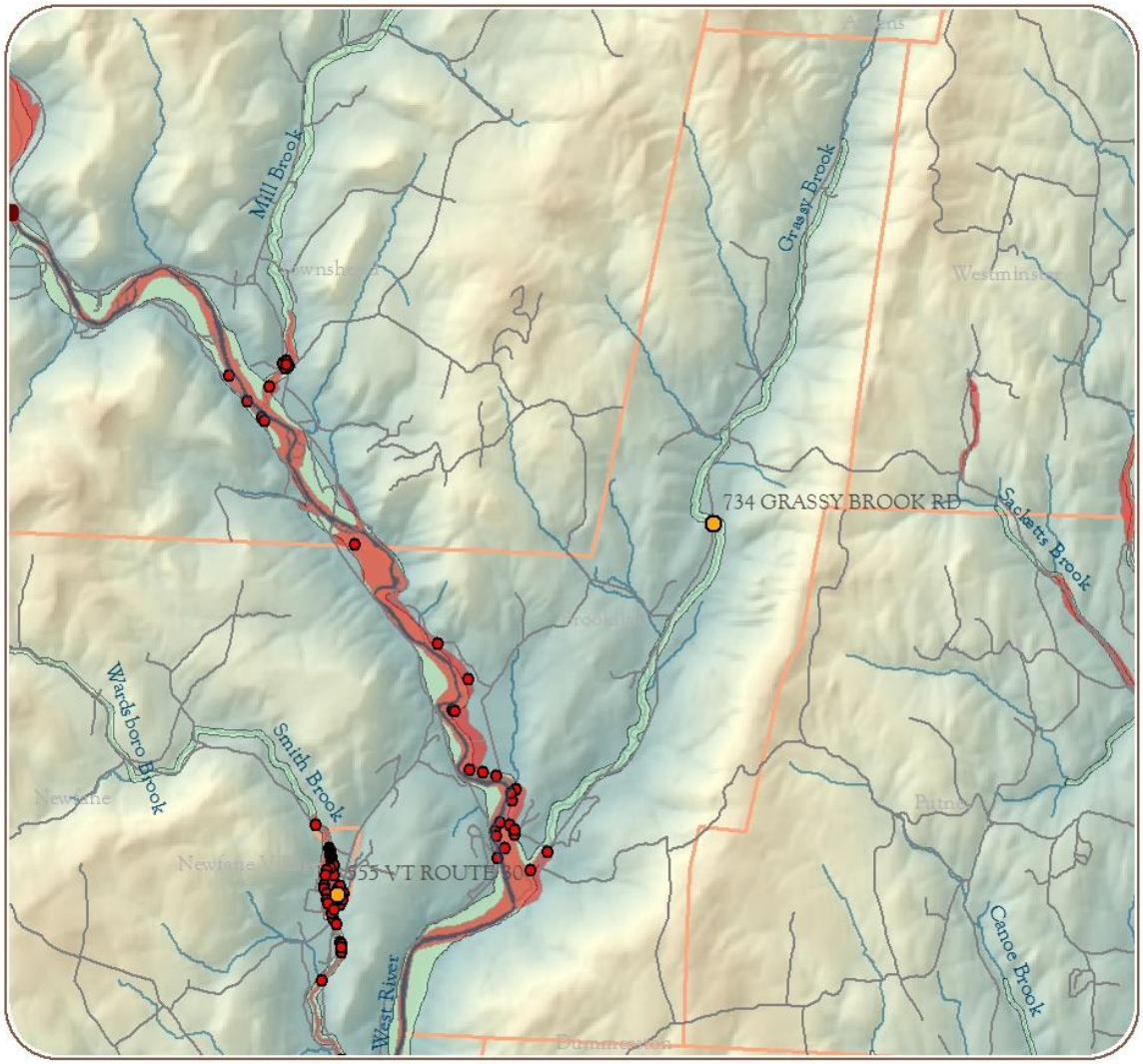
Structures in the SFHA

There are approximately 19 buildings within FEMA-designated Special Flood Hazard Areas (SFHAs).[26] There are 31 structures in the River Corridor[27]. Some of these structures could be in both areas, as the River Corridor and the SFHA overlap in some places. The map on the following page shows structures (red dots on map) that are located in the SFHA and the River Corridor. Most of the structures are located along the West River on the very southwest edge of Brookline. The exception to this is the Town Office which is in the River Corridor of the Grassy Brook, about halfway north in the town. These structures are particularly vulnerable to flooding and fluvial erosion hazards described in this plan.

Properties within SFHAs, that have a mortgage, are required to purchase flood insurance. Brookline's participation in the National Flood Insurance Program (NFIP) gives residents access to discount flood insurance through the National Flood Insurance Program. Flood insurance can still be purchased privately, however it is more expensive. Development in SFHAs must meet additional construction standards as outlined in Brookline's floodplain regulations, which is a stand-alone bylaw and was adopted in December 2005.

Several vulnerable structures during Tropical Storm Irene in 2011. Photos courtesy of Thomas Staats.

[26] 2016 Flood Hazard Summary Sheet for Brookline
[27] GIS analysis done by Senior Planner Jeff Nugent of Windham Regional Commission (4/20/15).



Town of Brookline
Critical Structures and Buildings in Hazard Areas

- Dam - High Hazard Potential
- Critical or Public Structures in Hazard Areas
- Buildings in Special Flood Hazard Areas
- Flood Hazard Areas
- River Corridors

8.26.15 VT DEC

Special Flood Hazard Areas are mapped by FEMA for the National Flood Insurance Program (NFIP).
www.msc.fema.gov

River Corridors and Flood Hazard Areas can be viewed on the Vermont Flood Ready Atlas - tinyurl.com/floodreadyatlas

Building locations from e911 site locations 12/12

For current data on flood risks and mitigation actions in the community please see please see Community Reports on www.floodready.vt.gov

0 0.5 1 2 3 Miles

Repetitive Loss Structures

According to FloodReady.Vermont.gov, Brookline has no repetitive loss claims.[28] A Repetitive loss structure is an NFIP-insured structure that has had at least 2 paid flood losses of more than $1,000 each in any 10-year period since 1978.[29] Severe repetitive loss (SRL) structures are NFIP-insured buildings that, on the basis of paid flood losses since 1978, meet either of the loss criteria described in the SRL section. SRL properties with policy effective dates of January 1, 2007 and later will be afforded coverage (new business or renewal) only through the NFIP Servicing Agent's Special Direct Facility (SDF) so that they can be considered for possible mitigation activities. An SRL property is defined as a residential property that is covered under an NFIP flood insurance policy and:

- 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
- 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.

Participation in and Compliance with the National Flood Insurance Program (NFIP)

The National Flood Insurance Program (NFIP) is a voluntary program organized by FEMA that includes participation from 20,000 communities nationwide and 247 Vermont towns and cities. Combined with floodplain mapping and floodplain management at the municipal level, the NFIP participation makes affordable flood insurance available to all homeowners, renters, and businesses, regardless of whether they are located in a floodplain.

The NFIP was instituted in 1968 to make flood insurance available in those communities agreeing to regulate future floodplain development. As a participant in the NFIP, a community must adopt regulations that: 1) require any new residential construction within the 100 year floodplain to have the lowest floor, including the basement, elevated above the 100 year flood elevation; 2) allow non-residential structures to be elevated or dry flood proofed (the flood proofing must be certified by a registered professional engineer or architect); 3) require anchoring of manufactured homes in flood prone areas. The community must also maintain a record of all lowest floor elevations or the elevations to which buildings in flood hazard areas have been flood proofed.

In return for adopting floodplain management regulations, the federal government makes flood insurance available to the citizens of the community. In 1973, the NFIP was amended to mandate the purchase of flood insurance as a condition of any federally regulated, supervised or insured loan on any construction or building within the 100-year floodplain. In 2012, Congress passed the Biggert-Waters Flood Insurance Reform Act to reduce subsidies for structures built before the NFIP was instituted (called pre-FIRM structures). Over 50 percent of Vermont's NFIP policies are pre-FIRM, which means that flood insurance premiums for many will increase over the ensuing years.

While the NFIP floodplain management criteria are administered by states and communities through their floodplain management regulations, FEMA's role is to provide technical assistance and to monitor communities for compliance with the minimum NFIP criteria. Brookline joined the NFIP on September 4, 1985 and is a member in good standing (CID 500280). The latest floodplain ordinance was adopted in December 2005 and is a stand-alone bylaw. The latest Flood Insurance Rate Maps (FIRMs) and Flood

[28] Report listing repetitive losses is available here:
<http://floodready.vermont.gov/sites/floodready/files/documents/VT%20RL%20Report%201.26.15.pdf>
[29] https://www.fema.gov/national-flood-insurance-program/definitions

Insurance Study (FIS) referred to in the development of this plan have an effective date of September 28, 2007.

The latest record indicates that there are five (5) active NFIP policies in Brookline. These policies have a total value of $1,585,000. There have been three (3) NFIP claims paid in Brookline since they joined the NFIP, totaling $347,115.[30]

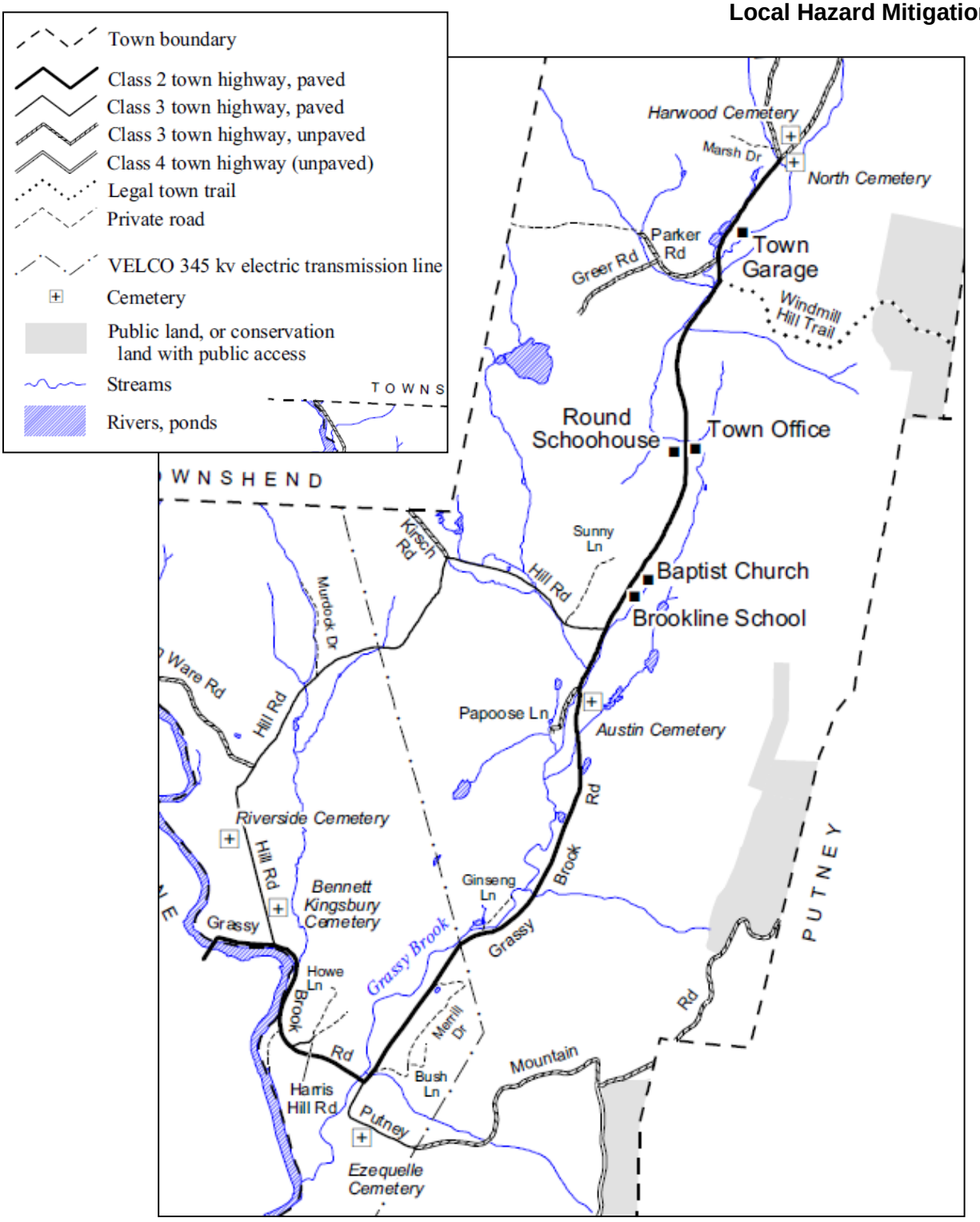
The Town works with the elected officials, Windham Regional Commission, the state and FEMA to correct any compliance issues and prevent further NFIP compliance issues through continuous communications, training and education. The State Floodplain Managers do conduct random Community Assistance Visits to check town compliance with locally issued permits. For continued compliance and overall growth of local knowledge base of the Floodplain Administrator, training is recommended.

Vulnerable Community Assets in Brookline

All of the community assets in Brookline lie within vulnerable range of Grassy Brook (this is shown on the map on the following page). Some of the primary assets noted by the town are:

- Brookline Town Office (Emergency Shelter) – along Grassy Brook, within 50 feet
- Brookline School – Sunny Lane Daycare (Emergency Shelter) – along Grassy Brook, within 50 feet
- Baptist church/ Brookline Meeting House – Brookline would like this to also be a shelter – along Grassy Brook, within 50 feet
- Historical Society Building (Round Schoolhouse) – across the street from town office and along the Grassy Brook
- Town Garage - along Grassy Brook

[30] FEMA NFIP Insurance Report, January 2016, accessed May 24, 2016. http://floodready.vermont.gov/sites/floodready/files/documents/NFIP%20Insurance%20Report%20VT%201.26.15.pdf



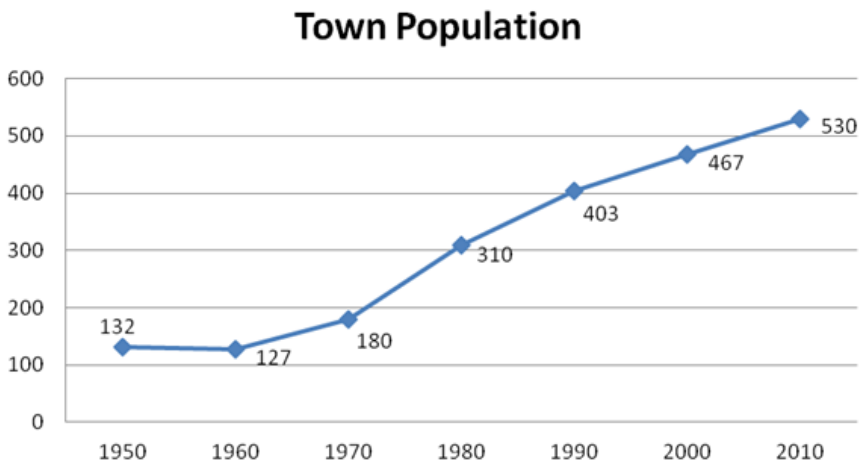
Market Values of Structures in Brookline

The total Grand List in the Town of Brookline: $72,632,050.00**
Common Level of Appraisal: 98.6 (Dec 2015)

** These counts do not include non-taxable structures. There are 9 (non taxable) locally exempt properties.

Development Trends

As the following table and graph show, Brookline has been steadily gaining population since 1960. As the bottom chart shows, between 2000 and 2010, population increased 14% in Brookline, which is only exceeded by northern neighbor Athens.



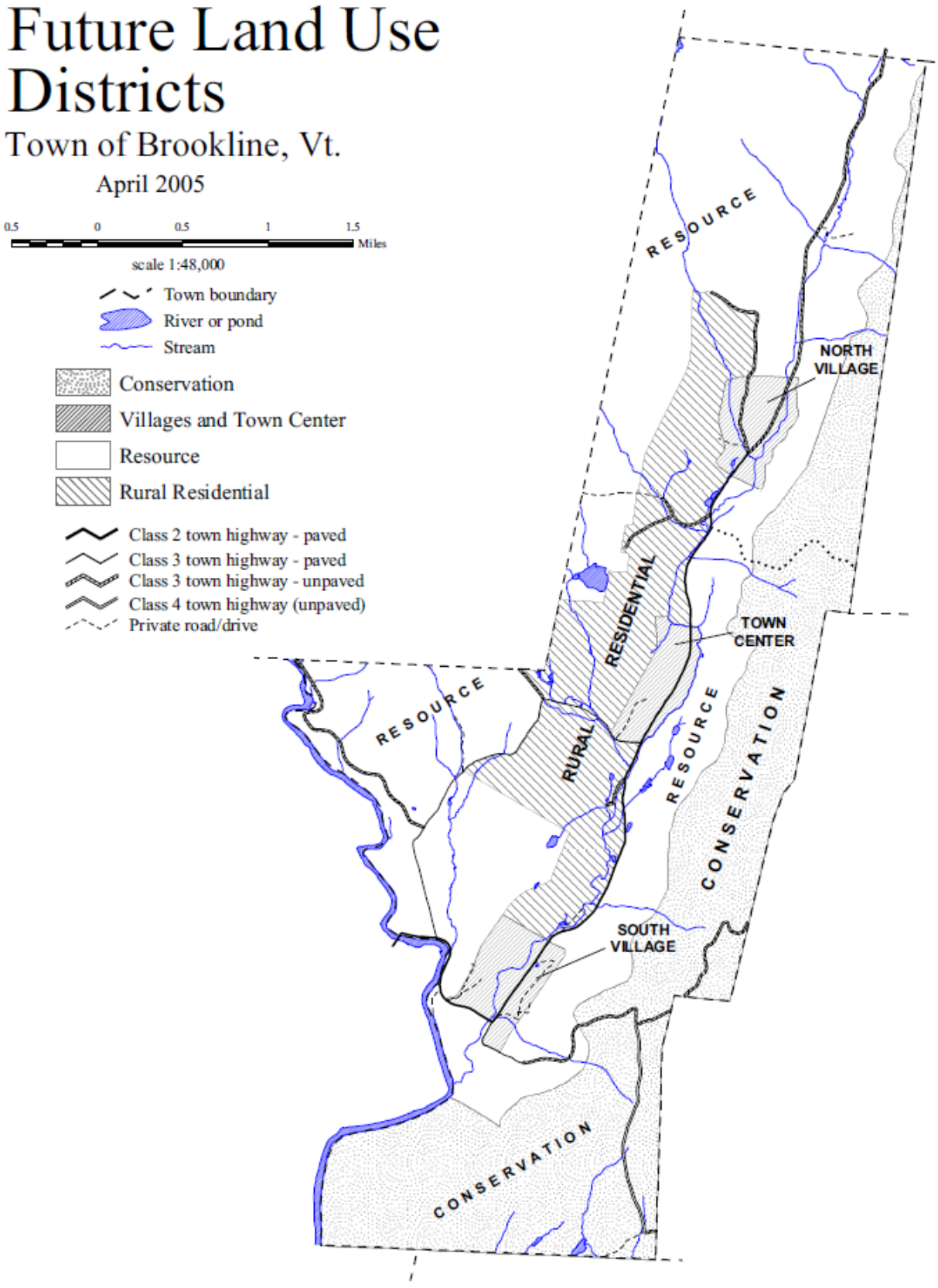
Brookline does not have zoning, so no building permits are required and landowners are freer to do with their property as they wish, which is partly what Brookline attributes their population growth to. There have been no new buildings placed in the town for about 10 years (since 2005). The changes that have been most prevalent to the town are that some camps have been modified into full-time residences. Other than that, there haven't been many changes in Brookline. It is a very rural and small town, set apart from its neighbors because of either topography or distance.

Brookline also attributes to the fact that they have high speed internet. A lot of towns in the region don't have access to high speed internet yet. Cell service is still lacking in Brookline.

There is not a lot of commercial development in Brookline. There are a number of home based businesses, artisans, farms and land based businesses, and creative individuals in town. A lot of people commute to the Brattleboro and other larger towns for work. Unless you're working for yourself, it can be difficult to get a job without working elsewhere out of the town. There are a lot of people that have lived in town for many years and have land that has been passed down for generations. Lack of businesses means less tax revenue, and less town funds for improvements and mitigation.

Brookline has some inherent vulnerability due to its configuration and development pattern along the Grassy Brook, its tributaries and the West River. The transportation system is vulnerable because there are limited ways to get in and out of town. Grassy Brook Road and Kirsh Road are really the only ways in and out during inclement weather as they are the only roads that are open in the winter. Additionally, Grassy Brook Road, near Route 30, needs upgraded as fluvial erosion is jeopardizing its stability. Should the bridge go out over the West River, Brookline could be cut off for a time period. They have no emergency shelters that are equipped with generators, or capable of sheltering people or animals overnight. These are vulnerabilities that Brookline needs to consider. There is also no locally designated Emergency Operations Center (EOC) for the town to communicate with outside entities and vice versa during an event. Establishment of an EOC at the town office is a mitigation objective of this plan.

Proposed Land Use Map from 2013 Brookline Town Plan



MITIGATION STRATEGY

Local Hazard Mitigation Goals for this Plan

The Hazard Mitigation Goals as outlined below were agreed on by consensus among the Hazard Mitigation Planning Committee during meetings for the development of this plan.

- Reduce the loss of life and injury resulting from all hazards.
- Reduce the impact of hazards on the town's 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,
    - Ensure that community infrastructure is not significantly damaged by a hazard event.
    - Being proactive in implementing any needed mitigation projects for public infrastructure such as roads, bridges, culverts, municipal buildings, etc.
- Hazard mitigation planning is incorporated into other community planning projects, such as the Town Plan, Capital Improvement Plan, and Town Local Emergency Operation Plan.
- The general public continues to participate and be actively involved in the hazard mitigation planning process.

Town Plan (2013) Policies that Support Mitigation

Transportation Policies

1. Review and update all road and bridge condition status annually to reflect the priority of needed improvements. Make recommendations for short and long-term improvements and implement projects on a consistent basis, including the Green Iron Bridge.
2. Continue to update and implement the budget for road and bridge improvements and for road equipment.
7. Assess road conditions and traffic patterns and signage to improve safety.

Emergency Planning

1. Require that all new public and private roads and driveways be properly constructed so do not contribute to the damage of Town roads from run-off.
2. Continue improving existing roads, culverts and bridges to carry at least the 25-year storm event without major damage.
3. Develop and periodically review emergency evacuation plans.
4. Require that the Town annually update the Local Emergency Operations Plan.
6. Continue to participate in the National Flood Insurance Program.
7. Review and update Material Safety Data Sheets in all Brookline municipal buildings for compliance with the Federal Emergency Planning and Community Right to Know Act.
8. Adopt an all hazards pre-disaster mitigation plan.

Natural Resources: Water Resources Policies

5. Assure that any individual storing, using or transporting hazardous chemicals does so in such a manner so as not to have any adverse effects on streams or sources of water in the Town.
6. Assure watercourses, ponds, and shorelands are retained and maintained in a natural state by maintaining an undisturbed buffer of vegetation along the watercourse.
7. Significant wetlands should be protected from development by maintaining an undisturbed, naturally vegetated buffer strip around the wetland edge sufficient to ensure the integrity of the wetland.

Natural Resources: Flood Hazard Area Policies

1. Assure that lands along the Grassy Brook and West River are devoted to agricultural and open space uses whenever feasible.

2. Limit development within the Special Flood Hazard Areas, as identified on the Digital Flood Hazard Plan, subject to flooding to agricultural and open space use.
3. Periodically review the Special Flood Hazard Areas for compliance with the Flood Hazard Bylaw as required by law in order to maintain eligibility in the National Flood Insurance Program.

Natural Resources: Soil and Topography Policies
1. Avoid development in areas dominated by slopes greater than 25 percent.
2. Minimize areas of earth disturbance, grading, and clearing of vegetation on slopes over 15 percent.
3. Land clearing, grading, and filling practices shall minimize erosion and sedimentation into streams, wetlands and other waters.

Progress between 2010 and 2012 to Current

Due to the length of time between when development of the previous draft plan, and this current plan, it is important to recognize progress made on previously identified mitigation actions. The old draft plan identified several actions and the below table discusses them and their current status.

2012 drafted Mitigation Action	Responsible Party	Expected Completion Timeframe/Year	Priority	Current Status
Adopt Codes and Standards for mandatory use of connectors and brackets with new construction.	Selectboard	1-2 years	Medium	This hasn't happened and this is not something that the town wishes to pursue at this time.
Culvert replacement on Parker Road, upsize from 15” to 40” to prevent flooding of residence	Selectboard and Highway Department	1 year	High	This wasn't completed and remains a need. Town is still under discussion about what to do here. Homeowner has been working on measures to protect their home. This is a town and private homeowner issue. Road foreman has done minor improvements to the road. This area floods, the adjacent residence gets water inundation, and the road gets damaged every time there is a large rain event.
Widen Ellen Ware Road to allow proper ditching and upgrade culverts	Road Commission and Selectboard	1 year	Medium	This has been done in some areas, but there are still narrow areas remaining. This is in progress and will be continued. The funding is not available to be able to set a deadline on completion at this time.
Rebuild/repair section of Grassy Brook Road along West River	Road Commission and Selectboard	2 years	Low	This has not been done and remains a need that the town wants to pursue.
Bury power / utility lines into town critical facilities	Selectboard and contractors	2-3 years	Medium	This hasn't happened and this is not something that the town wishes to pursue at this time.
Working in conjunction with Newfane to make Newbrook Fire Station self-sufficient shelter	Selectboard, Newbrook Fire Station	1 year	Medium	Newbrook Fire Department is an emergency shelter with backup generator; Not Red Cross certified.

2012 drafted Mitigation Action	Responsible Party	Expected Completion Timeframe/Year	Priority	Current Status
Training of EMD for Level I certification and Town Officials in ICS 100 & 402	Selectboard	1 year	Medium	Training remains an ongoing need.

These additional mitigation efforts were undertaken in Brookline since 2011, though they were not identified in the previous Brookline Hazard Mitigation Plan:

1. The town has upgraded 20-25 new culverts in the last five years to bring them up to state standards. Yearly the town reviews their culvert list and prioritizes upgrades. There are about 300 culverts in Brookline and an average of six culvert upgrades every year. Daily as part of his job, the Road Foreman is looking for improvements while doing general maintenance. A lot of the old culverts that have been upgraded were 12-14". The state now requires a minimum of 18" plastic culverts. The Road foreman is also doing more ditch maintenance to protect the roads.

2. The Town is now working on an upgrade to the Greer Road bridge using the Better Back Roads grant. This work was contracted out. The project is installing rip-rap around the abutments and on the banks around the Greer Road Bridge. TS Irene undermined a lot of trees on both sides and this is causing recurring erosion that has jeopardized the bridge abutments. This will be a mitigation fix that was recommended and approved by ANR.

3. Grassy Brook Road paving of three miles.

4. A new gravel base and multiple culvert upgrades on the lower section of Putney Mountain Road. These improvements are going to help with water movement and prevent further road erosion.

5. On Ellen Ware Road, there was a dangerous stretch with poor visibility due to the road height. To remedy this safety concern, some ledge was bust out to lower the road height and create greater visibility (increased sight distance). This has solved this concern.

Ongoing Efforts

1. The Town is aware of its vulnerable populations via their Meals on Wheels program and Nursing Care provided to those individuals with oxygen tanks, and other special needs.
2. Two years ago the Road Foreman made a list of dead and dying trees and hired a contractor to take them down. They have set aside money to take down problem trees, and they have marked trees that currently need taken down. GMP also takes down problem trees. This is a normal part of the Road Foreman's work and he does inspections regularly. The Road Foreman is also the Tree Warden.
3. Checking Culverts and under bridges debris jams - This is part of the Road Foreman's routine work. The Road Foreman does get permissions from VT ANR for significant jam removals or management.
4. Continue actions to replace and upsize culverts at the rate of 6-8 per year on all Town Highways. - They upgrade to the latest state standards as they do replacements. They have a culvert inventory that is updated yearly and used to plan for future fixes. Things are tyically upgrading 6-8 culverts per year, though it varies based on need.
5. Yearly tree trimming.
6. Road maintenance is done regularly. Grading to maintain crown in road for runoff/proper drainage and adding more gravel are the biggest maintenance pieces on gravel roads.
7. Leaf removal and ditch cleaning are maintenance activities done every spring by the road crew. If ditches are being eroded, the crew may also stone line them.

8. Brookline updates their culvert inventory every couple of years. The last major update was done in 2012 and they are replacing culverts as needed. They are hoping to do another update very soon.
9. The town maintains two emergency shelters in town. The EMD would like to set up a formal shelter at the Baptist Church/Brookline Meeting House.
    a. Brookline Town Office (short term Emergency Shelter)
    b. Brookline School – Sunny Lane Daycare (short term Emergency Shelter)
    c. Brookline Meeting House – Brookline would like this to also be a shelter
10. Brookline is a member in good standing of the National Flood Insurance Program. The floodplain ordinance is kept compliant and the town maintains SFHA maps at the town office.

Identification of Mitigation Actions

The Brookline Hazard Mitigation Planning participants identified the following hazard mitigation activities based on an evaluation of hazard event vulnerability not addressed by existing hazard mitigation initiatives and the feasibility of new activities. As a part of the ongoing plan process, these were updated in 2015 by the Hazard Mitigation Planning participants to reflect progress and new ideas.

Mitigation actions are listed in priority order by hazard. Actions were prioritized by the plan participants. These are new actions so any shifts in prioritization of actions came out through the multi-year plan development process. The following criteria were used in establishing project priorities. The ranking of these criteria is largely based on the best available information and best judgment as many projects are not fully scoped out at this time. Prioritization was done during the meetings for the plan development in discussions among participants and guided by WRC's Emergency Planner.

- Does the action reduce damage?
- Does the action contribute to community objectives?
- 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?
- Is the action legal?
- Does the action offer reasonable benefits compared to its cost of implementation?
- Is the action environmentally sound?

Cost-Benefit Analysis

As part of public involvement discussions, there was a rough cost/benefit analysis done for each action listed in the table and those results are shown in the table. The below cost and benefits tables address the priorities for the mitigation strategies that are stated in the Mitigation Actions Table. This was how the mitigation actions were assessed by the Hazard Mitigation Planning participants. Priority was assessed somewhat independently of cost/benefit and was based more on the perceived need of each action and availability of funding, versus what the action costs and benefits.

At the time of applying for FEMA's PDM-C, FMA or HMGP grant programs, each project listed below will undergo full benefit-cost analysis (BCA) methodology, version 5.1 or higher to maximize savings. Whenever possible, Brookline will utilize 406 mitigation funding.

Cost Estimates

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

Benefit Estimates

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

Mitigation Actions Identified by the Hazard Mitigation Planning participants

HAZARD	ACTION	RESPONSIBLE PARTY	TIME-FRAME	FUNDING SOURCE	MITIGATION OR PREPAREDNESS	COST / BENEFIT	PRIORITY	STATUS
All hazards	Make the Baptist Church/ Brookline Meeting House into an emergency shelter	Selectboard / Brookline Meeting House Committee	Steps have begun; Expected to complete by Summer 2017	Town budget; donations; grants	Mitigation	High/High	High	Town is in discussion about this; they are in the process of repairing the structure and making it ADA compliant; They are looking for grants. Fundraising has been happening and grants have been applied for.
All hazards	Acquire and install generators at town office and the newly established emergency shelter; Establish the town office as the EOC	Selectboard / EMD	Purchasing upon grant funding award.	Grants and town match	Mitigation	Low/High	High	The town has been discussing this, recognizes the need, and will be pursuing this once they have a hazard mitigation plan in place, or they see an opportunity.
All hazards	Adopt VTAlert	Selectboard	Training set up ASAP; Complete by the end of 2016	State funded	Preparedness	Low/High	High	This has not yet begun.
All hazards	Install a cell phone booster in the town church tower	Selectboard	Start upon grant funding award (ideally Spring 2016) and complete by end of 2016	Grant funding / Town funding	Mitigation / Preparedness	Low/High	High	They are researching alternatives and will be looking for grant funding.
Fluvial Erosion	Update the Floodplain ordinance to include River Corridors	Floodplain Administrator / WRC	Start Summer 2016; Town vote on TMD 2017	WRC dues; town funding	Mitigation	Low/High	High	Brookline is working with the Windham Regional Commission and the VT ANR on this update. Updated regulations are expected soon.
Fluvial Erosion	Grassy Brook Road improvements/ledge blast out on stretch in northern part of town	Road Crew and Contractor	This will be started and finished in Fall 2016.	Better Back Roads grant	Mitigation	Medium/ High	High	This is going out to bid now.
Fluvial Erosion	Alter Grassy Brook Road between Hill Road and Harris Hill Road along the West River.	Road Crew and Contractors; VTrans	Begin ideally by spring/summer 2018; It would only take about 2 months to complete.	Grant funding	Mitigation	High/High	Medium	They would need to get permits and acquire parts of three parcels. This is in discussion phase at this point.

HAZARD	ACTION	RESPONSIBLE PARTY	TIME-FRAME	FUNDING SOURCE	MITIGATION OR PREPAREDNESS	COST / BENEFIT	PRIORITY	STATUS
Beaver dam failure	Upgrade Bridge number B5 on Grassy Brook Road. What's existing is a rusted out culvert. The Road Foreman is monitoring it.	Road Foreman	Goal is to start this in Summer 2017. It would take about a month to complete.	Grant funding through either FEMA or Vtrans	Mitigation	High/High	Medium	Hydraulic study was completed that recommended a larger box culvert. The town has applied for a grant but it was denied for 2016 because they have recently gotten a grant. Vtrans has advised the town this project is needed.
Flooding / Fluvial Erosion / Beaver dam failure	Upgrade culvert 23	Road Foreman and Contractor	Start and finish Summer 2017	Vtrans structures grant	Mitigation	Medium/ Med/High	High	Hydraulic study done. These are state required improvements designed to take 100-year floods or better.
Flooding / Fluvial Erosion	Upgrade culvert 18. Concrete repairs should increase the lifespan by five years.	Road Foreman and Contractor	Start and finish Summer 2016	Vtrans structures grant	Mitigation	Medium/ Med/High	Medium	Hydraulic study done. This is an old box culvert put in during the 1960's. The concrete is failing.
Flooding / Fluvial Erosion	Upgrade culvert 21	Road Foreman and Contractor	Start and finish Summer 2018	Vtrans structures grant	Mitigation	Medium/ Med/High	High	Hydraulic study done. These are state required improvements designed to take 100-year floods or better.
Flooding / Fluvial Erosion	Upgrade culvert 57 on Grassy Brook Road (on the dirt section on the north end of town)	Road Foreman and Contractor	Start and finish Summer 2019	Vtrans structures grant	Mitigation	High/ Med/High	Low	Hydraulic study done recommended box culvert. These are state required improvements designed to take 100-year floods or better.
Invasive Species	Educational outreach to residents about how they can take measures to control for invasive species	Town / UVM Extension / Vermont Invasives	Hand-outs at TMD 2017	Town	Mitigation	Low/ Medium	High	Brattleboro Reformer has had an article about poison parsnip.
Invasive Species	Develop a mowing schedule for town owned land to prevent the spread of invasive species. The ultimate goal is to get mowing equipment themselves so that they can control timing better to avoid seed spread.	Town / Contractor	New mowing schedule has been put in place and has begun in 2016.	Grant funding / Town funding	Mitigation	Medium/ Medium	High	This will prevent the spread of Poison parsnip that has recently come onto town land. Town has established two mowing a year (Early July and third/fourth week in August), and is now renting equipment.

Details on Mitigation Actions

Make the Baptist Church/Brookline Meeting House into an emergency shelter - It has a bathroom, kitchen, and a central location. It can hold a large number of people. It will serve as a community meeting house, gathering point for the public, as well as an emergency shelter. This is one of the oldest structures in Brookline and the town would like to improve it to become more of an asset for a number of reasons. Daycare is adjacent to this location, so it would also serve as a shelter for the kids. Basement of the daycare center can serve as an overnight shelter.

Generator for shelters (town office, Sunny Lane Daycare, and Brookline Meeting House) - Needed at town office and the emergency shelter, and hopefully eventually the daycare center. The town now owns all of these buildings.

Alter Grassy Brook Road between Hill Road and Harris Hill Road along the West River - The idea is to shift the lanes, moving the lane nearest the river to the inside. This would require ledge to be removed and some property appropriation. The issue is that the lane nearest the river is sagging towards the river. It is a gradual thing that continuously needs to be repaired and built up. They have heavily invested in new paving, but this is a temporary fix. Old wooden logs hold the road up in this section and they are deteriorating. If a log fails, the road would be one lane; this would cause significant inconvenience for residents. Two residences would be cut off.

Upgrade of Bridge 5 on Grassy Brook Road - undersized box culvert. Having a more equiped and larger bridge in this location would mean that any future beaver dam failure (which cannot be mitigated) would cause a lot less damage. Once the breached water reaches this area it's collected more volume. If Grassy Brook is already full with water, the water backs up. During a past failure, Hill Road was completely washed out, it undermined downstream bridge, and there were three feet of water on top of Hill Road.

Upgradge culvert 23 – This culvert needs upgraded as it is undersized and gets flooded by beaver dam failures. Road is starting to settle; It would eventually drop out.

upgrade culvert 57 on Grassy Brook Road on the dirt section on the north end of town – TS Irene washed out this culvert. It is rusted out in the bottom. 9'x7' culvert. Water is going outside of the culvert allowing material to wash away.

Upgrade culvert 18 - This culvert is damaged currently and needs to be upgraded as well. This culvert was put in the 1950's. It is on Grassy Brook Road, about a mile and half south of the town office. It gets overtopped during large events. Ice is breaking the structure slowly as it gets into cracks and expands.

Grassy Brook Road on the very northern end has ledge very close to the dirt road. Because of this there is no ditch next to the road so in the winter months drainage from the ledge creates ice build-up on the road and spring runoff is constantly eroding gravel from the road. The mitigation action is to blast out some ledge to create a ditch next to road for better drainage. They have measured out 300 feet in length. Hydraulic hammer on excavator will break up ledge, create ditch for water lower than road, widen the road, and create better visibility in this stretch. This will also involve a culvert upgrade.

Culvert/Structure Upgrades for Mitigation and Flood Resilience

Upgrading or upsizing of undersized culverts is a primary mitigation action that towns can take to better withstand larger storm events—100-year or greater events—without having road damage, while also allowing for natural stream stability processes to occur and better aquatic organism passage through the structure. Upgrade projects should be designed to accommodate the bankfull width of the stream. Vermont ANR River Engineers, VTrans staff, regional planning commission staff, and others can work to direct and assist towns through the permitting and grant process so that the proper design is chosen and permitted. Improperly sized and installed cause upstream and downstream erosion as floodwaters are

unable to flow naturally through undersized structures, and thus have to flow around them in unintended ways.

Installing larger and more resilient structures is more costly in the short term, but they hold up to larger events and allow for debris to flow through, which prevents damage, disruption and repair costs into the future. Over the long term it is more cost effective to have a larger structure that will prevent river and road conflicts. Additionally, Vermont Department of Transportation standards require larger culverts in an effort to ensure that they are mitigating future damage with every newly permitted structure.

For towns, the first step is to inventory all culverts, then assess and prioritize them for upgrade and work with VTrans, ANR, environmental groups, FEMA, and others to find the funding for the work. An important piece of the whole process is to recognize which culvert upgrades will provide the most mitigation benefits and to understand how these upgrades individually and collectively achieve greater flood resilience. Those structures whose upgrade will provide the most mitigation benefit are included in the Mitigation Actions Table of this plan.

Implementation of Mitigation Actions / Capabilities

Barriers to Implementation:

1. Financial constraints of town budget
2. Limited staff at town level
3. No full time road crew
4. Brookline doesn't own much highway equipment (only one road grader), so they have to rely on help from locals or other towns for equipment.
5. There are some folks in town involved in emergency response through the fire department. But the town lacks an EMD or any volunteers or staff working for emergency preparedness for the town.
6. Small population means limited tax base.
7. Brookline does not currently regulate development in the River Corridor, which limits control of this hazardous area.
8. Cell phone coverage and landline availability can make communications difficult in Brookline.
9. No conservation commission to assist with/spearhead carrying out actions related to invasive species.
10. Floodplain Administration is misunderstood. Training is needed for the Floodplain Administrator.
11. No restrictions on development (no zoning) other than the floodplain bylaw and minimum state requirements for septic systems. This makes Brookline more susceptible to vulnerable development.
12. Road Foreman has indicated that the yearly set-aside for tree removal is inadequate.

Capabilities to build upon for implementation:

1. Town cohesion and social capital – people have equipment and a willingness to help
2. Active Selectboard
3. Active Planning Commission
4. Four part-time employee positions, engaged employees
5. Two part-time Road Crew employees
6. Windham Regional Commission assistance when needed
7. Floodplain regulations in place.
8. Newbrook Fire and Rescue is strong and active, and located adjacent to Brookline.
9. Local snowmobile club with trails. They are willing to and could assist with an evacuation, if needed.
10. Small population and limited community assets means limited vulnerability.

Recognizing that there is no place that doesn't have barriers to overcome in project implementation, Brookline is in a fair position overall. There are committed volunteers and staff who make this town function well. They are invested and plan to remain in the area. They are also located just off of a major travel corridor of the region (Route 30), yet most residents live on back dirt roads that can be difficult to

access during certain times of the year. This lends to a "do it yourself" mentality that serves Brookline positively. The limited number of roads into and out of the town means that they are vulnerable from a transportation perspective during a major event.

The town looks to and works closely with the Windham Regional Commission. They look to the Regional Plan policies for guidance on land use decisions which influence their town plan policies and goals. The town works closely with VT Department of Environmental Conservation Agency of Natural Resources and the Army Corps of Engineers when mitigating any work in streams or rivers. Additionally the town adopts the latest VTrans Road Standards for road/culvert/bridge improvement projects.

With the support of these agencies and the Commission, Brookline is capable of carrying out all of the mitigation actions outlined in this plan.

Existing Planning Mechanisms / Integration

The following policies, programs and activities related to hazard mitigation are currently in place and/or being implemented in the Town of Brookline. The Hazard Mitigation Planning participants analyzed these programs for their effectiveness and noted improvements needed. Brookline uses all of the tools listed below to help plan for current and future activities with the town. For example: the Local Emergency Operation Plan has a contact list that is used for response purposes in the case of a hazard event, and is updated every year after Town Meeting. Town Road and Bridge Standards are followed by the town and Brookline competed updating their culvert inventory most recently in 2012. In the development of this plan, the latest 2013 Town Plan was used.

As Brookline goes through the update process for the planning mechanisms outlined in the table below, they will look to the Hazard Mitigation Plan's Table of Actions and Risk and Vulnerability Assessments to help guide land use district decisions, and guide goals and policies for those districts. They have agreed to this. At the Town Meeting every March, policies and action items in the Town Plan are reviewed and integrated into hazard mitigation as needed. The Local Emergency Operations Plan contact list is updated after Town Meeting each year, including updates to vulnerable geographic locations, as well as locations of vulnerable populations. Updates to each of the planning mechanisms outlined in the table below are handled by the identified responsible party identified. There is no timeframe for updating the below referenced plans and regulations to better incorporate hazard mitigation, however, as each document is updated the hazard mitigation plan will be reviewed for incorporation. The goals of this hazard mitigation plan will be incorporated in the upcoming town plan update to ensure that emergency preparedness and mitigation planning efforts are included in the Town Plan, with particular attention to including the projects in the Mitigation Actions Table. This will assist with ensuring that this plan is utilized and project follow-through occurs.

Brookline is not yet updating the Town Plan, but when they do it is recommended that they address flood resiliency. The hazard mitigation plan will be considered and incorporated as appropriate. The Planning Commission plans to work with the Windham Regional Commission to update the floodplain ordinance to include River Corridor regulations. The LEOP is updated yearly and was updated last in 2016. Other mitigation/emergency planning related documents and their status are outlined in the below table:

Type of Existing Authority / Policy / Program / Action	Description	Effectiveness/Enforcement/ Hazard that is addressed	Gaps in Existing Protection/Improvements Needed
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, etc.	Flood Resilience not addressed	Town Plan adopted in 2013; Next plan should incorporate flood resiliency and town survey concerns. Town Plan update will be completed by Planning Commission with assistance from the Windham Regional Commission.

Type of Existing Authority / Policy / Program / Action	Description	Effectiveness/Enforcement/ Hazard that is addressed	Gaps in Existing Protection/Improvements Needed
Local Emergency Operation Plan	Municipal procedures for emergency response	Incident Command; vulnerable sites list included	LEOP and adopted by Town Select board in 2016; next LEOP should include all of the appendices. LEOP is completed by Town EMD and Selectboard.
School Emergency Response Protocol	School procedures for emergency response	School evacuation plan in place.	Sunny Lane Daycare should review its emergency plan and discuss it with the town; plan should be routinely exercised with town participation.
LEPC 6 Hazardous Materials Plan	Procedures for hazmat emergency response at regional level	LEPC 6 has the plan	Continued involvement with the LEPC; LEPC should update their hazmat event plan.
Mutual Aid – Emergency Services	Agreement for regional coordinated emergency services	Keene (NH) Mutual Aid – written agreement/contract for Fire/Ambulance and HazMat	None identified
Mutual Aid – Public Works / Road Crew	This would address sharing of equipment or services between towns.	There are no formal agreements in place at this time. As needs arise towns help each other.	It would be beneficial for all towns to have formalized agreements in place before needs arise. Not having this creates unnecessary legwork during and following events. Brookline is participating in the Municipal Shared Services meetings hosted by WRC.
Road Standards	Design and construction standards for roads and drainage systems	Adopted new VTrans Road Standards in 2013.	No gaps identified. Brookline Road Crew will continue to comply with the most recent Town Road and Bridge standards set by VTrans.
Zoning regulations	Regulates the division of land, standards for site access and utilities	Zoning not in place; only Floodplain regulations.	PC would like to update floodplain bylaw to include River Corridors. Floodplain Administrator should get further training.
Sewage Regulations	Regulates on-site sewage systems	State Regulations apply	None Identified
Flood Hazard Area Regulations	Regulates development in FEMA identified SFHAs	Stand alone bylaw	Revised in 2007 to include new FEMA DFIRM's.
National Flood Insurance Program (NFIP)	Provides ability for residents to acquire flood insurance	NFIP member since 1985	Further training for Floodplain Administrator recommended
Maintenance Programs	Bridge & Culvert Inventory	Updated in 2012	Should be updated.
Building Code	Regulates building construction standards	No building codes in place	NA
Wetland protection – VT Wetland Rules	Protected by 1990 Vermont Wetland Rules	Protection of environment, water resources, wildlife, biota	None Identified

PLAN MAINTENANCE PROCESS

Monitoring and Updating the Plan – Yearly Review

Once the plan is approved and adopted, the Town Clerk in Brookline, along with interested and appointed volunteers and stakeholders, will continue to work with the Windham Regional Commission to monitor, evaluate, and update the plan throughout the next 5-year cycle. The plan will be reviewed annually around Town Meeting Day at a Selectboard meeting along with the review of the town's Local Emergency Operations Plan (LEOP). This meeting will allow town officials and the public to discuss the town's progress in implementing mitigation actions and determine if the town is interested in applying for grant funding for projects that can help mitigate future hazardous events; e.g., bridge and culvert replacements, road replacements and grading, as well as buying out any repetitive loss structures that may be in the Special Flood Hazard Area, and revise the plan as needed. Windham Regional Commission's emergency planner will assist the Town Clerk in Brookline with this review, as requested by the Town. Progress on actions will be kept track using a table that WRC will provide to the Emergency Committee to update. There will be no changes to the plan, unless deemed necessary by the Town. If so, the post disaster review procedure will be followed.

Plan Maintenance – 5 Year Update and Evaluation Process

The Hazard Mitigation Plan is dynamic. To ensure that the plan remains current and relevant, it is important that it undergo a major update periodically as required in 44 CFR § 201.6(c)(4)(i). This update process will be thorough and occur every five years. This update will include a thorough evaluation of the plan and incorporate any new requirements that FEMA has for Hazard Mitigation Plans. Participants outlined below will work with the Emergency Planner at the Windham Regional Commission (WRC) in accordance with the following procedure:

1. The Brookline Selectboard will appoint a team to convene a meeting of the hazard mitigation planning committee. The town's Town Clerk will chair the committee, and other members should include local officials such as Selectboard members, fire chief, floodplain administrator, constable/police chief, road commissioner, Planning Commission members, health officer, interested stakeholders, etc. The Emergency Management Director will work with the Windham Regional Commission Emergency Planner and be the point person for the Town.

2. The WRC Emergency Planner will guide the Committee through the update process. This update process will include several advertised public meetings. At these meetings the Committee will use the existing plan and update as appropriately guided by the WRC Emergency Planner to address:
    - Update of hazard events and data gathered since the last plan update.
    - Changes in community and government processes, which are hazard-related and have occurred since the last review.
    - Changes in community growth and development trends and there affect on vulnerability.
    - Progress in implementation of plan initiatives and projects.
    - Incorporation of new mitigation initiatives and projects.
    - Effectiveness of previously implemented initiatives and projects.
    - Evaluation of the plan for its effectiveness at achieving its stated purpose and goals.
    - Evaluation of unanticipated challenges or opportunities that may have occurred between the date of adoption and the date of the report, and there affect on capabilities of the town.
    - Evaluation of hazard-related public policies, initiatives and projects.
    - How mitigation strategy has been incorporated into other planning mechanisms

- Review and discussion of the effectiveness of public and private sector coordination and cooperation.

3. From the information gathered at these meetings, and other interactions the Emergency Planner has with the Town, along with data collected independently during research for the update, the WRC Emergency Planner will prepare the updated draft in conformance with the latest FEMA Region 1 *Local Hazard Mitigation Plan Review Guide with the Local Mitigation Plan Review Tool* document.

4. The Selectboard will review the draft report. Consensus will be reached on changes to the draft. Emphasis in plan updates will be put on critically looking at how the plan can become more effective at achieving its stated purpose and goals.

5. Changes will be incorporated into the Plan by the WRC Emergency Planner.

6. The Selectboard will notify the public that the draft is available for public comment and review. The Town will advertise and make available the draft plan for provide comments both electronically and in hard copy. The draft plan will simultaneously be distributed electronically to adjacent towns for review and comment.

7. Public and adjacent town comments will be incorporated by the WRC Emergency Planner. The final draft will be provided to the Town Clerk, and interested individuals that participated in the update, for final review and comment, with review comments provided to the Committee and incorporated into the plan.

8. WRC Emergency Planner will finalize the plan with any remaining comments from the Emergency Management Director and others, and submit electronically to DEMHS and FEMA.

9. The Plan will be reviewed by the DEMHS State Hazard Mitigation Officer (SHMO) and FEMA Region 1.

10. SHMO and FEMA comments will be addressed in the plan by the WRC Emergency Planner.

11. The plan will be resubmitted as needed until the plan is approved pending adoption. Once the plan is approved by FEMA, it will be ready for adoption.

12. The Selectboard will adopt the plan and distribute to interested parties.

13. The final adopted plan will be submitted by the WRC Emergency Planner to DEMHS and FEMA.

14. FEMA will issue final approval of the adopted plan and the five year clock will begin again.

Post-Disaster Review/Update Procedure

Should a declared disaster occur, a special review will occur amongst the Selectboard, the Town Clerk, the WRC Emergency Planner, and those involved in the five year update process described above. This review will occur in accordance with the following procedures:

1. Within six months of a declared emergency event, the town will initiate a post disaster review and assessment. Members of the State Hazard Mitigation Committee will be notified that the assessment process has commenced.

2. This post disaster review and assessment will document the facts of the event and assess whether existing Hazard Mitigation projects effectively lowered community vulnerability/damages. New mitigation projects will be discussed, as needed.

3. A draft After Action Report of the review and assessment will be distributed to the hazard mitigation committee.

4. A meeting of the committee will be convened by the Selectboard to make a determination of whether the plan needs to be amended. If the committee determines that NO modification of the plan is needed, then the report is distributed to local communities.

5. If the committee determines that modification of the plan IS needed, then the committee drafts an amended plan based on the recommendations and forwards to the Selectboard for public input.

6. The Selectboard adopts the amended plan after receiving approval-pending-adoption notification from FEMA.

7. The adopted plan will be sent to FEMA for Final Plan approval.

Continued Public Participation

Maintenance of this plan and implementation of the mitigation strategy will require the continued participation of local citizens, agencies, and other organizations. To keep the public aware of and involved in local hazard mitigation efforts, the town will take the following measures:

- Provide hazard mitigation information at Town Meeting
- Schedule and advertise a planning meeting each year, soon after Town Meeting
- Seeking participation from key players in addition to general public interest:
    - Select board
    - Planning Commission
    - Public Works
    - School
    - Fire & Rescue
    - Emergency Mgt/ 911 Coordinator
- Post the hazard mitigation plan on the town website
- Selectboard will review past hazard mitigation committee members and consider whether new members should be added. Representatives of local businesses, nonprofits, academia, etc. should especially be considered.
- Notify the public of committee meetings through town bulletin board, website, newspaper, Facebook, etc.

APPENDIX

1. Adoption Sheet
2. Website advertisement for Draft Hazard Mitigation Plan (posted posted 8/23/16-9/6/16)
3. Email sent to adjacent towns for public comment on the draft plan, and responses from Dummerston and Newfane
4. Flyer advertising availability of Draft Hazard Mitigation Plan for public comment
5. Email sent 8/9/16 to town staff and Hazard Mitigation Planning Committee for review of the draft
6. Website advertisements for September 24, 2015 Hazard Mitigation Committee meeting at the Brookline Town Office
7. September 24, 2015 Hazard Mitigation Committee meeting sign-in sheet
8. September 24, 2015 Meeting agenda
9. September 24, 2015 Meeting flyer that was posted around town
10. Photos of damages to Hill Road and Grassy Brook Road resulting from 2013 Greer Pond beaver dam failure. Photos courtesy of Thomas Staats.
11. 2011 Tropical Storm Irene damage to Grassy Brook Road/Athens Road, and recovery effort in Brookline. Photos courtesy of Thomas Staats.

Certificate of Adoption
Town of Brookline, VT
Selectboard

A Resolution Adopting the Local Hazard Mitigation Plan for the Town of Brookline, VT

WHEREAS, the Town of Brookline has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of natural and man-made hazards which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Brookline has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its *Town of Brookline Local Hazard Mitigation Plan* under the requirements of 44 CFR 201.6; and

WHEREAS, the *Town of Brookline Local Hazard Mitigation Plan* specifically addresses hazard mitigation strategies and recommends the implementation of action(s) specific to the community to mitigate against damage from natural hazard events; and

WHEREAS, the Town of Brookline authorizes responsible agencies outlined herein to execute their responsibilities to implement this plan for the purposes of long term risk reduction and increased community resiliency and;

WHEREAS, the Town of Brookline will follow the Plan Maintenance Process outlined in this plan to assure that the plan stays up to date and compliant; and

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

RESOLVED that the Town of Brookline adopts the *Town of Brookline Local Hazard Mitigation Plan* as well as future revisions and maintenance outlined in this plan and required by 44 CFR 201.6 and FEMA for a period of five (5) years from the date of this resolution.

Duly adopted this _____ day of _____.
date *month, year*

Selectboard

_____
Bernardine Hoard, Chair

_____
Gwendolyn Tanza

_____
Dorothy Maggio

_____
Bruce Mello

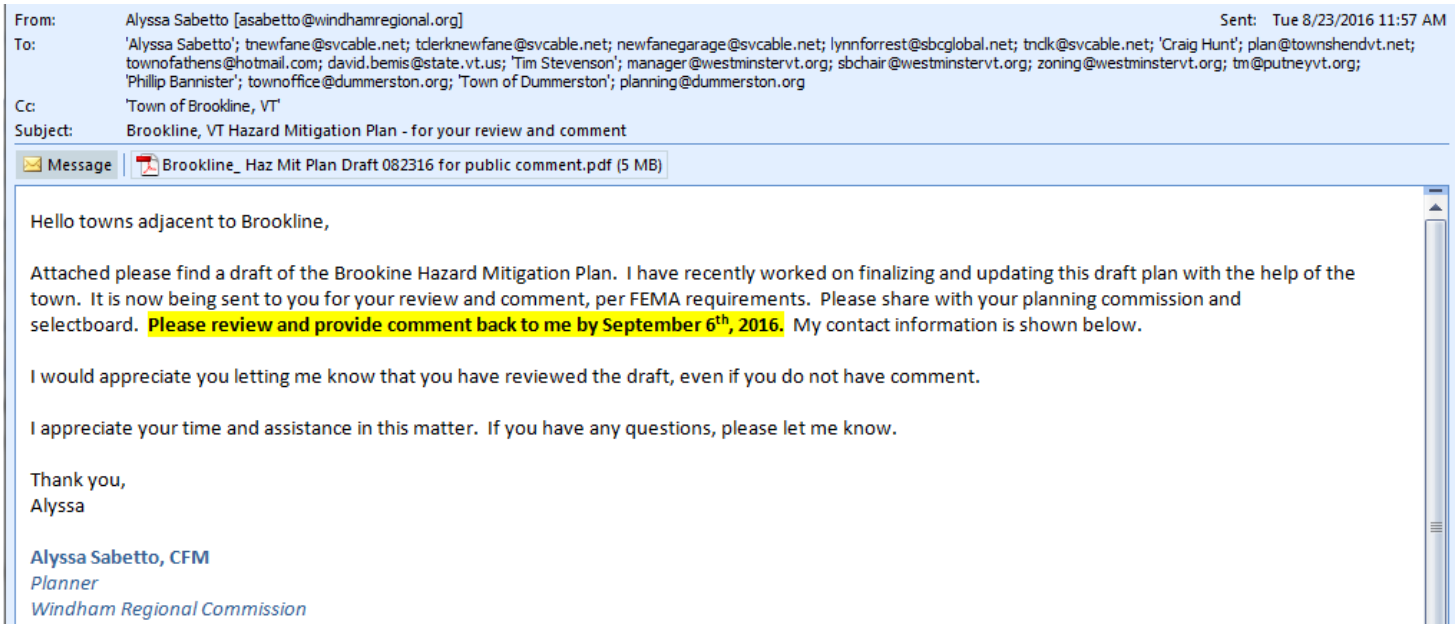
_____
Stanley Noga, Jr.

ATTEST

_____
Guy Tanza, Town Clerk

2. Website advertisement for Draft Hazard Mitigation Plan (posted 8/23/16-9/6/16)

3. Email sent to adjacent towns for public comment on the draft plan



From: Alyssa Sabetto [asabetto@windhamregional.org] Sent: Tue 8/23/2016 11:57 AM
To: 'Alyssa Sabetto'; tnewfane@svcable.net; tclerknewfane@svcable.net; newfanegarage@svcable.net; lynnforrest@sbcglobal.net; tndlk@svcable.net; 'Craig Hunt'; plan@townshendvt.net; townofathens@hotmail.com; david.bemis@state.vt.us; 'Tim Stevenson'; manager@westminstervt.org; sbchair@westminstervt.org; zoning@westminstervt.org; tm@putneyvt.org; 'Phillip Bannister'; townoffice@dummerston.org; 'Town of Dummerston'; planning@dummerston.org
Cc: 'Town of Brookline, VT'
Subject: Brookline, VT Hazard Mitigation Plan - for your review and comment
Message | Brookline_ Haz Mit Plan Draft 082316 for public comment.pdf (5 MB)

Hello towns adjacent to Brookline,

Attached please find a draft of the Brookine Hazard Mitigation Plan. I have recently worked on finalizing and updating this draft plan with the help of the town. It is now being sent to you for your review and comment, per FEMA requirements. Please share with your planning commission and selectboard. **Please review and provide comment back to me by September 6th, 2016.** My contact information is shown below.

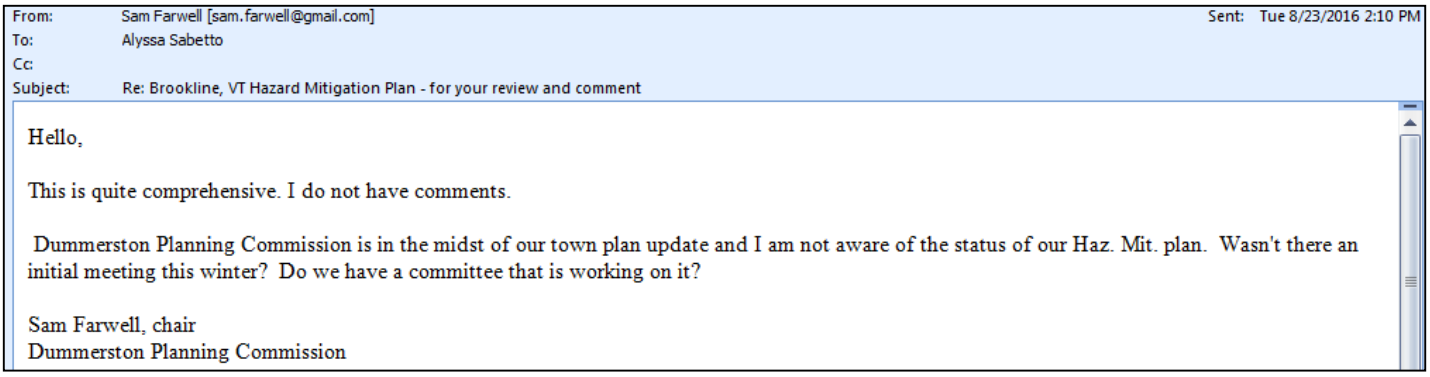
I would appreciate you letting me know that you have reviewed the draft, even if you do not have comment.

I appreciate your time and assistance in this matter. If you have any questions, please let me know.

Thank you,
Alyssa

Alyssa Sabetto, CFM
Planner
Windham Regional Commission

Two written responses were received from the adjacent Towns of Dummerston and Newfane



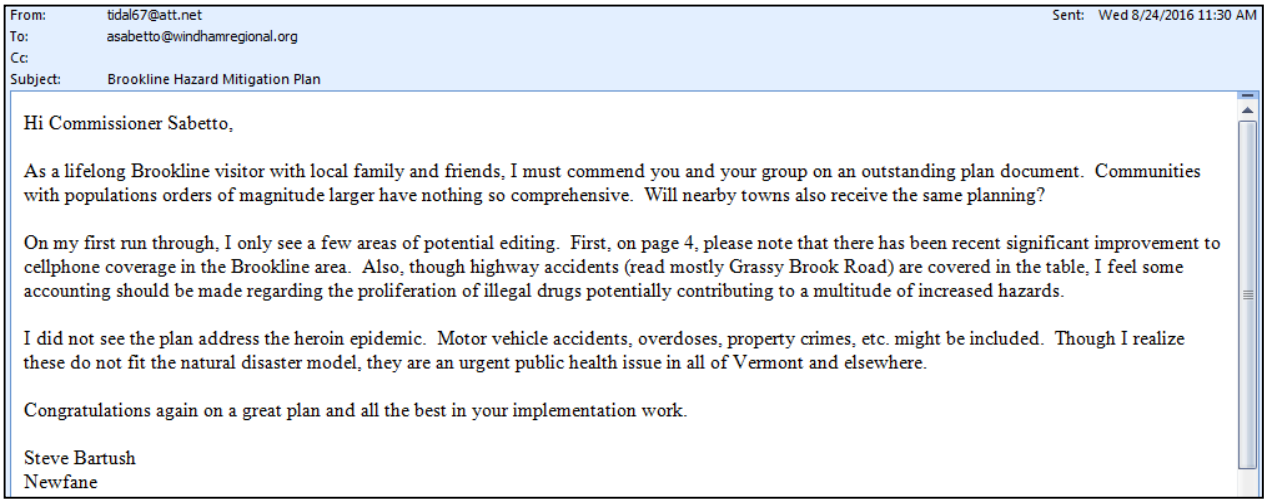
From: Sam Farwell [sam.farwell@gmail.com] Sent: Tue 8/23/2016 2:10 PM
To: Alyssa Sabetto
Cc:
Subject: Re: Brookline, VT Hazard Mitigation Plan - for your review and comment

Hello,

This is quite comprehensive. I do not have comments.

Dummerston Planning Commission is in the midst of our town plan update and I am not aware of the status of our Haz. Mit. plan. Wasn't there an initial meeting this winter? Do we have a committee that is working on it?

Sam Farwell, chair
Dummerston Planning Commission



From: tidal67@att.net Sent: Wed 8/24/2016 11:30 AM
To: asabetto@windhamregional.org
Cc:
Subject: Brookline Hazard Mitigation Plan

Hi Commissioner Sabetto,

As a lifelong Brookline visitor with local family and friends, I must commend you and your group on an outstanding plan document. Communities with populations orders of magnitude larger have nothing so comprehensive. Will nearby towns also receive the same planning?

On my first run through, I only see a few areas of potential editing. First, on page 4, please note that there has been recent significant improvement to cellphone coverage in the Brookline area. Also, though highway accidents (read mostly Grassy Brook Road) are covered in the table, I feel some accounting should be made regarding the proliferation of illegal drugs potentially contributing to a multitude of increased hazards.

I did not see the plan address the heroin epidemic. Motor vehicle accidents, overdoses, property crimes, etc. might be included. Though I realize these do not fit the natural disaster model, they are an urgent public health issue in all of Vermont and elsewhere.

Congratulations again on a great plan and all the best in your implementation work.

Steve Bartush
Newfane

4. Flyer advertising availability of Draft Hazard Mitigation Plan for public comment

Brookline Hazard Mitigation Plan

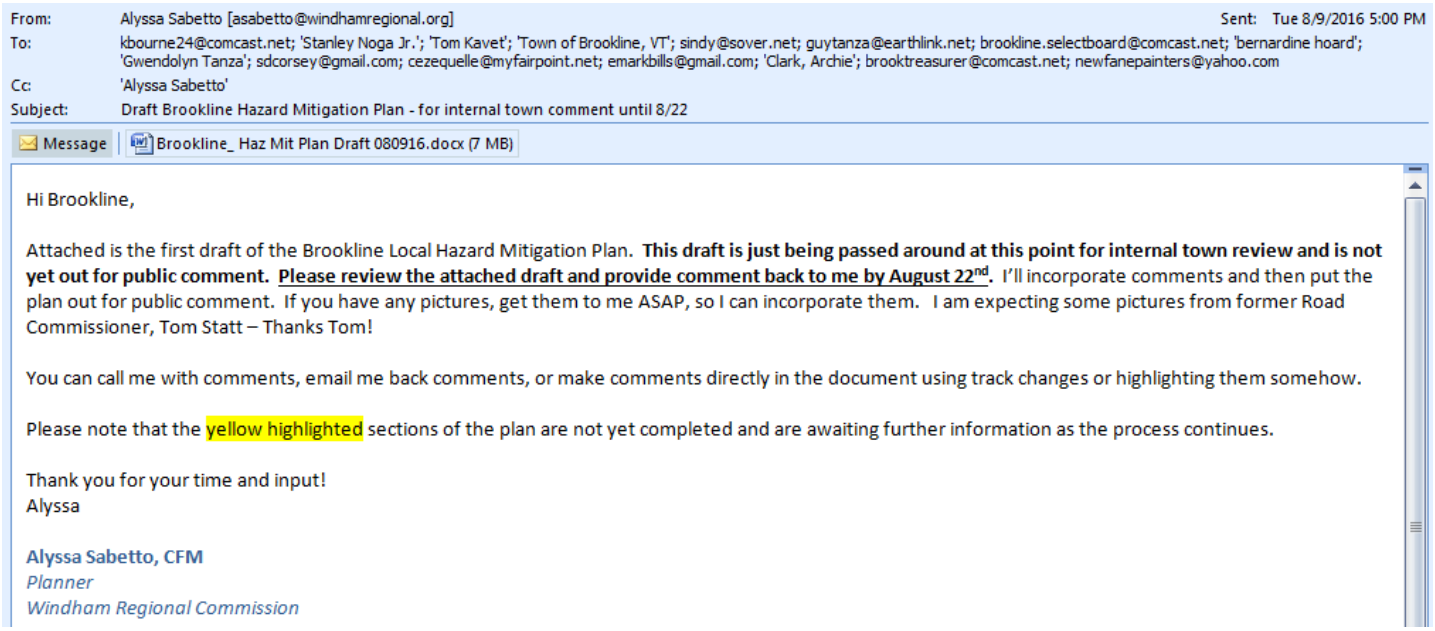
PUBLIC COMMENT PERIOD

The draft Brookline Hazard Mitigation Plan is now available for public review at the Brookline Town Office and on the town website: www.brooklinevt.com

The Plan will be available for comment until the end of the public comment period on September 6, 2016.

Anyone who would like to comment on the plan should contact Alyssa Sabetto at the Windham Regional Commission. She can be reached via phone at 802-257-4547 x108 or email at asabetto@windhamregional.org. We encourage your review and participation!

5. Email sent 8/9/16 to town staff and Hazard Mitigation Planning Committee for review of the draft



From: Alyssa Sabetto [asabetto@windhamregional.org] Sent: Tue 8/9/2016 5:00 PM
To: kbourne24@comcast.net; 'Stanley Noga Jr.'; 'Tom Kavet'; 'Town of Brookline, VT'; sindy@sover.net; guytanza@earthlink.net; brookline.selectboard@comcast.net; 'bernardine hoard'; 'Gwendolyn Tanza'; sdcorsey@gmail.com; cezequelle@myfairpoint.net; emarkbills@gmail.com; 'Clark, Archie'; brooktreasurer@comcast.net; newfanepainters@yahoo.com
Cc: 'Alyssa Sabetto'
Subject: Draft Brookline Hazard Mitigation Plan - for internal town comment until 8/22

Message | Brookline_ Haz Mit Plan Draft 080916.docx (7 MB)

Hi Brookline,

Attached is the first draft of the Brookline Local Hazard Mitigation Plan. **This draft is just being passed around at this point for internal town review and is not yet out for public comment.** **Please review the attached draft and provide comment back to me by August 22nd.** I'll incorporate comments and then put the plan out for public comment. If you have any pictures, get them to me ASAP, so I can incorporate them. I am expecting some pictures from former Road Commissioner, Tom Statt – Thanks Tom!

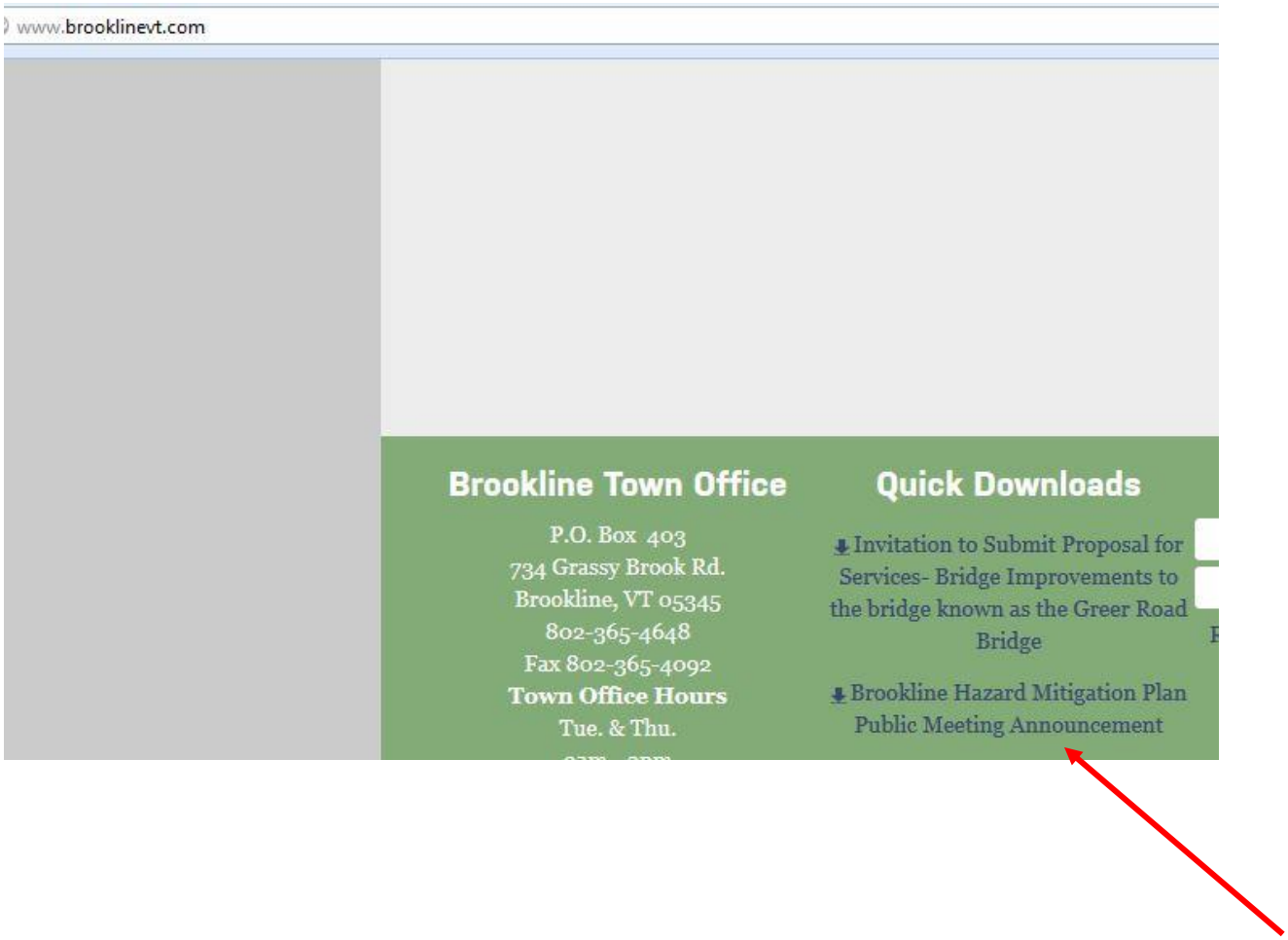
You can call me with comments, email me back comments, or make comments directly in the document using track changes or highlighting them somehow.

Please note that the yellow highlighted sections of the plan are not yet completed and are awaiting further information as the process continues.

Thank you for your time and input!
Alyssa

Alyssa Sabetto, CFM
Planner
Windham Regional Commission

6. Website advertisements for September 24, 2015 Hazard Mitigation Committee meeting at the Brookline Town Office



7. September 24, 2015 Hazard Mitigation Committee meeting sign-in sheet

Brookline, VT - HAZARD MITIGATION PLAN UPDATE MEETING
September 24, 2015
Location: Brookline Town Office

SIGN IN SHEET

Name and email address	Affiliations – Please list all	Town where you live
GUY TANZA BROOK763@COMCAST.NET	Town Clerk	BROOKLINE
E. Mark Bills Emarkbills@Gmail.com	Part time road Forman Tree Warden	Wardsboro
Stanley Naga Jr stannogajr@gmail.com	Selectman	Brookline
Archie Clark arch24@myfairpoint.net	Road Commissioner	Brookline
Barbara Bourne Kbourne24@comcast.net	Planning Comm member	Brookline
TOM KAVET tom@kavet.net	Planning Commission Chair	Brookline
Dot MAGGIO DotMaggioVT@GMAIL.com	Selectboard	BROOKLINE
Helen Samuels hwsamuels@gmail.com	Resident	Brookline

8. September 24, 2015 Meeting agenda

Brookline Hazard Mitigation Plan Update & Community Resiliency Meeting

Brookline Town Office – September 24, 2015

Agenda

1. Introduce the Hazard Mitigation Plan

a) Purpose
b) Process
c) Review of past involvement

2. Hazards

a) Complete Hazard Ranking Table
b) Discuss events that have happened that should be included in the plan
c) Mapping of vulnerable areas – mark up map as a group

3. Mitigation Actions

a) Review and update Mitigation Goals
b) Review Mitigation Actions table developed by Brookline in 2012
c) Discuss progress made since the plan was last worked on
d) Discuss Existing Hazard Mitigation Projects, Programs & Activities
e) Update Mitigation Actions Table
f) Gaps and capabilities with Implementation

4. Other Updates

a) Development trends – new developments, upcoming developments
b) Review of other elements of the draft plan and questions that weren't discussed

5. Next Steps

9. September 24, 2015 Meeting flyer that was posted around town

Brookline Hazard Mitigation Plan

Public Meeting Announcement

Date: Thursday, September 24, 2015

Time: 6:00-8:00 PM

Location: Brookline Town Office
736 Grassy Brook Rd, Brookline, VT 05345

Come help create Brookline's Local Hazard Mitigation Plan! What hazards does the town face? What actions can the town take now to lower vulnerability before the next natural hazard strikes?

For more information contact
Alyssa Sabetto at 802-257-4547 x109

WINDHAM REGIONAL COMMISSION

10. Photos of damages to Hill Road and Grassy Brook Road resulting from 2013 Greer Pond beaver dam failure. Photos courtesy of Thomas Staats.


Hill Road damage


Hill Road damage


Hill Road damage


Hill Road damage

Hill Road damage

Grassy Brook Road damage

11. 2011 Tropical Storm Irene damage to Grassy Brook Road/Athens Road, and recovery effort in Brookline. Photos courtesy of Thomas Staats.


KOBELCO

2011 Tropical Storm Irene damage to the North end of Grassy Brook Road. Photos courtesy of Thomas Staats.