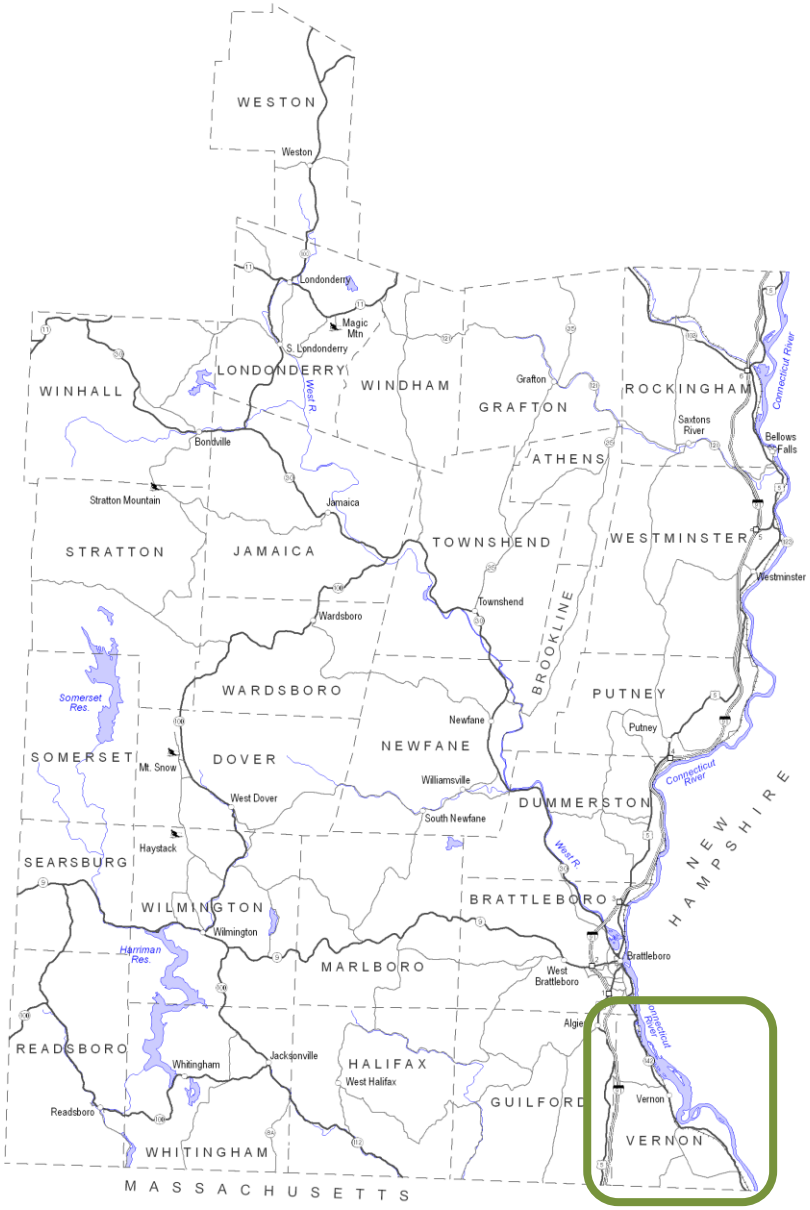
Town of Vernon
Local Hazard Mitigation Plan



Adopted by the Town on 10/15/19
FEMA Final Approved on 10/18/19

Prepared for the Town of Vernon
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 Vernon.

The purpose of this plan is to assist the Town of Vernon in identifying all of the hazards facing the town, as well as to identify new and continuing strategies to reduce long term risks from identified hazards.

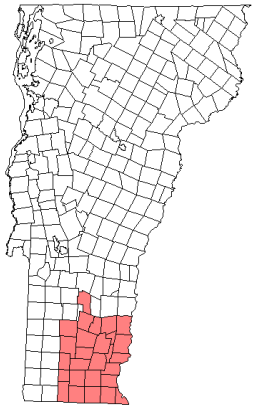
Hazard mitigation is any sustained action that reduces or eliminates risk to people and property from natural and human-caused hazards and their effects. Based on the results of previous Project Impact efforts, FEMA and state agencies have come to recognize that it is less expensive to prevent damage 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.

VERNON GEOGRAPHY & TOWN PROFILE

The Town of Vernon is a rural town on the southern and eastern Vermont border, along the Connecticut River. It is composed of 12,800 acres or 20 square miles in southern Windham County. Vernon is bordered to the north by Brattleboro, to the west by Guilford, and Northfield, Massachusetts lies to the South. State highway 142 runs north/south through Vernon and is the main road in Town. Interstate highway 91 runs north/south through a western section of Vernon. Vernon has the highest percentage of agricultural soils of any town in the Windham Region. Three black gum swamps are located throughout the J. Maynard Miller Town Forest. The town is also home to the Vernon Dam hydropower plant, and the former site of Vermont's only nuclear power plant, Vermont Yankee.

The physical characteristics of Vernon are dominated by the Connecticut River, which forms the eastern boundary of the Town and the State. The topography of Vernon is varied, being relatively flatter in the Connecticut River Valley and turning hilly as one goes west. Land use in Vernon is characterized by large rural areas and low density, primarily residential development. For the most part, homes and commercial establishments are located along rural routes in a linear pattern. There is no defined village area in Vernon. Woodlands are predominant in Vernon and cover a vast acreage of land. These forestlands provide the scenic backdrop for the Town and provide wood products, game for hunting, maple products and recreation.

With the exception of the Connecticut River and lower section of Broad Brook, the Town of Vernon has few streams draining off its twenty square miles of land area. These waters are typically small flowage and either drains to the east into the Connecticut River or to the west into the Fall River. Foremost of these waters are Town Brook, Newton Brook, Cold Brook, and Roaring Brook.

Most forestland is in private, non-industrial ownership. Approximately 3,452 acres – mostly forested – are actively managed under the Vermont Current Use Value Appraisal Program. As of the writing of this Plan, there are no appreciably large scale residential or commercial developments slated for permitting or construction. There is no municipal water or sewer service in Vernon.

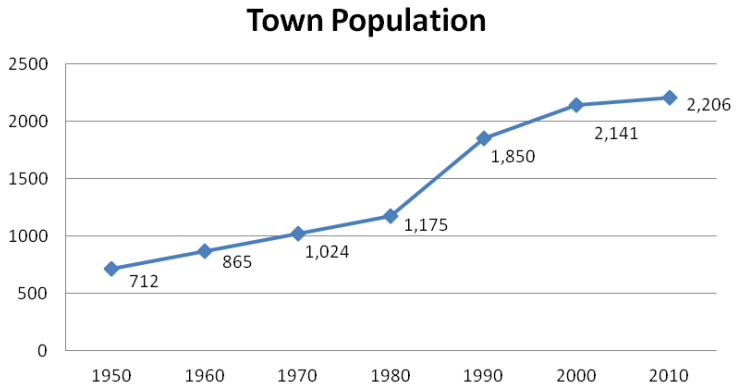
The climate is generally temperate with moderately cool summers and cold winters, as in the rest of Vermont. The weather is unpredictable, and large variations in temperature, precipitation, and other conditions may occur both within and between seasons.

Development Trends

As the following table and graph show, the population of Vernon rose from 2,141 to 2,206 people between 2000 and 2010, an increase of 3%. Vernon has steadily and slowly been increasing in population since 1950, with a rapid increase since around 1980. This is possibly due to Vermont Yankee nuclear power plant being built in 1972. Towns adjacent to Vernon either slightly gained or lost population between 2000 and 2010, with Guilford gaining just a percent more population than Vernon. The gain in population in Vernon during that time was much smaller than the previous 10-year period from 1990-2000.

Population Trends in Surrounding Towns

Town	1990	2000	2010	% Change 1990-2000	% Change 2000-2010
Vernon	1,850	2,141	2,206	16%	3%
Brattleboro	12,241	12,005	12,046	-2%	0.3%
Guilford	1,941	2,046	2,121	5%	4%
Hinsdale, NH	3,926	4,082	4,046	4%	-1%
Northfield, MA	2,838	2,951	3,032	4%	3%
Bernardston, MA	2,048	2,155	2,129	4%	-1%



Vermont Yankee closed in 2014-15, eliminating a major regional employer. Vernon has a 100 bed assisted living and nursing home combination, Vernon Advent Christian Homes, which is also a large employer. There is also an elderly housing project on Huckle Hill.

Emergency Services

Vernon has an Emergency Management Director and staff appointed by the Vernon Selectboard. The staff typically consists of town officials and volunteer citizens, as well as the Fire Department. The Police Department, Recreation Department and Highway Department complement the Emergency Operations Center staff during an activation, if needed.

The Vernon Selectboard has developed an emergency plan to incidents impacting the health and safety of Vernon residents. Such emergencies may include train derailments, chemical spills, floods, hurricanes, tornadoes, shooters, bomb threats, etc.

Response plans are practiced by frequent drills and full participation by the Town in an exercises evaluated by the Federal Emergency Management Agency (FEMA) once every two years. Emergency response personnel have undergone specialized training to respond to emergency incidents at the site of nuclear waste storage on the Entergy Vermont Yankee site[1].

The Town of Vernon Emergency Operations Center is a facility on Governor Hunt road just south of the Vernon School. This facility is designed to provide continuous occupancy capability, state-of-the-art communications equipment, and other emergency response capabilities for town emergency response personnel in the event of an emergency condition requiring Town of Vernon intervention. At the writing of this plan, the physical location of the center is expected to relocate, however an office will continue to be maintained by the town.

Vernon is served by the Vernon Volunteer Fire and Rescue Department. The Department is composed of approximately 37 volunteer members, some of whom are specifically EMS. The Fire Chief is appointed by the Selectboard and receives a yearly stipend and training. The Department serves the entire town and has mutual aid agreements with surrounding towns. Keene Mutual Aid serves as dispatch for the Department. Given the constraints imposed by a small volunteer Department, it has neither the financial nor the human resources to provide the level of fire protection that would be required by large-scale development. As with many small town fire departments in Vermont, there is a lack of younger volunteer firefighters. EMS does not have this issue. The Vernon Fire and Rescue Department makes all efforts to recruit volunteer fire-fighting personnel to protect Vernon residents. Members attend training courses sponsored by Vermont Fire Academy and the various mutual aid associations. There is a firehouse on Fort Bridgman Road. The town maintains five (5) fire ponds with many agreements for easement granted by private property owners.

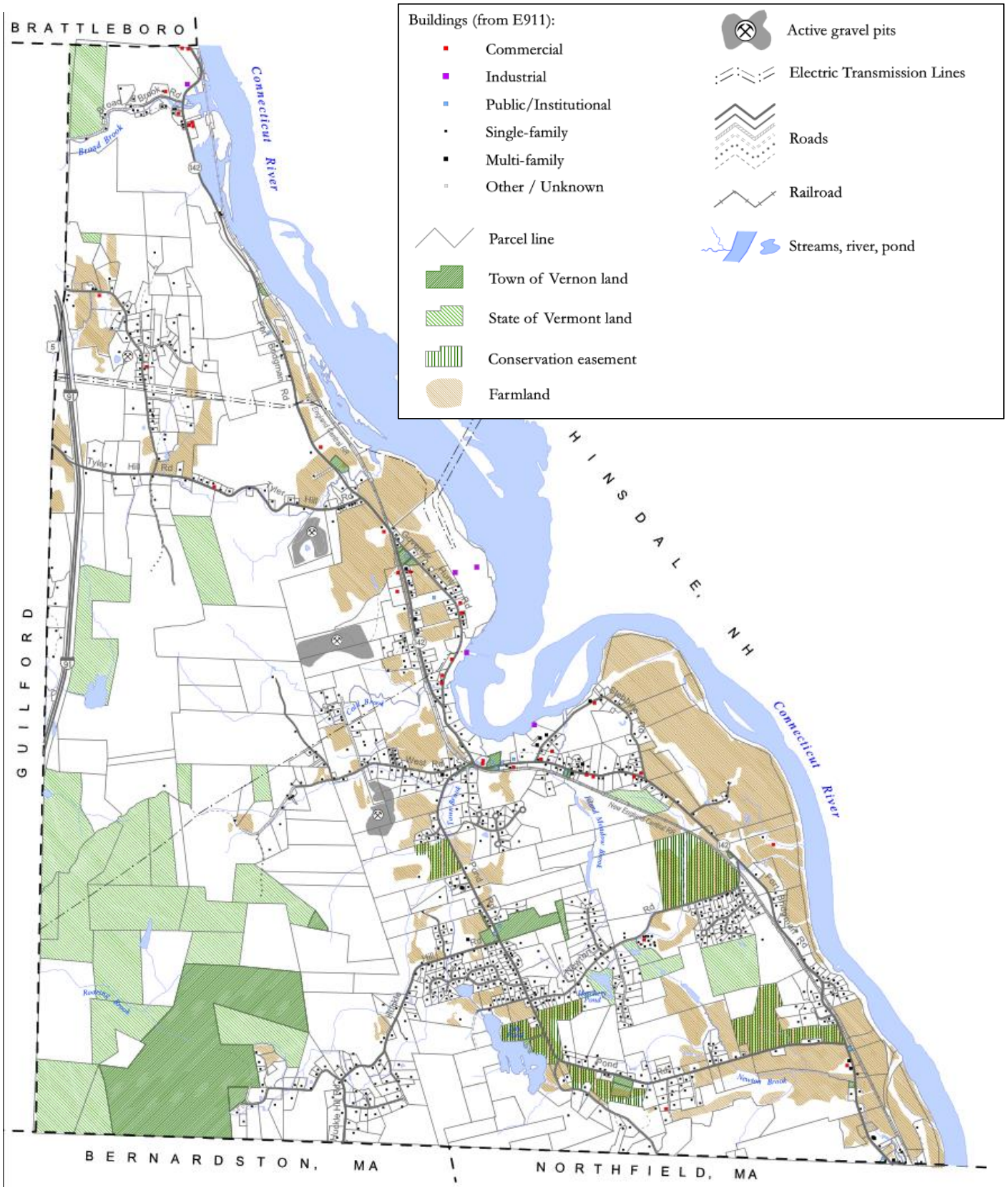
Emergency medical services and emergency medical transport services are provided by Rescue Inc. operating from the nearest facility in Brattleboro. Rescue Inc. is a non-profit organization funded through subscriptions and donations. Rescue Inc. provides Vernon and other area towns with ambulance service, medical care, transport to and from area hospitals and large regional hospitals. Rescue Inc. is staffed by highly trained volunteers and full-time personnel. The statewide 911 locatable address system provides dispatch service for fire, emergency and ambulance calls.

The Vernon Elementary School is set up to be a warming shelter and does have a backup generator. For overnight sheltering, residents rely on the nearby Brattleboro High School, which is a Red Cross designated shelter for the entire region. The nearest hospitals in order of proximity to Vernon are the Brattleboro Memorial Hospital in Brattleboro, Bay State Franklin in Greenfield, and Dartmouth-Hitchcock Medical Center in Keene, NH, and Bay State Hospital in Springfield, MA.

Vernon has a contract with the Windham County Sheriff's Department for police protection. Vernon has a furnished office that is utilized by the Windham County Sheriff in fulfillment of contracted public safety services to the Town.

[1] 2018 Vernon Town Plan

Existing Land Use Map from the 2018 Vernon Town Plan



PLANNING PROCESS

Town residents who took part in the planning process for developing the Local Hazard Mitigation Plan for Vernon 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 participate 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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Current Process

The Town commenced the planning process in November 2018. Alyssa Sabetto, Emergency Planner for the Windham Regional Commission, worked with Emergency Management Director Dave Emery to set up a meeting of a hazard mitigation planning committee. The Hazard Mitigation Planning participants later convened on November 27, 2018 at the Vernon Town Office and met with Alyssa. Dave invited these attendees directly, and they formed the core planning team. The meeting was also advertised and open to the public.[2] 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 an old draft plan, but she mostly rewrote the plan to meet the current standards and guidelines of FEMA for hazard mitigation plans. She took the information from the November 27, 2018 meeting, along with follow-up information gathered in conversations and a follow-up meeting on February 20, 2019 with the Town Administrator, Emergency Management Director and Town Clerk, 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 town review by the Committee, town personnel, Planning Commission and Selectboard on July 22, 2019. This internal town review period was from July 22-August 5, 2019. Comments, corrections, and some additional information was compiled and sent to Alyssa, who made the revisions, additions and corrections to finalize the draft for public comment.

[2] See appendices 6 and 7 for sign in sheet and meeting agenda.

The revised draft plan was put out for public comment on August 8, 2019. This was done by posting an electronic copy on the town's Facebook page and unofficial town website, and a hard copy of the plan was made available at the town office for public review and comment. Flyers were posted around town advertising its availability for review and comment. No comments were received from the public during the two-week comment period. It was simultaneously distributed to the adjacent towns of: Brattleboro, Guilford, Hinsdale, NH, and Bernardston and Northfield, MA for comment via email.[3] There were comments from Guilford which were all grammatical changes, and they were incorporated. The plan was finalized by Alyssa Sabetto for submittal to VT Department of Emergency Management (VEM). This submittal allows VEM to make suggested revisions on the draft, and allows 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:

2018 Contributors	Affiliations	Home
David Emery	Vernon Emergency Management Director	Brattleboro
David Walker	Road Commissioner	Vernon
Jeff Dunklee	Selectboard, Planning Commission	Vernon
Michelle Pong	Vernon Town Administrator	West Chesterfield, NH
Josh Unruh	Selectboard Chair, Assistant EMD	Vernon
Bob Spencer	Planning Commission Chair	Vernon
Tim Arsenault	Town Clerk, Windham Regional Commissioner for Vernon	Vernon
Jean Carr	Selectboard, Town Library Director	Vernon
Alyssa Sabetto	Windham Regional Commission	Brattleboro

Public Involvement and Input from Neighboring Communities
Making the Vernon 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.[4]

[3] See appendix 2 for reach-out and response.
[4] See appendix 8 for town advertisement of November 27, 2018 meeting.

- The primary hazard mitigation planning meeting took place on November 27, 2018 and was open to the public.[5]
- The draft plan was made available in hard copy for public review and comment at the town office from August 8-August 22, 2019.[6]
- Flyers were put up around town for public comment on the draft.[6]
- On August 8, 2019 an invitation was extended via email to neighboring towns to provide a means and opportunity to review and comment on the draft Vernon Hazard Mitigation Plan.[7] There were comments from Guilford. 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 following table is the scale used to rank each hazard that is analyzed:

Hazard Assessment Ranking Criteria		
	Frequency of Occurrence: Probability of a plausibly significant event	**Potential Impact:** Severity and extent of damage and disruption to population, property, environment and the economy
1	Unlikely : <1% probability of occurrence in the next 100 years	Negligible: Isolated occurrences of minor property damage and environmental damage, potential for minor injuries, no to minimal economic impact
2	Occasionally: 1–10% probability of occurrence per year, or at least 1 chance in next 100 years	Minor: Isolated occurrences of moderate to severe property and environmental damage, potential for injuries, minor economic disruption
3	Likely: >10% but <75% probability per year, or at least 1 chance in next 10 years	Moderate: Severe property damage on a community scale, injuries or fatalities, short-term economic impact
4	Highly Likely: 100% probability in a year	Major: Severe property damage on a community or regional scale, multiple injuries or fatalities, significant economic impact

[5] See appendix 6 for sign in sheet.
[6] See appendix 3.
[7] See appendix 2.

Potential impact is considered and scored separately for impacts to infrastructure, life, economy and the environment. 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 impact scores for infrastructure, life, economy and environment, along with the probability (frequency of occurrence) score are used to determine the hazard ranking score for each hazard. 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 Vernon 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 Vernon has decided are pertinent to their community and they have chosen to mitigate for at this time which are Inundation Flooding, Fluvial Erosion and Invasive Species. The below table shows the hazards in terms of their hazard ranking score as determined by the Hazard Mitigation Planning participants.

HAZARD ASSESSMENT								
		Potential Impact						
Possible Hazard	**Probability**	Infrastructure	Life	Economy	Environment	**Average:**	**Score:**	**Most vulnerable facilities and populations**
Invasive Species	4	1	1	3	4	2.25	9	Primary concerns are EAB, HWA, milfoil, Asiatic bittersweet, Japanese barberry, multiflora rose, Japanese knotweed and invasive mussels are the main concerns; The CT River is a vector for invasives.
Ice	4	2	2	2	1	1.75	7	Indian Point and where Broad Brook hits the CT River are two ice jam points.
Snow	4	2	2	2	1	1.75	7	The town has the infrastructure to handle large snow events.

Possible Hazard	**Probability**	Infrastructure	Life	Economy	Environment	**Average:**	**Score:**	**Most vulnerable facilities and populations**
Inundation Flooding	4	2	2	1	1	1.5	6	Agricultural lands along the CT River; Broad Brook area is vulnerable spot; Route 142 has overtopped in portions (did in 1938 hurricane); Route 142 bridge over Broad Brook
Fluvial Erosion	4	1	1	1	3	1.5	6	CT River has fluvial erosion issue along much of it because of rising and falling waters associated with dam operations. There is not much fluvial erosion outside of the CT River. Broad Brook Road is really the only road that experiences fluvial erosion impacts. Tyler Hill road used to have issues but there have been culverts upgraded to mitigate those issues;
Wind	3	3	2	2	1	2	6	Microbursts are seen more frequently; Power lines and trees are the hazard; winds come down the CT River.
Cold	4	2	2	1	1	1.5	6	There are vulnerable populations, but biggest populations of elderly are in senior communities that have generators.

Possible Hazard	**Probability**	Infrastructure	Life	Economy	Environment	**Average:**	**Score:**	**Most vulnerable facilities and populations**
Drought	2	1	1	2	2	1.5	3	All of Vernon is on well water. There is a significant farming community in Vernon that is impacted when there is a drought.
Wildfire	2	1	2	1	2	1.5	3	Land around the train tracks is a vulnerability from sparks in dry weather.
Hail	2	1	1	2	2	1.5	3	Crop damage would be the main economic concern.
Infectious Disease Outbreak	2	1	2	1	1	1.25	2.5	Public school and nursing home would be concerns.
Earthquake	2	1	1	1	1	1	2	There is a fault line along the CT River.
Heat	2	1	1	1	1	1	2	Not common to have excessive heat.
Landslides	1	1	1	1	1	1	1	Much of Vernon is flatter terrain.

The above table shows vulnerability to some natural hazards that Vernon—due to their small population and limited resources—at this point in time doesn't feel the risk posed by these hazards is high enough to justify the cost to further mitigate for them. Snow and Ice are something that the Town is very accustomed and comfortable handling. Vernon has chosen to profile inundation flooding and fluvial erosion, despite them scoring lower than Ice and Snow, because both Snow and Ice are something that the Town is very accustomed to and comfortable handling as they currently do. Winter and ice storms are a way of life in Vermont and they are handled well by both the Town and VTrans. Current methods of handling winter weather events are deemed adequate at this time, though the town may choose to address these hazards in the future. Heat, landslides and earthquake are not hazards that Vernon feels pose enough risk to consider mitigation. Cold is something they feel their population is accustomed to dealing with, along with the fact that their vulnerable populations are mostly covered by emergency generators, and they are close to a regional emergency shelter in Brattleboro. Wind, drought, wildfire, infection disease and hail do pose some risk to Vernon, but not enough that they feel the need to mitigate for these hazards at the current time. Current methods of handling most hazards are deemed adequate at this time, though the town may choose to address these hazards in the future. For hazards not covered in this plan, the reader is referred to the State of Vermont All Hazards Mitigation Plan.

All this being said, Vernon is a unique town in the Windham region for a couple of reasons: Vernon was the host community for Vermont Yankee Nuclear Power Plant, located just upstream of the Vernon hydroelectric dam, from 1972 until December 29, 2014. This status as

the host community meant that Vernon received extensive emergency planning assistance, financially and through the creation of many emergency management plans, that other towns have not received. Vernon was the epicenter of the 8-town "Emergency Planning Zone" which was the planning zone for a nuclear event. The financial benefit of hosting Vermont Yankee afforded Vernon the ability to complete mitigation and infrastructure upgrade projects for general vulnerabilities facing the town. Because they hosted the nuclear plant, they operated under a financial structure that neighboring towns did not have. They are no longer receiving funds from the plant, with its closure. However, the effect of this past investment is that Vernon does not have the extensive list of infrastructure upgrade needs that most other towns have. Therefore, most of the prior vulnerabilities such as undersized culverts and roadway concerns have been addressed prior to now and since TS Irene. Vernon did not suffer significantly from TS Irene.

With these considerations and the fact that their terrain is fairly flat and there are not many streams in the western half of the town, Vernon is a less vulnerable town compared to other towns in the region. Vernon has chosen to discuss two non-natural hazards in this plan, dam failure and train derailment. These hazards are not included in the hazard ranking table, but are discussed later in this Plan.

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 three natural hazards of most concern to Vernon.

Flooding and Fluvial Erosion

Flooding Description
Flooding is the most widespread and destructive hazard in the United States. Flooding has also been the most common and costly hazard to affect Vernon. Flooding can occur anytime of the year as a result of heavy rains, thunderstorms, tropical storms, hurricanes or Nor'easters. It can result from the overflow of major rivers and their smaller tributaries, or inadequate local drainage. Historically, floods have been a factor in over 80 percent of all federally declared disasters. People living in close proximity to bodies of water such as rivers, lakes, and streams are at greater risk from flooding than those not living in the floodplain. There is a 26 percent chance of experiencing a flood during the life of a 30-year mortgage compared to a 4 percent chance of a fire. Vernon has an NFIP compliant floodplain ordinance, which gives residents access to discount flood insurance and enables the Town to regulate development within the Special Flood Hazard Area (SFHA). SFHAs are subject to inundation by the 1% annual chance flood (100-year flood). Maps of these areas can be found at the Town Office or online at the FEMA Map Service Center.[8]

Vernon experiences flooding at the end of Newton Road caused by low terrain that pools water during large rain events.

There are very few dirt roads in the Vernon, compared to other towns in Vermont. This prevents washouts from roads, that other towns experience more often because of they have a lot of dirt roads.

[8] https://msc.fema.gov/portal

Fluvial Erosion Description

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 accompany these events.

Interesting Fact: Although the Connecticut River defines the eastern boundary of Vernon with Hinsdale, NH, much of the Connecticut River is not within the Town of Vernon since New Hampshire owns to the high water mark.
- Vernon Town Plan

The historic road network of many Vermont towns and villages typically follows waterways. This historic settlement pattern creates vulnerability for the road network, infrastructure and development within and along what are called River Corridors. River Corridor mapping was released by the Vermont Agency of Natural Resources (ANR) in early December 2014; small stream mapping was released in January 2016. This mapping delineates fluvial erosion hazard areas and includes a 50-foot buffer beyond those designated areas. For small streams, a 50-foot buffer from top-of-bank on either side of the waterway constitutes the River Corridor. This mapping can assist municipalities in developing bylaws and effective mitigation strategies to regulate development within fluvial erosion hazard zones. Vernon does not currently have a fluvial erosion bylaw, but may choose to add this to their floodplain regulations in the future.

Fluvial Erosion and Flooding Impact

Broad Brook Road from the beginning on the west end is eroding pretty significantly. To fix this problem would require in-stream work in conjunction with ANR. Flooding in this area is a known issue. Road flooding which can limit access to structures in this area is part of the vulnerability of this area. This area is prone to ice jams, which is made worse because the Route 142 bridge over Broad Brook is too small, which leads to ice buildup behind the bridge.

On the Brattleboro town line, due to lack of proper drainage, there is regular ponding and flooding on Route 142. Flash floods are becoming more frequent in this area. Vernon village experiences flooding at times from overflows on Town Brook, which is in the FEMA floodplain. Flash floods typically occur in as a result of summer thunderstorm activity. If Route 142 is cut off south of Tyler Hill, you are cut off from the other end of town and would have a long travel route to get to the other end going through adjacent towns. This would be a big problem and major delay in any emergency event.

Aside from some small streams, the four main waterways with concern for fluvial erosion are Broad Brook, Town Brook, Newton Brook and Connecticut River. Everything flows towards the Connecticut River and the topography isn't that vulnerable with steep or failing slopes except on Broad Brook and the banks of the Connecticut. Overall, fluvial erosion impact on the built environment in Vernon is limited.

Bank erosion on the Connecticut River is a significant concern in the town and the greater environmental NGO community that monitors the activities of the hydroelectric dam owners in the region. There are agricultural lands on the Connecticut River that are being lost by literally falling into the River every year. It is a significant amount, resulting in less yield on the crops. The banks are steep the entire length of the River. There is not a lot of Connecticut River access in Vernon, though the River forms the towns eastern border. The only access for the

Riverbank erosion leaves exposed tree roots. Photo courtesy of the Connecticut River Joint Commission.

public is just south of the Vernon dam, and the next closest is in Massachusetts just above Northfield School. Frequent releases of water from the dam to generate electricity have to be closely monitored by river users since water levels can rise rapidly. The Connecticut River is not able to act in a natural way because of the numerous impoundments on the River. It is more a series of impoundments than it is one River. For this reason, Vermont ANR does not map River Corridor on the Connecticut River.

The FEMA designated floodplains in Vernon are along the Connecticut River and the tributary streams of Newton Brook and Town Brook, as well as the two ponds, Lilly Pond and Hatchery Pond. River Corridor is scattered along the tributary streams and smaller branch off from them. The largest waterway that SFHA falls along is the Connecticut River. Due to a slightly higher elevation, the western portion of Vernon is largely devoid of SFHA and has only a couple of small streams that are buffered in River Corridor. The public is generally not as aware of mapped designated hazard area, though experience teaches residents where the vulnerable spots are. The fact that not all of the areas that experience damage are mapped shows that maps and regulations alone cannot prevent all vulnerably located development.

Riverbank erosion evidenced by leaning trees. Photo courtesy of the Connecticut River Joint Commission.

A waterway that is constrained is unable to reach geomorphic equilibrium which increases flooding in that area and puts increased pressure and larger flood loads on upstream and downstream sections, as well as causing more flooding damage. A river is in geomorphic equilibrium when its water, energy, sediment, and debris are in balance. In this condition a river is neither building up sediment in the channel nor losing sediment from its bed. Importantly, a river in equilibrium has not become overly deep and can continue to overflow onto its floodplains. The water that spills onto the floodplain slows down, and the velocity of the water still in the channel does not become excessively powerful. Mitigation actions are intended to assist with achieving greater equilibrium which will also lessen or even eliminate flooding levels and damages.

Ice jam flooding is fairly common in the early springtime, generally around March. The heavy rainfall, combined with runoff from snowmelt due to the mild temperatures, results in flooding of rivers, streams and creeks, mainly from the formation of ice jams. Vernon doesn't have mapped current or historic ice jams.[9] However, locals know that the Connecticut River has historically had an issue with ice jam flooding at the Brattleboro-Vernon Town line. They used to "float the pond" on the Connecticut to relieve ice jams.

Extent of Flooding

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 highest recorded measurement at the nearest stream gauge to Vernon (on a tributary to the Connecticut River, in Vernon) was 12.42 feet, which was measured on October 8, 2005.[10] The mean annual peak discharge at this site is 31 cubic feet per second, but this event measured 250 cubic feet per second. At this site that level is between a 100 and 200-year event. This gauge is no longer operational by the USGS.

Extent for thunderstorms/heavy rain events: The table below shows the top 10 rain events a former but long operating USGS weather monitoring station in Vernon and the nearest current weather station in Greenfield, MA. Both tables are given to give perspective and more historic data (and to show how TS Irene compares). 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 this data, the "Precipitation Frequency Estimates" table on the following page, allows one to determine the event frequency based on the rainfall amount. TS Irene does not appear on the Greenfield, MA table. It is important to remember that precipitation levels vary throughout the region.

Maximum 1-Day Total Precipitation[11]		
for Vernon, VT		
Rank	Value (inches)	Ending Date

[9] CRELL Ice jam database/map http://icejams.crrel.usace.army.mil/apex/f?p=524:5:0::NO
[10] USGS Stream gauge 01156450 Connecticut River tributary near Vernon (1964-2018) https://nwis.waterdata.usgs.gov/usa/nwis/peak/?site_no=01156450
[11] Data provided by the NOAA, Northeast Regional Climate Center at Cornell University. http://www.nrcc.cornell.edu/. Courtesy of Jessica Spaccio, Climatologist. 5/14/2018.

1	4.35	1937-08-10
2	4.12	1969-06-16
3	3.99	1944-09-15
4	3.80	1935-07-07
5	3.78	1995-10-28
6	3.76	1975-07-14
7	3.71	1996-07-14
8	3.71	1984-05-30
9	3.61	1973-08-03
10	3.58	1927-11-04
Period of record: 1893-01-01 to 1998-07-31		

Maximum 1-Day Total Precipitation[12]		
for Greenfield No 3, MA		
Rank	Value (inches)	Ending Date
1	4.00	2019-01-30
2	3.67	2013-07-23
3	3.59	2000-06-07
4	3.56	2018-08-12
5	3.55	2012-09-19
6	3.51	2008-09-07
7	3.48	2014-08-14
8	3.46	2000-08-12
9	3.26	2011-03-07
10	3.25	2015-09-30
Period of record: 2000-01-01 to 2019-02-05		

The table below is specific for Vernon, and has the values associated with the size of an event in order to determine the storm frequency[13]. This is for reference. Vernon should consider what size event is reasonable to set standards to build to, for both infrastructure and buildings. Some experts advise that towns should be using the 10 year one hour or two-hour frequency estimates to reflect the monsoon type storms that are seen in the region. Infrastructure built for 24-hour events often can't keep up with high intensity storms leading to erosion and street flooding. This should be a consideration in the future.

Extreme Precipitation Estimates							
	1hr	**2hr**	**3hr**	**6hr**	**12hr**	**24hr**	**48hr**
1yr	0.75	1.02	1.26	1.57	1.95	2.44	2.71
2yr	0.93	1.22	1.54	1.91	2.34	2.87	3.21

[12] Data provided by the NOAA, Northeast Regional Climate Center at Cornell University. http://www.nrcc.cornell.edu/. Courtesy of Jessica Spaccio, Climatologist. 5/14/2018.
[13] Northeast Regional Climate Center Extreme PRECIPITATION ESTIMATES: Vernon, VT <http://precip.eas.cornell.edu/data.php?1549400904286> accessed 2/5/19.

5yr	1.17	1.52	1.95	2.4	2.92	3.53	4.03
10yr	1.38	1.8	2.33	2.85	3.45	4.13	4.78
25yr	1.74	2.25	2.94	3.59	4.3	5.09	5.99
50yr	2.07	2.67	3.53	4.28	5.09	5.97	7.12
100yr	2.46	3.16	4.2	5.08	6.01	7.01	8.46
200yr	2.93	3.75	5.02	6.05	7.11	8.22	10.07
500yr	3.69	4.7	6.34	7.6	8.87	10.17	12.67

Extent of Fluvial Erosion

The largest area of fluvial erosion is on Broad Brook. This active area is about 1000' feet wide.

Probability of Flooding and Fluvial Erosion

Flooding is highly likely, as determined by the number of past events and the local knowledge of the Hazard Mitigation Planning Committee. There are events every year, especially during spring snow melt and late summer season rains. Flash flooding is a locally probable event, with flash floods typically occurring in summer months. Higher-elevation drainage areas and streams are particularly susceptible to flash floods, which plan participants noted are more common.

Fluvial erosion is highly likely and exists in Vernon, especially along the Connecticut River.

Past Occurrences

Since 1996, when National Climatic Data Center detailed records start, there have been 41 flood events in Windham County, Vermont. Not all flooding events are documented. There have been 16 Presidential Disaster Declarations in Windham County since 1953. Of these, 7 were severe storms, 5 were floods, 2 hurricanes, 1 snow event and 1 severe ice storm.[14]

Disaster Declarations for Windham County, VT

Disaster Number	Incident Begin Date	Incident End Date	Declaration Date	Incident Type	Title	Disaster Close Out Date
4356	10/29/2017	10/30/2017	01/02/2018	Severe Storm and Flooding	SEVERE STORMS AND FLOODING	
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

[14] 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 5/14/18.

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, & LANDSLIDES	11/12/1976
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 Vernon and the Windham Region:

January 30, 2019 – Flooding on Hubbard Road, and a lot of standing water in fields resulting from 4 inches on top of snow and ice. This topped the charts for a rain event in Vernon between 2000 and 2019—topping Tropical Storm Irene totals.

August 12, 2018 – A large rain storm. The town opened the Emergency Operations Center but no damage occurred for the town.

June 9, 2015 - A moist and unstable air mass ahead of an advancing cold front led to the developing of thunderstorms during the early afternoon hours on Tuesday, June 9th across eastern New York. As the thunderstorms organized into small lines, some of the thunderstorms produced wind damage, mainly to trees and power lines. These thunderstorms reached southern Vermont by the midafternoon hours and produced a report of wind damage near Halifax. Trees and wires were reported down during a thunderstorm on McMillan Road in Halifax. Thunderstorms ended over the region by the late afternoon, as the cold front crossed the region from west to east.

July 14, 2014 - As a strong area of low pressure moved across upstate New York on Monday, July 28th, repeated rounds of thunderstorms occurred during the afternoon and evening hours. This led to flash flooding across northern Windham County, as small streams and creeks rapidly overspread their banks. Although the worst of the flooding remained north of Windham County in Windsor County, many residents reported this flooding to be the worst seen in the area since Tropical Storm Irene in 2011. Heavy rain from thunderstorms led to flash flooding in Windham.

July 7, 2014 - A warm and humid air mass was in place across southern Vermont on the afternoon of Monday, July 7th. A cluster of showers and thunderstorms moved from upstate New York into southern Vermont during the mid-afternoon hours. These thunderstorms had previously weakened, but were still associated with very strong winds aloft. As these thunderstorms interacted with the high terrain of the southern Green Mountains, they produced gusty winds. These winds caused damage to trees and power lines near Readsboro. The thunderstorm continued eastward towards the Connecticut River Valley, but did not produce any additional severe weather before exiting the state to the east.

September 12, 2013 - A series of cold fronts moved towards the region on Thursday, September 12th. Despite some periods of cloudiness, a warm and humid air mass ahead of the approaching boundaries allowed for moderate amounts of instability to be in place. Along and ahead of the boundaries, several lines of showers and thunderstorms developed and moved across the region during the afternoon and early evening hours. In addition to a large amount of cloud to ground lightning, a few of the thunderstorms became severe, with damaging wind gusts. Several trees were downed across the region. Some areas that received repeated showers and thunderstorms experienced flash flooding as well, with roads washed out and/or closed as a result. Two to four inches of rain in a short period of time was reported in the areas that experienced flash flooding.

September 1, 2013 - A moist and humid air mass was in place across the region on Sunday, September 1st. A surface frontal boundary was situated across eastern New York into southern New England during the morning hours. During the day, the frontal boundary slowly lifted northward. With enough instability in place due to daytime heating, some showers and thunderstorms developed along this frontal boundary. The showers and thunderstorms tracked over the same locations during the afternoon hours across southern Vermont. As a result of the persistent heavy rain, flash flooding occurred in downtown Wilmington. A mudslide also occurred due to the heavy rainfall. By the evening hours, the showers and thunderstorms were located north of the region and beginning to weaken, and the threat for flash flooding ended.

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.

Tropical Storm Irene – August 28, 2011 – Vernon did not have a lot of damage from Irene. The Connecticut River posed a problem because of the debris floating down the River, some of it hazardous. Vernon was minimally touched by TS Irene.
Elsewhere in the region, rainfall amounts generally averaged 4 to 8 inches. Strong winds also occurred across southern Vermont, with frequent wind gusts of 35 to 55 mph, along with locally stronger wind gusts exceeding 60 mph. The strongest winds occurred from the north to northeast during the morning hours, then from the west to northwest during Sunday evening. The combination of strong winds, and extremely saturated soil led to numerous downed trees and power lines across the region. This also resulted in widespread long duration power outages. In particular, the approximate number of Windham County customers affected by power outages was 18,000. President Obama raised the federal match share to 90% from 75% for TS Irene relief for Vermont.

May 26, 2011 - A nearly stationary frontal boundary was draped across western and northern New York State as several waves of low pressure moved easterly along the boundary. In addition, a warm front lifted northeastward across southern Vermont during the morning hours of Thursday, May 26th. The passage of the warm front ushered in a warm, humid and unstable airmass. A large bowing segment of thunderstorms tracked east from the Catskills and Schoharie Valley of east central New York across western New England including southern Vermont during the late evening hours. There were numerous reports of wind damage and power outages.

May 26, 2010 - Numerous trees and wires were reported down in Guilford and Vernon due to strong thunderstorm winds. Two downed trees were reported on homes in Vernon.

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.

July 9, 2008 - Numerous trees and power lines were downed between Brattleboro and Guilford due to strong thunderstorm winds. Route 5 was partially closed between Brattleboro and Guilford due to numerous downed trees and power lines. In Brattleboro, some of the streets

that had downed trees included Vernon, Thomas, South Main, Acorn, Oak, Spring, and Cotton Mill Hill.

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. Rain and snow caused damage to roads and utility lines across Windham County. Across the state, nearly $3.6 million was obligated as part of the FEMA Public Assistance Program.

June 29, 2006 - After being nearly stationary while deepening for several days, an upper-level trough from the Great Lakes to the lower Ohio Valley was accelerating eastward at daybreak on June 29. An associated weak low pressure over Lake Erie trailed a cold front through the Ohio Valley. During the day, this system moved rapidly eastward and touched off thunderstorms in the warm, humid air mass over western New England in the early evening. Torrential rainfall produced flash flooding in Windham County.

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.

April 1, 2004 - As much as three inches of rain fell between March 31 through April 2 across southern Vermont. This rain combined with the last of the snow melt to produce an excessive runoff of water. As a result, flooding took place in Bennington County. The Manchester Schools were closed due to flooding. The gage on the Batten Kill River in Arlington, rose to 6.90 feet, nearly a foot above the 6-foot flood stage during the predawn hours of April 3. In Windham County, flooding was reported in West Brattleboro, where the Ames Brook and Whetstone Creek both rose over their banks and impacted nearby roads.

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.

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.

July 2000 - A stalled frontal boundary across extreme southern Vermont interacted with a strong upper level disturbance from July 15 into early July 16. The result was a slow-moving low pressure area which formed over Virginia. This low pumped a deep layer of tropical air into the region and produced the second widespread heavy rainstorm of the summer. Two to four inches of widespread rain fell, with locally higher amounts across the higher terrain of Windham County. Specific amounts included 3.00 inches at Bennington and 5.17 inches at West Wardsboro, in Windham County. This rain produced enough runoff to cause the Battenkill to

exceed the six-foot flood stage by about a foot at Arlington, Bennington County, a 47 year high. Also, the Deerfield River rose 6 feet above unofficial flood stage in Wilmington, Windham county. Several roads were reported under water.

The widespread heavy rain event set the stage for more widespread flooding later Sunday. The air remained very moist and unstable in wake of the rainstorm. More thunderstorms erupted late in the day across southern Vermont. These storms moved very slowly, trained over the same region, and were further enhanced by the steep terrain. The thunderstorm rainfall, as well as the earlier rainstorm, dumped in excess of 8 inches locally at Newfane, Windham county. Since the ground was already saturated, the heavy rains from the thunderstorms produced flooding and flash flooding across the region.

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 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. 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. 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. 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. Scattered power outages also occurred over the area, when strong winds downed water-laden tree branches onto wires.

July 25, 1994 – A hail storm in Vernon is on record as causing $50,000 in damages.

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.[15] Route 100 was completely washed out, as was Fowler

[15] USGS "Vermont Floods and Droughts" information page http://md.water.usgs.gov/publications/wsp-2375/vt/. Accessed 4/3/15.

Road. Kentfield Road was badly damaged. 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.

Sources used
National Climatic Database records; Local knowledge of areas of concern and impacts, Discussions and emails with Vernon Town Clerk, EMD and Town Administrator during January 2019; Correspondence with Connecticut River Joint Commission

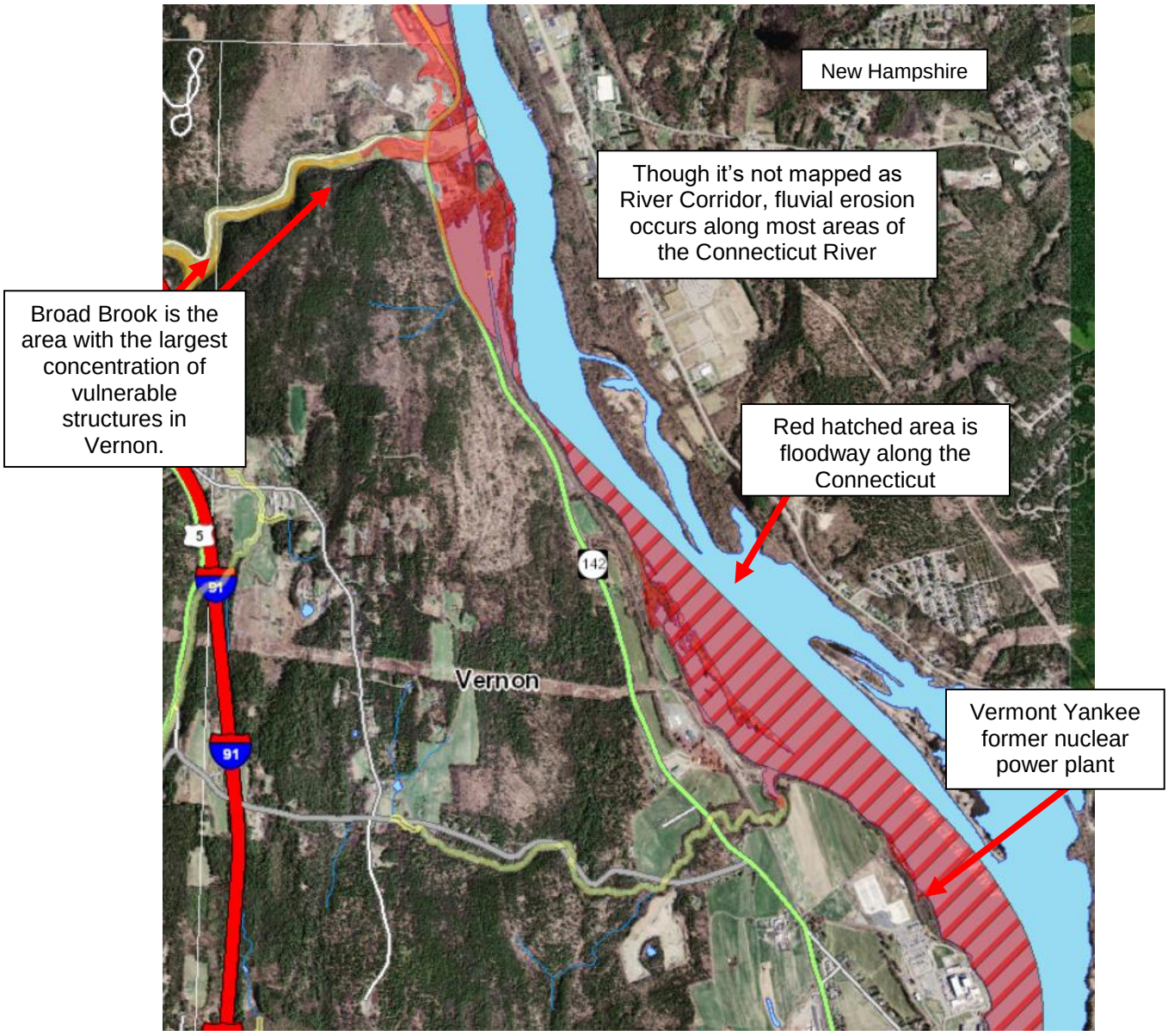
Geographic Area of Hazard/Location/Occurrence of Fluvial Erosion and Flooding/Special Flood Hazard Area and River Corridor Mapping

In some instances, stabilization/mitigation projects in Vernon have helped. In other areas throughout Vernon, issues remain. Many of the fluvial erosion issues are on private land, and thus require the consent of the land owner to mitigate the hazard. The river Corridor mapping (included in this plan) shows the ANR defined River Corridors, which are likely to have fluvial erosion. The map also points out some of the issues discussed in the text of particular problem spots.

FEMA has mapped "A", "AE" and Floodway zones in Vernon, making it a "D" level community, requiring comprehensive floodplain regulations to serve each zone. "A" zones do not have Base Flood Elevations determined. AE zones do have base flood elevations determined. Floodways are the highest risk flood zones, as they are associated with moving floodwaters. Properties within any zone of the SFHA, that have a mortgage, are required to carry flood insurance, and properties without a mortgage are advised to. Vernon's participation in the NFIP gives residents access to discount flood insurance through the National Flood Insurance Program (NFIP). The Flood Hazard Summary Sheets on FloodReady Vermont's website says there are 49 structures in the Special Flood Hazard Area and 10% of these structures have flood insurance.[16]

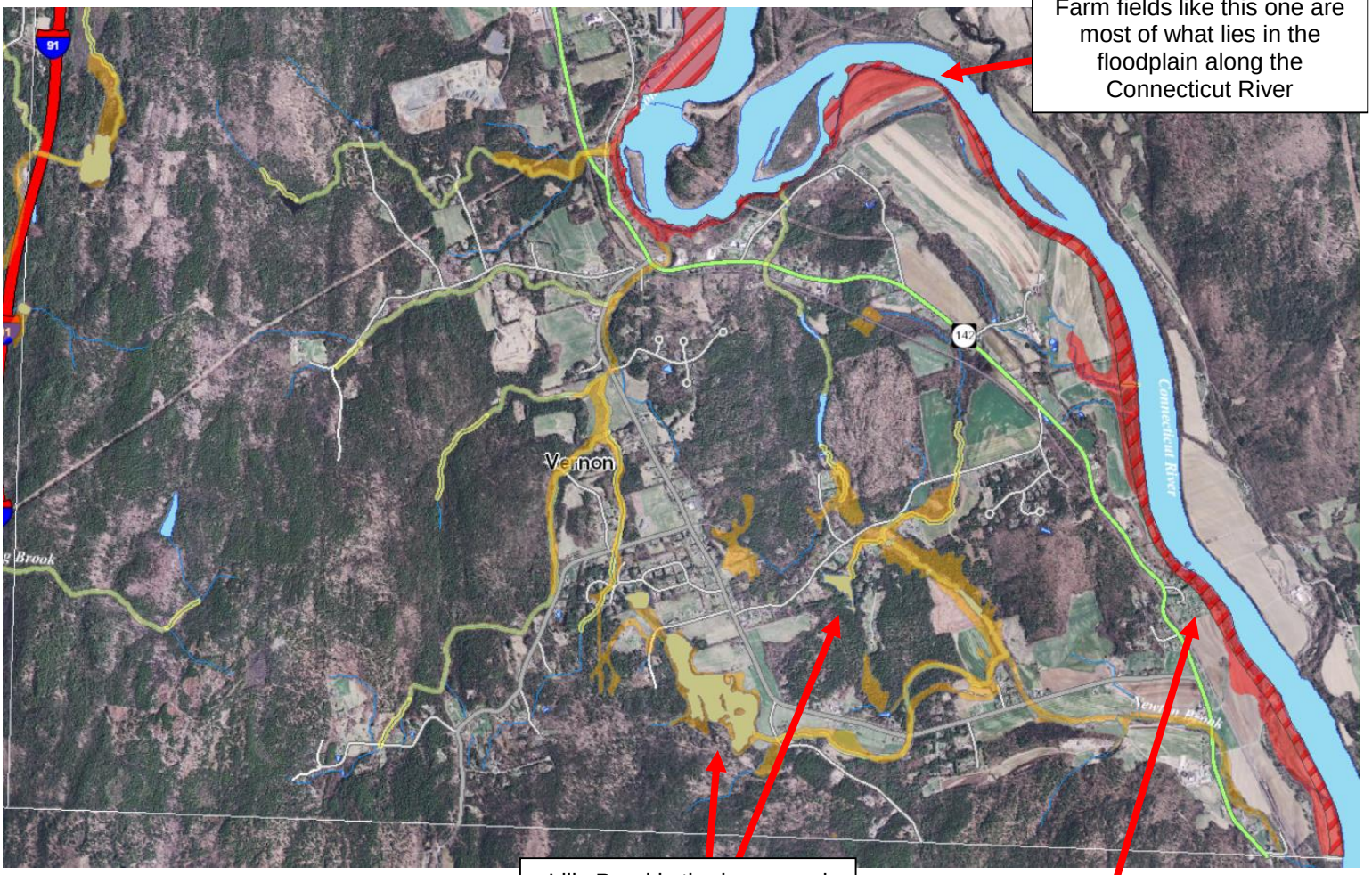
[16] Flood Hazard Summary Report for Vernon, accessed 2/4/19 <https://anrweb.vt.gov/DEC/FoFReports/SSRSReportViewer.aspx?RepName=ExpandedCommunityReport&Municipality=Vernon>

The below maps were created using the Vermont Agency of Natural Resources 'Natural Resources Atlas. These maps are snips showing all of the special flood hazard areas (SFHAs) that FEMA has designated in Vernon. They are shown in orange (A zone), red (AE zone) and red hatch (AE with floodway). The floodplains shown in these maps are based on the FEMA Flood Insurance Rate Maps (FIRMs) available through the FEMA Map Service Center.[17] This 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. Together this area is the mapped River Corridor. The ANR defined River Corridor to also include a 50-foot setback requirement on all streams with a watershed between .5 and 2 square miles. The relevant streams with this setback are also mapped. This setback would be determined on the ground, measuring 50-feet from top of bank or top of slope. The below map shows the northern half of Vernon.



[17] FEMA Map Service Center https://msc.fema.gov/portal

The below map shows the Special Flood Hazard Areas (SFHAs) in orange (A zone), red (AE), Floodway (red hatched), and the River Corridors in cream color, for the southern half of Vernon. SFHAs are along the Connecticut River and the tributary streams of Newton Brook and Town Brook, as well as the two ponds, Lilly Pond and Hatchery Pond. River Corridor is scattered along the tributary streams and smaller branch off from them. The largest waterway that SFHA falls along is the Connecticut River. Due to a slightly higher elevation, the western portion of Vernon is largely devoid of SFHA and has only a couple of small streams that are buffered in River Corridor.



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 particular 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.

Black Swallowwort carpets a bank to the exclusion of almost everything else. It even twines up a utility pole guy wire. Note the abundant seed pods. (Photo courtesy of John Anderson, Dummerston)

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.

"Vernon has a very mild climate for Vermont; in addition, it lies along the flood plain corridor of the Connecticut River and in some areas contains substantial sandy soils. These characteristics allows species that are at the northern extreme of their range to be found in Vernon and often in no other town in the Connecticut River drainage of Vermont or in some cases, nowhere else in Vermont at all." (excerpt from the *2019 Vernon Town Plan*).

Invasive Plant Species

In the absence or near absence of natural predators or controls, invasive non-native plants are able to spread quickly and out-compete 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 they are to the west, because the eastern towns are more populated, contain major transportation routes such as I-91 and the rail corridor, 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.

Heavy travel corridors like I-91, Route 142 and the rail line in Vernon are highways for the spread of invasives. Black swallowwort (pictured above), an aggressive invasive vine plant with small purplish black flowers, is rampant along Route 30 and is working its way up the West River Trail. Some plants can't take the use of salt on roads, but a newer invasive – slender

cottonweed – is working its way up I-91 and along Route 5 sparsely – and it appears to be a salt tolerant plant.

Waterways and riparian areas are also corridors that invasives can overtake and spread along. The Connecticut River is very susceptible, particularly because of the dams causing the water level to frequently rise and fall, which erodes the banks and leaves them vulnerable to invasive plant species that can easily overtake the eroded surface. The Town of Vernon has a representative on the Connecticut River Joint Commission. They are active and concerned about the environmental impacts that the dams are having on the river, including erosion issues on the river banks. They are looking at ways to slow down or stop the erosion, though both changes to the dam operations and infrastructure. There are a couple of aquatic invasive plant species that are a particular concern in this area of the Connecticut River:

Eurasian milfoil

First found in the Connecticut River in the mid-1990s at the mouth of the Black River, Eurasian milfoil has now spread, and appears as far north as Fairlee. Milfoil forms dense beds that can seriously impair recreational use, reduce fish spawning grounds, and outcompete beneficial native plants. Boaters must check their boats and trailers before and after launching in the river and infested lakes[18].

Image courtesy of vtinvasives.org

Brittle naiad

Brittle Naiad is a submersed or floating plant. This species typically appears to be compact and bushy, but can reach 1.2 meters in length. Leaves are toothed and stiff, and are easily fragmented when manipulated. Brittle naiad has been shown to inhibit native plant species' growth by blocking sunlight during the early growing season, and outcompeting plants for resources such as space. Dense mats of brittle naiad can pose problems for fish and waterfowl. Death and decomposition of these mats can decrease oxygen availability in aquatic systems. A brittle naiad infestation can also limit the recreational potential of a water body.

[18] http://www.crjc.org/invasives.htm


Image courtesy of vtinvasives.org

Brittle naiad prefers lentic (still water) systems such as ponds, lakes, and canals. It can grow in water up to 4 meters deep. Brittle naiad can tolerate turbid (cloudy) and eutrophic (excess nutrients) water conditions.

It is illegal to transport any aquatic plant under the Vermont nuisance species transportation law. Boaters and other recreators must inspect their vessels, trailers, and other pieces of equipment after use. Draining a vessel (not into a water of the State of Vermont) is also required while transporting a vessel in Vermont.

For aquatic invasives, avoiding transport of species to new bodies of water is the best, and cheapest, management option. Inspecting vessels and equipment for aquatic nuisance species, as well as draining and drying vessels and equipment is the best way to avoid unintentional transport of species.

Non-aquatic invasive plants

The banks of the Connecticut are prime locations for invasives, but they are also present elsewhere in Vernon. In particular, plan participants noted that the Town Forest and private land are all impacted by both invasive plants and insects.

Native species, such as beech trees and hay scented fern, are able to take over and prevent regeneration of more desirable species when an area gets overrun by deer who overeat desirable natives. Beech bark disease is causing the die off of older beech trees, leading to beech suckers growing from the roots which the deer don't eat by choice, but the tree clone sucker shoots are doomed to die after 10-15 years because of the beech bark disease. This means other healthy trees can't establish themselves, leaving the forest worse off in the long term.[19]

[19] "Press Release: Sadawga Plant Survey" http://townofwhitingham-vt.org/press-release-sadawga-plant-survey accessed 7/31/18.

Particular invasive plant concerns for Vernon are: There are heavy infestations of Asiatic bittersweet (*Celastrus orbiculata*), Japanese barberry (*Berberis thunbergii*) and multiflora rose (*Rosa multiflora*), and Glossy buckthorn (*Frangula alnus)*. Other species such as Oriental bittersweet, certain species of honeysuckle, Japanese barberry, yellow flag iris, and Japanese knotweed have become well established in many locations. TS Irene eroded stream and river banks so much and allowed for the flourishing of invasives on the bare soil left in its wake. Six years later, the trees are starting to get reestablished in these riparian areas, and they are knocking back the Japanese knotweed somewhat by shading it out. This tree-cover may self-contain it until the next storm. Purple loosestrife is commonly seen in many riparian and wetland habitats in the region. Phragmites is a newer invasive, a tall grass, that invades wet areas to the point where nothing else will grow. It has even been spotted in remote areas away from roadways, so is possibly wind-spread. Knapweed is semi-invasive that has been found along the power line corridors and railroad tracks—where it seems capable of withstanding spraying. Yellow rattle (pictured below) is another invasive flowering plant, a parasite on grass, is now being seen on power lines.

Yellow Rattle, pictured here, is hemi-parasitic on grasses. It can devastate hayfields. It is primarily confined to power line rights of way. (Photo courtesy of John Anderson, Dummerston)

Giant hogweed has not yet been discovered in Vernon. Tree of heaven is present in Vernon. Elevations generally below 1,500 feet are most susceptible to invasive species, though any land with some sort of major disturbance (from wind, water, logging, or land clearing and development) could potentially host them. Invasives tend to come up early and flower early, allowing them to get established before native plants have the chance. It may be possible to slow down or even halt the spread of these species by identifying and removing plants as soon as they appear. Early detection is the key. This detection can be aided by educating residents about the identification of and problems caused by invasive species. Several landowners have put control programs in place. Vernon does not have a Conservation Commission. One local conservationist in the region says it is harder to find native wildflowers now, and sees the future Vermont forest as resembling southern forests more and more—with compositions consisting of sassafras, white oak and gum trees, though he says it's hard to tell what will overtake the hemlock habitat.

Roaring Brook Wildlife Management Area (RBWMA) consists of a number of parcels totaling 1,428 acres located in the towns of Vernon (1,289.52 acres) and Guilford (138.55 acres), Vermont. The parcel abuts the northbound lane of I-91 from the Massachusetts state line northward for 2.4 miles. The RBWMA is adjacent to several large conserved parcels in Massachusetts (conserved lands map on page 14) creating an approximately 5,000-acre area of conserved habitat in the region. Roaring Brook is used primarily for hunting and, to a lesser extent, snowmobiling. There is evidence of considerable and destructive off-roading activity, which tears up the land and makes it easier for non-native plant species to take over. Currently there is limited legal access to the parcel. The Vernon Town Forest, which abuts this parcel on

the east, has good access and a trail system linking the parking area to the more prominent black gum swamp on the town forest.

Vernon is also home to a Black Gum Swamp which is a fragile and unique natural community. Although the old gums still appear to be healthy and younger gums are growing nearby, many factors could destroy the swamps as we know them. Black gums prefer warmer climates; several unusually cold winters could kill them. A strong windstorm could uproot their shallow root system. Careless logging, off-road vehicles, or heavy hiker visitation could cause soil and organic matter to wash down into the swamp basins and suffocate the roots. Well-meaning visitors could kill the trees and other rare plants simply by trampling and compacting the soil[20]. Invasive species infestation would be detrimental for this sensitive forest and diligence needs to be taken to prevent infestations.

The next page contains a list of invasive plants on the Vermont Fish and Wildlife Department watch list.[21]

[20] 2019 Vernon Town Plan
[21] 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

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 and garden debris, as this is critical to prevent the spread of non-native seeds and insects. Mowing roadsides from the north to the south can also help prevent the migration of invasive seeds on-site.

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). Hemlock wooly adelgid is currently present throughout the state. Having first been discovered in Orange

County in February 2018, Emerald ash borer (EAB) has been confirmed in Orange, Caledonia, and Washington Counties so far. 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.[22]

Hemlock woolly adelgid

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.

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 cause die off. In 2014 the mortality rate was only 40%, whereas in 2015 the mortality rate was 98-99% because it was an especially cold winter. Populations build back up in warmer months.

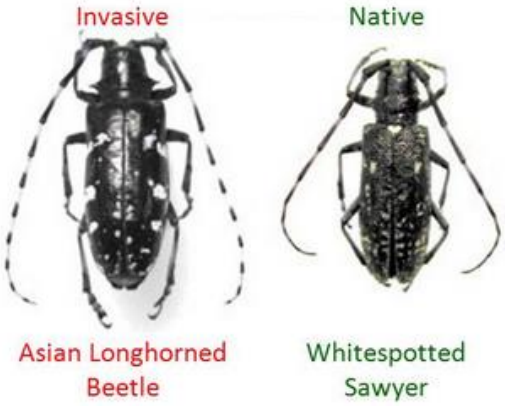
HWA is ubiquitously present in Vernon. In the Windham region, it was initially found in Brattleboro and the Guilford area. It is now found in 14-15 Windham Region towns, and has been recently found in Springfield in Windsor County. It has not been found in Weston, Winhall, Somerset, Searsburg or Readsboro. HWA is moving south to north in lower elevations first, and is mostly throughout southern Vermont at this point. Dead or dying hemlocks are a sadly regular sight in the region. It was first found at the SIT campus in 2010 and is now found throughout the town of Brattleboro.

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.

Asian longhorned beetle[23]

[22] vtinvasives.org (accessed 2/20/15)
[23] http://www.maine.gov/dacf/php/caps/ALB/ALBdamagepics.shtml

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.



Signs and Symptoms of Infestation: Oval to round wounds on the bark where the females have chewed out a site to deposit their eggs. Round emergence holes in the trunks and branches of trees. Piles of coarse sawdust at the base of trees.

The closest area to the Windham region that has the pest is Worchester County, Massachusetts in 2008. And they have an active quarantine and public notification campaign about the pest.[24] They are having to destroy every host tree, infected or not, and will be replanting in the oaks. Boston had a small outbreak 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

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

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. In 2018 Emerald ash borer has been confirmed in Orange, Washington, and Caledonia Counties in Vermont. It is currently present in 33 states (most recently in Maine). The EAB is not yet present in Vernon or anywhere in Windham County.

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.

Signs and Symptoms: Symptoms and signs include D-shaped adult exit holes, bark splitting, serpentine frass-filled (sawdust-like waste) feeding galleries, wood pecker feeding, crown dieback, and epicormic shoots (whips growing off the trunk and branches). Many of these symptoms and signs are similar to other insects and diseases of ash.


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

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.[25]

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. Purple traps have been put up in Vernon by the State ANR to catch the EAB for early detection, but they have been proven present so they will no longer be maintained by the state.

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 to 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

[25] 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.

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. The large deer population is causing the loss of new trees to regenerate the forest hardwoods, thereby leaving vulnerability for invasives to come in.

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. There are scattered pockets of ash trees in Vernon, including in the town forest. Vernon has not done an ash tree survey to know where vulnerable trees are located. They have also not completed an EAB plan.

The loss of maple trees to ALB, could mean a devastation to the maple industry, which is a big industry in Vermont, including in Vernon. A lot of people sugar in Vernon, 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 a big decrease in the number 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 Vernon and 13-14 other towns in the Windham region. 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.

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 road crews to identify threats 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 a good option for an urban tree canopy. Additionally, trees have to be retreated every one to two years because of the insect's 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 time in the interior wood, out of the vessel 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 Vernon. Invasive plants are present in Vernon. Long-standing and spreading forest threats in the Windham Region are glossy buckthorn, purple loosestrife, Japanese barberry, multi-flora rose, Japanese knotweed, cow parsley, and garlic mustard, and Asiatic bittersweet. The Connecticut River faces a host of invasives. 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 material from various sources, including flood waters. Logging, and particularly clear cutting, create areas that are particularly susceptible to invasives. Logging on a commercial scale is not occurring, but private landowners do have their land logged at time. About 35% of the town is in the Current Use program (4,389.99 acres out of 12,416 acres total). Logging is recognized as an important industry in Vernon and statewide.

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.[26] 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

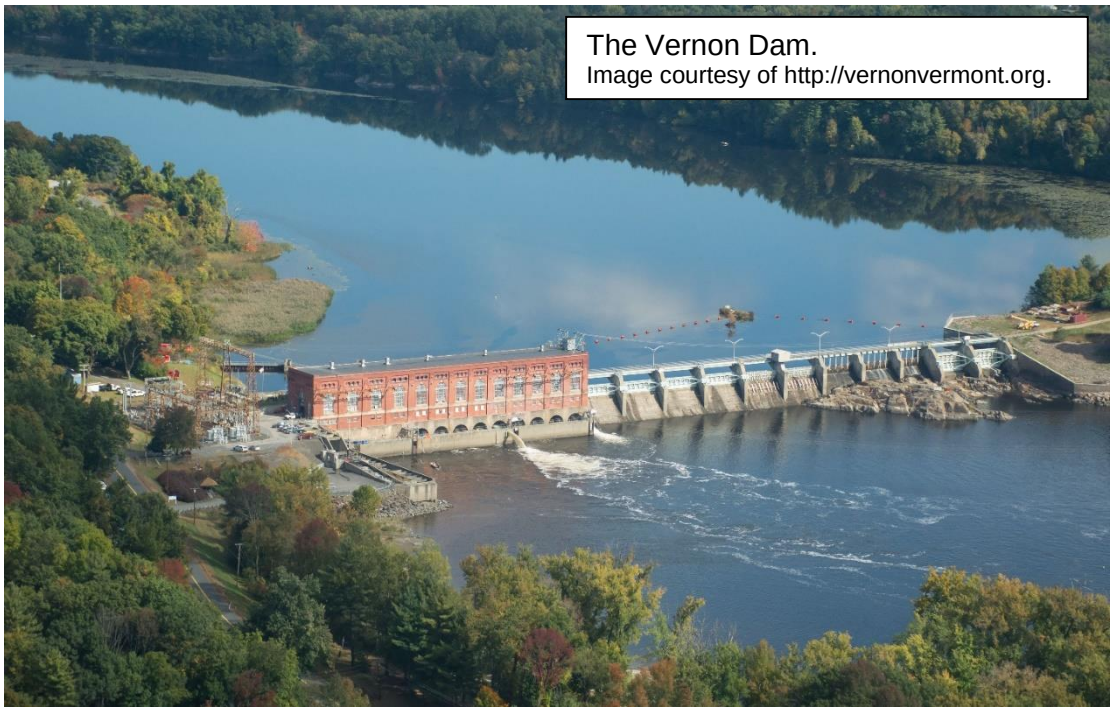
[26] < http://www.vtinvasives.org/tree-pests/community-preparedness>

containment. Bio-controls are being worked out currently but aren't yet a solution. Insect pests are often found first by concerned citizens, arborists and foresters.

Sources Used
Interview with Windham County forester Bill Guenther on 3/2/15 (802-257-7967 or bill.guenther@vermont.gov); Interview with VT State Forester Jim Esden on 3/4/15 (802-885-8822 or jim.esden@vermont.gov); Information from Bob Spencer, Vernon Planning Commission Chair in email sent 4/3/19; VT Fish and Wildlife website; VTinvasives.org; Cerceris.info webpage; Main Forest Service webpage[27]; Images courtesy of Google images and Maine Forest Service.

Dam Failure

There is one dam in Vernon, the Vernon Dam or The Vernon Project, FERC No. 1904 owned by Great River Hydro, LLC. The Vernon Dam is a hydroelectric dam located on the Connecticut River at river mile 141.9 and extends upstream approximately 26 miles. The dam and powerhouse is approximately 2 miles upstream of the Ashuelot River and 7.4 miles downstream of the West River. The installed capacity of the project is: 32,400 kW.[28]



The Vernon Dam.
Image courtesy of http://vernonvermont.org.

Dam failure inundation mapping data and images are contained here. Though dam failure is not a natural hazard for Vernon, and therefore not required to be addressed in this plan. Vernon is at risk for dam failure from nearly every dam upstream, and therefore the hazard should be understood. The mapping images contained here are actually mapping from the failure of Moore Dam, which is the northernmost dam on the Connecticut River and the biggest dam in the Great River network. This mapping serves to show the risk that Vernon faces, not just from failure of the Vernon Dam, but also from dam failure upstream, because in the event that the

[27] http://www.maine.gov/dacf/mfs/forest_health/invasive_threats/index.htm
[28] http://www.greatriverhydro-relicensing.com/vernon-project/

Moore dam on the Connecticut between Littleton, N.H., and Waterford, Vt., failed, the release of the water behind it would trigger the failure of *all* the dams downstream in a cascade effect. Only Moore, Comerford and Wilder dams on the Connecticut are considered "high hazard," and carry the potential to knock out the hydro dams downstream from them. Bellows Falls and Vernon dams do not have that potential, and therefore are not considered “high hazard”. Though dam failure is not a natural disaster, it should be understood as it would impact the town.[29]

The images contained herein show two scenarios, orange is the “sunny day” scenario which is associated with no additional rain enhancing the flood scenario; the other is “PMF” or probable maximum flow which is associated with maximum flow scenarios of flood stage and dam failure. The below data is taken at three locations on the Connecticut in Vernon going from north to south. This data shows changes in flood stage at locations going downstream. The boxes tell the location of the cross section that the data is based at.

Cross Sections:Moore Dam

Cross Section 287
Moore Dam
STA-324401.90
Broad Brook Confluence
132.4 Miles Below Dam

Sunny Day
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***227.00***
Incremental Rise (ft): ***10.90***
Peak Breach Flow (cfs): ***131,327.30***
Breach Wave Arrival Time (hrs): ***12.20***
Time to Peak Breach Stage (hrs): ***32.50***
PMF
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***237.50***
Incremental Rise (ft): ***6.60***
Peak Breach Flow (cfs): ***279,681.40***
Breach Wave Arrival Time (hrs): ***10.74***
Time to Peak Breach Stage (hrs): ***30.14***

Cross Sections:Moore Dam

Cross Section 295
Moore Dam
STA-304357.50
Below Vernon Dam
136.2 Miles Below Dam

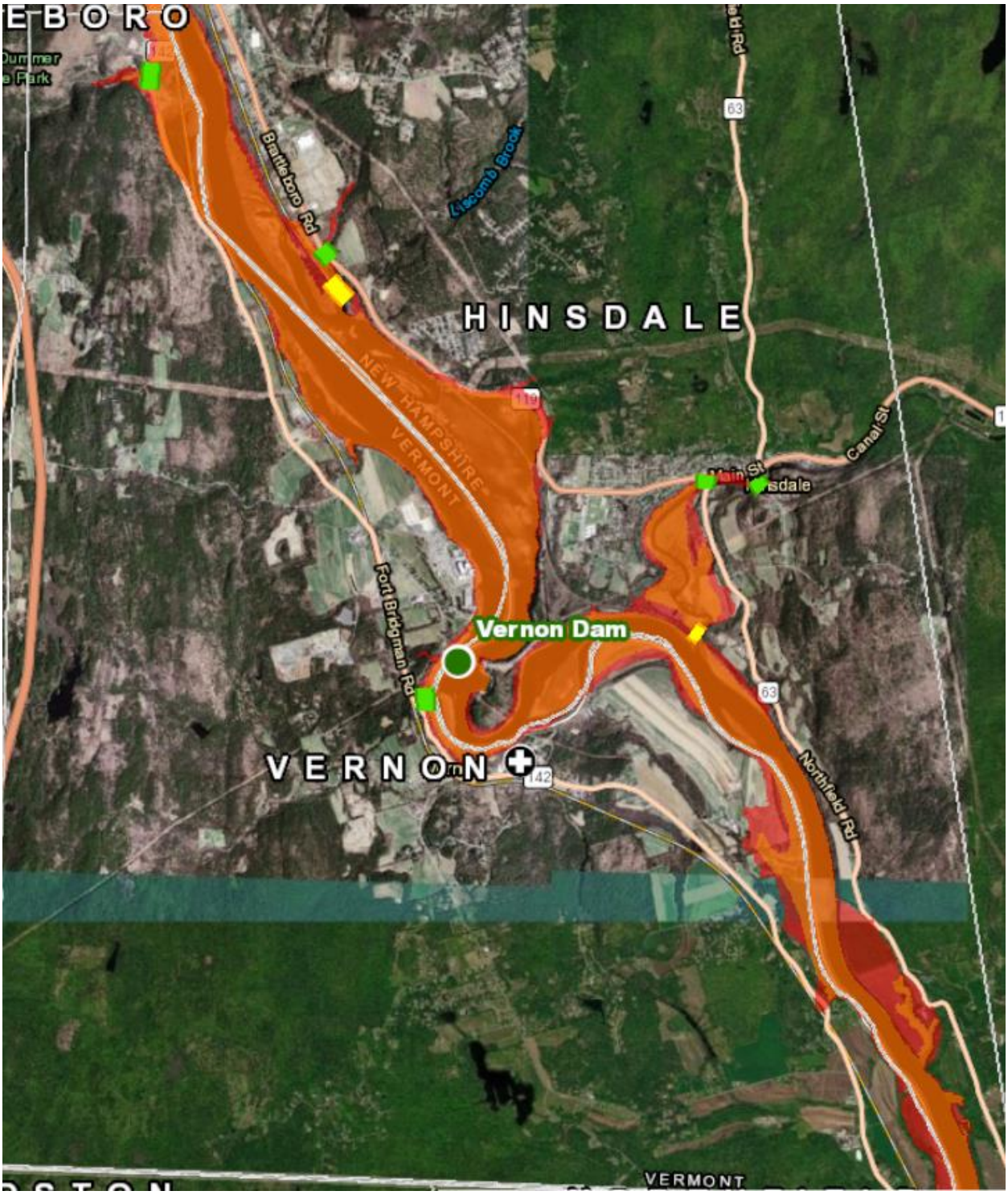
Sunny Day
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***205.50***
Incremental Rise (ft): ***20.40***
Peak Breach Flow (cfs): ***130,835.50***
Breach Wave Arrival Time (hrs): ***12.60***
Time to Peak Breach Stage (hrs): ***33.70***
PMF
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***222.00***
Incremental Rise (ft): ***10.50***
Peak Breach Flow (cfs): ***279,544.40***
Breach Wave Arrival Time (hrs): ***11.25***
Time to Peak Breach Stage (hrs): ***31.96***

Cross Sections:Moore Dam

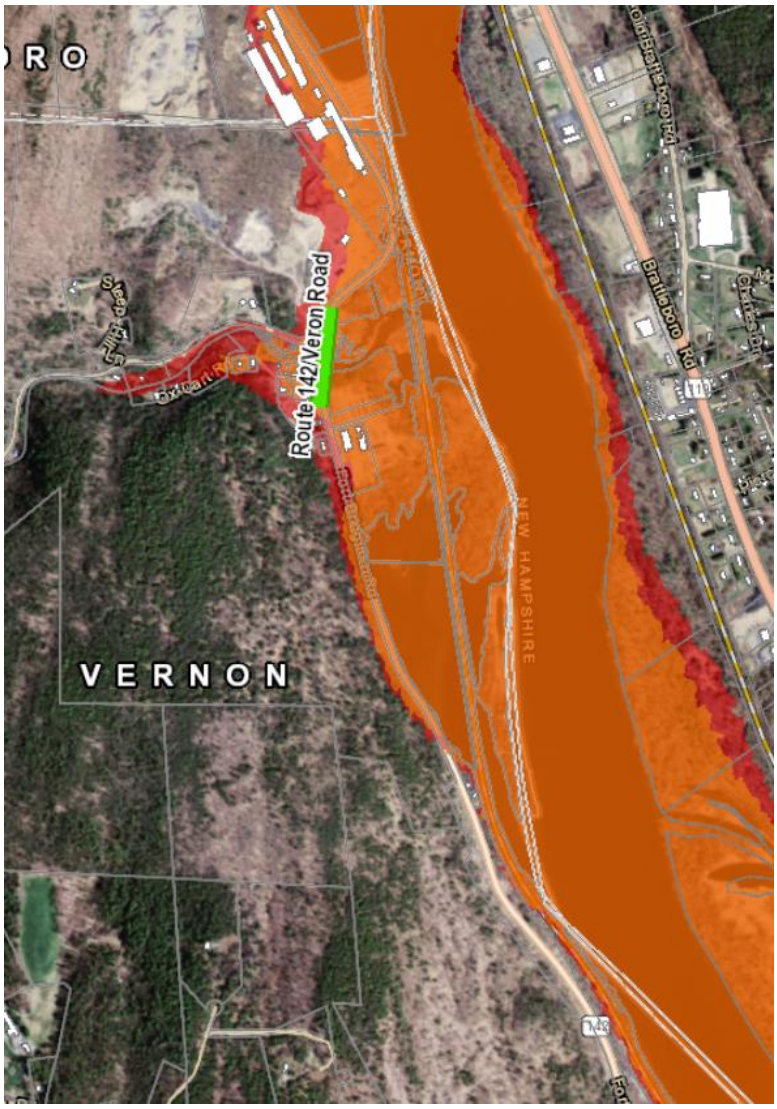
Cross Section 304
Moore Dam
STA-282239.00
Upstream of Newton Brook Confluence
140.4 Miles Below Dam

Sunny Day
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***202.20***
Incremental Rise (ft): ***17.30***
Peak Breach Flow (cfs): ***130,811.70***
Breach Wave Arrival Time (hrs): ***12.90***
Time to Peak Breach Stage (hrs): ***34.00***
PMF
Peak Non-Breach Stage (ft):
Peak Breach Stage (ft): ***217.70***
Incremental Rise (ft): ***9.90***
Peak Breach Flow (cfs): ***279,539.90***
Breach Wave Arrival Time (hrs): ***11.57***
Time to Peak Breach Stage (hrs): ***32.36***

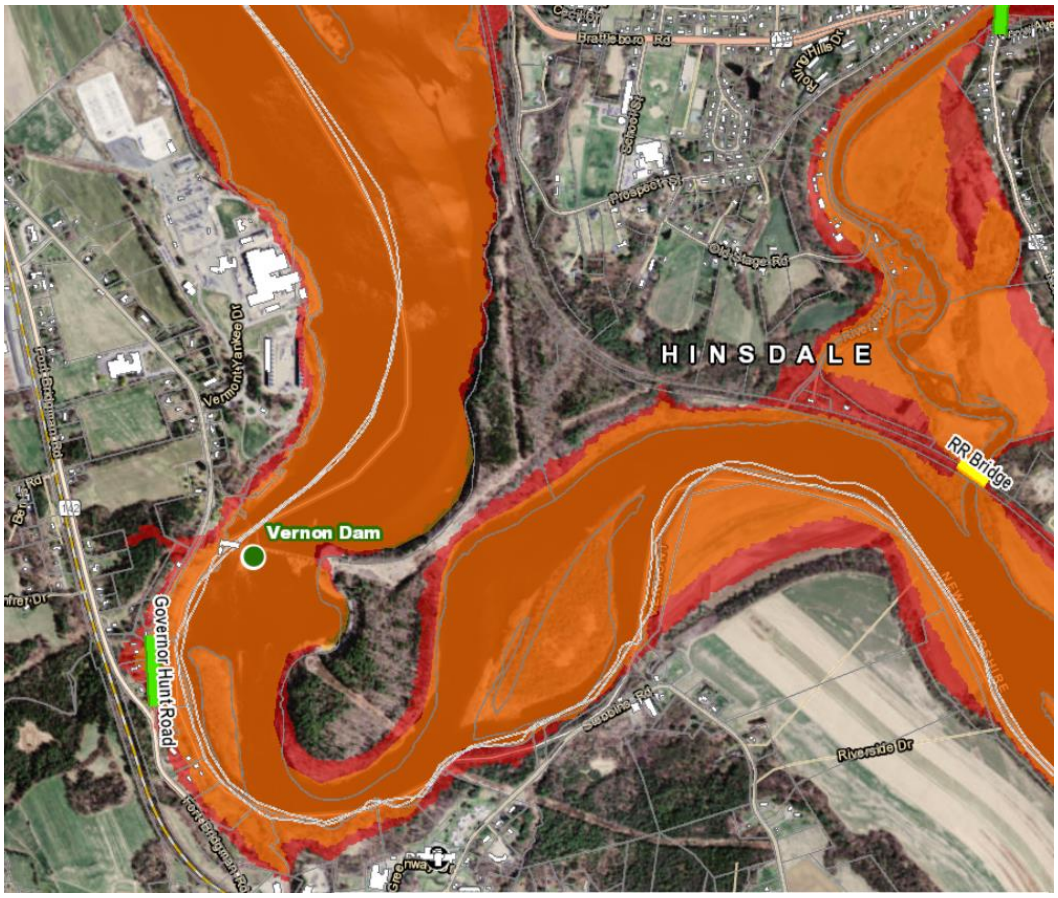
[29] More and detailed information about Emergency Action Planning for the Deerfield and Somerset dams can be obtained by contacting Great River Hydro LLC or Matt Cole at mcole@greatriverhydro.com.



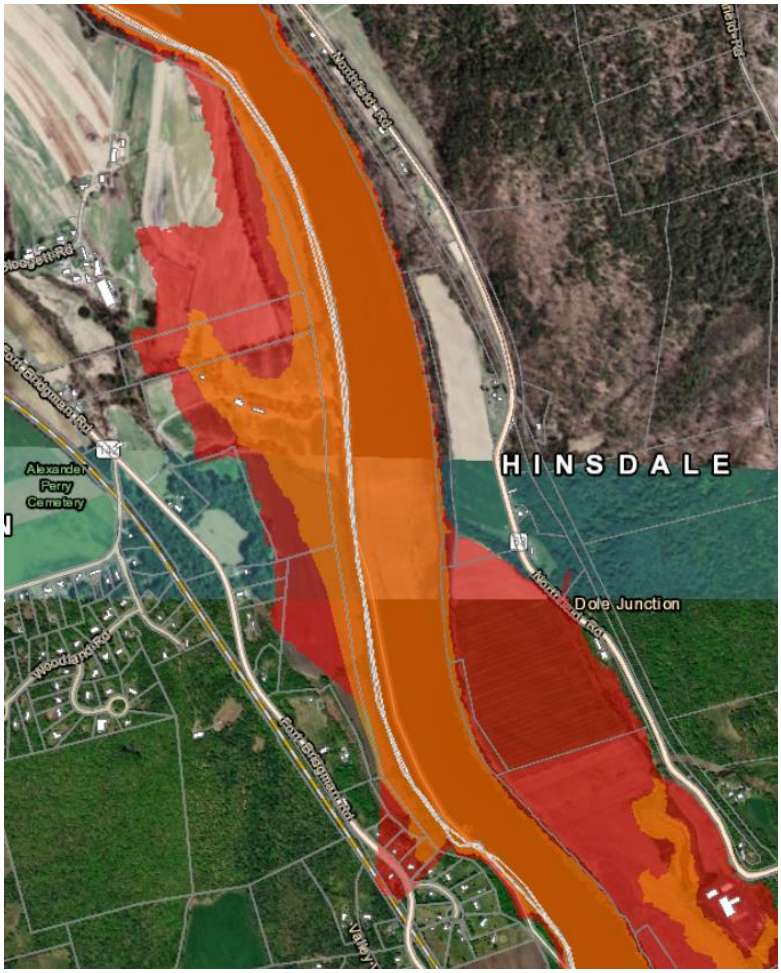
Sunny day scenario is shown orange and PMF scenario is in red.



Northern Vernon



Central Vernon, including Vernon Dam



Southern Vernon

Train Derailment

Train derailment is a concern for the Town of Vernon mitigation plan participants, and they chose to add it the hazards addressed by this Plan. Train tracks run north to south through Vernon, along the same area as Route 142. There is a small Google map on the next page that highlights the rail line. This rail line carries both Amtrak passenger cars and freight rail traffic. There is an Amtrak station in Brattleboro. A number of parcels in Vernon have access to the New England Central Railroad tracks. For example, Cersosimo Industries has an extensive siding at the location of its quarry and chip plant. With the many at-grade crossings, there is a need to consider installing or improving existing railroad crossing signage, particularly on the numerous private road crossings. The limited supply of developed rail siding facilities suggests a continued great dependence upon the highway network for freight transport[30]. The Town is not informed of what type of freight is on the tracks, or will be coming through Town, at any time.

[30] Vernon Town Plan, 2014.

The concerns that the Town has come from several reasons:

(1) There is limited egress from the Town that isn't near the tracks. The main road, Route 142 lies close to the tracks through the Town.

(2) The tracks are close to Vernon Elementary School, so a train derailment could put the school at risk.

(3) There are four un-barricaded train crossings in Vernon. This presents a risk of a train colliding with a vehicle.

The probability of a train derailment is impossible to determine, other than to know it is possible. The Town has noticed that there are more trains on the tracks and the trains are travelling at higher rates of speed, both factors which raise the probability of an event. The planning participants felt out of control with this hazard and unable to mitigate for an event because they have no control over the railroad companies who make the decisions, and felt they have little influence in any matters related to the railroad.

In terms of raising awareness of a train derailment or other hazard, the idea of a siren alert system was raised. There is still a siren system in place from Vermont Yankee. Due to the high maintenance cost of keeping the system, however, the Fire Chief, EMD and the Selectboard decided that the system will be taken out of service and not used any longer, though at this time it is still physically in place and probably operable. The plan it to remove the sirens as time permits. The town is using the VTAlert system and the residents can sign up as they desire to be included. The town also has a well-designed route alerting plan which allows for street to street notification. The Fire Department is in a mutual aid system that has a Mass Casualty Incident (MCI) plan, for any type of hazard event including train derailments.

ASSESSING VULNERABILITY

Structures in the SFHA

There are approximately 49 buildings within FEMA-designated Special Flood Hazard Areas (SFHAs).[31] There are 9 structures that lie in the River Corridor. Some of these structures may lie in both SFHA and River Corridor. The maps on the following pages show structures that are located in the SFHA or the River Corridor. Affected structures are clustered on Broad Brook Road in the north, as well as three along Town Brook on Pond Road and Fort Bridgman Road

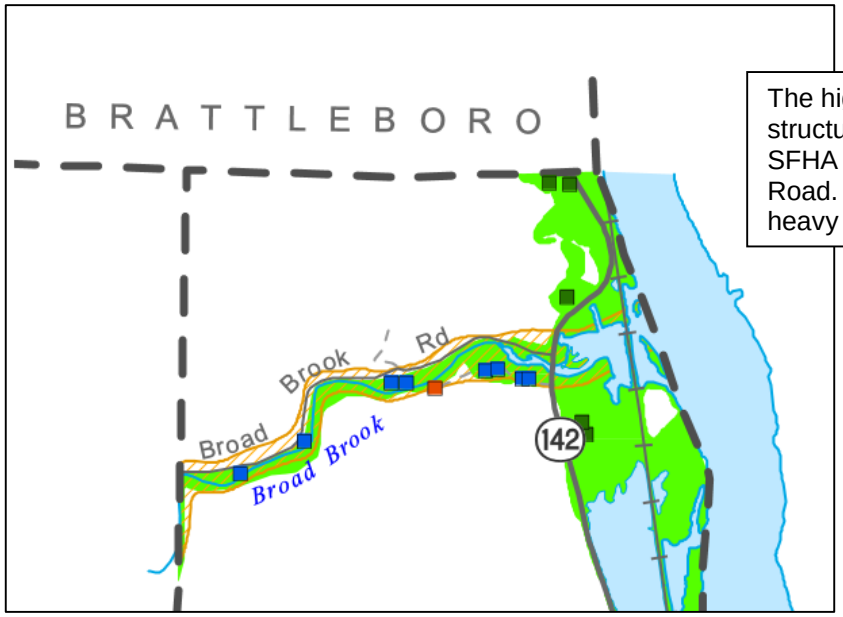
[31] 2018 Flood Hazard Summary Sheet for Whitingham

near the Connecticut in the central eastern portion of Vernon, and several on Newton Brook in the south. Outside of this, there are no structures in Vernon that are in either the River Corridor or the Floodplain. Vulnerabilities outside of these structures, to flooding, are primarily roads and other associated infrastructure.

Overall, there isn't a lot of development in the floodplain or the river corridor, and it is concentrated where it exists. The Vernon Dam significantly limits the flooding hazard of the Connecticut River. The Broad Brook area is the most vulnerable area to flood damages in Vernon.

There is a switchyard on Governor Hunt Road that is in the FEMA SFHA. Carroll Concrete, on Fort Bridgman Road, is also in the FEMA SFHA. These are the only two Tier II reporters located in the SFHA.

Properties within SFHAs, that have a mortgage, are required to purchase flood insurance. Vernon'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 Vernon's floodplain regulations.

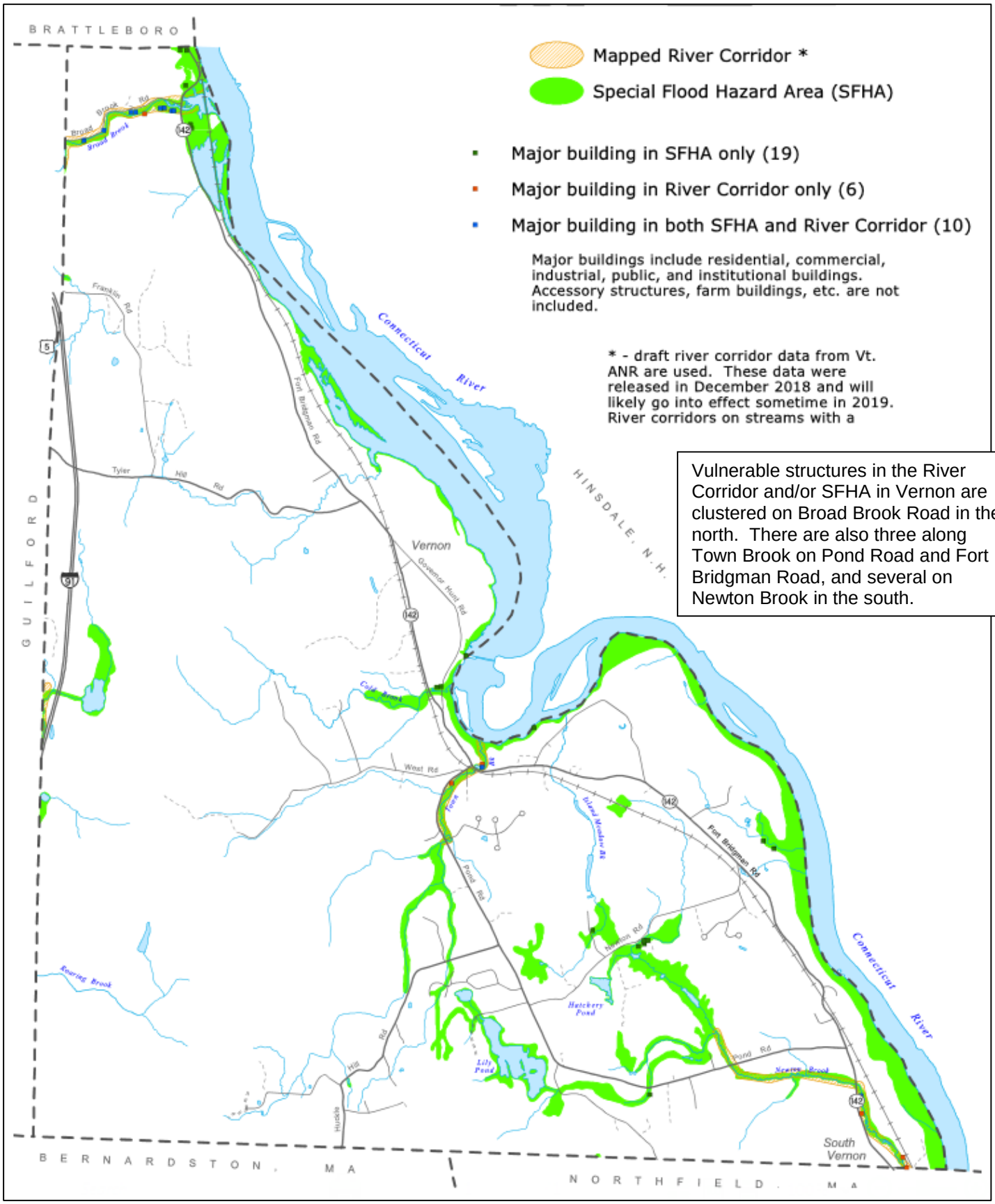


The highest concentration of structures in the River Corridor and/or SFHA in Vernon is on Broad Brook Road. This area is a concern during heavy rain or high water events.

Mapped River Corridor *

Special Flood Hazard Area (SFHA)

- Major building in SFHA only (19)
- Major building in River Corridor only (6)
- Major building in both SFHA and River Corridor (10)


BRATTLEBORO
Mapped River Corridor *
Special Flood Hazard Area (SFHA)
Major building in SFHA only (19)
Major building in River Corridor only (6)
Major building in both SFHA and River Corridor (10)
Major buildings include residential, commercial, industrial, public, and institutional buildings. Accessory structures, farm buildings, etc. are not included.
* - draft river corridor data from Vt. ANR are used. These data were released in December 2018 and will likely go into effect sometime in 2019. River corridors on streams with a
Vulnerable structures in the River Corridor and/or SFHA in Vernon are clustered on Broad Brook Road in the north. There are also three along Town Brook on Pond Road and Fort Bridgman Road, and several on Newton Brook in the south.
Connecticut River
HINSDALE, N.H.
GUILFORD
Vernon
South Vernon
BERNARDSTON, MA
NORTHFIELD, MA
Broad Brook
Roaring Brook
Cold Brook
Town Brook
Newton Brook
Hickory Pond
Lily Pond
Island Meadow Rd
Fort Bridgman Rd
Governor Hunt Rd
West Rd
Pond Rd
Newton Rd
Tyler Hill Rd
Franklin Rd
Huckle Hill Rd

Repetitive Loss Structures

According to FloodReady.Vermont.gov, Vernon has no repetitive loss claims.[32] 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.[33] 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.

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[32] Report listing repetitive losses is available here: <https://floodready.vermont.gov/sites/floodready/files/documents/cisrpt_RL%206.26.18.PDF>

[33] https://www.fema.gov/national-flood-insurance-program/definitions

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. Vernon joined the NFIP on September 27, 1991 and is a member in good standing (CID 500137). The latest floodplain ordinance was adopted on October 13, 2010 and is as stand-alone ordinance. The latest Flood Insurance Rate Maps (FIRMs) and Flood 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 Vernon[34]. These policies have a total value of $1,423,100. There have been two (2) NFIP claims filed in Vernon since they joined the NFIP, with a total of $1,089 paid out.[35] Vernon may want to do public outreach to encourage the purchase of flood insurance for people in the River Corridor and the FEMA 500-year floodplain (Zone X on the FIRMs). Flood insurance is reasonably priced in these areas, and covers damage from fluvial erosion, as well as inundation flooding. Nearly 20% of flood insurance claims nationally are for flood damage to buildings located outside the SFHA.

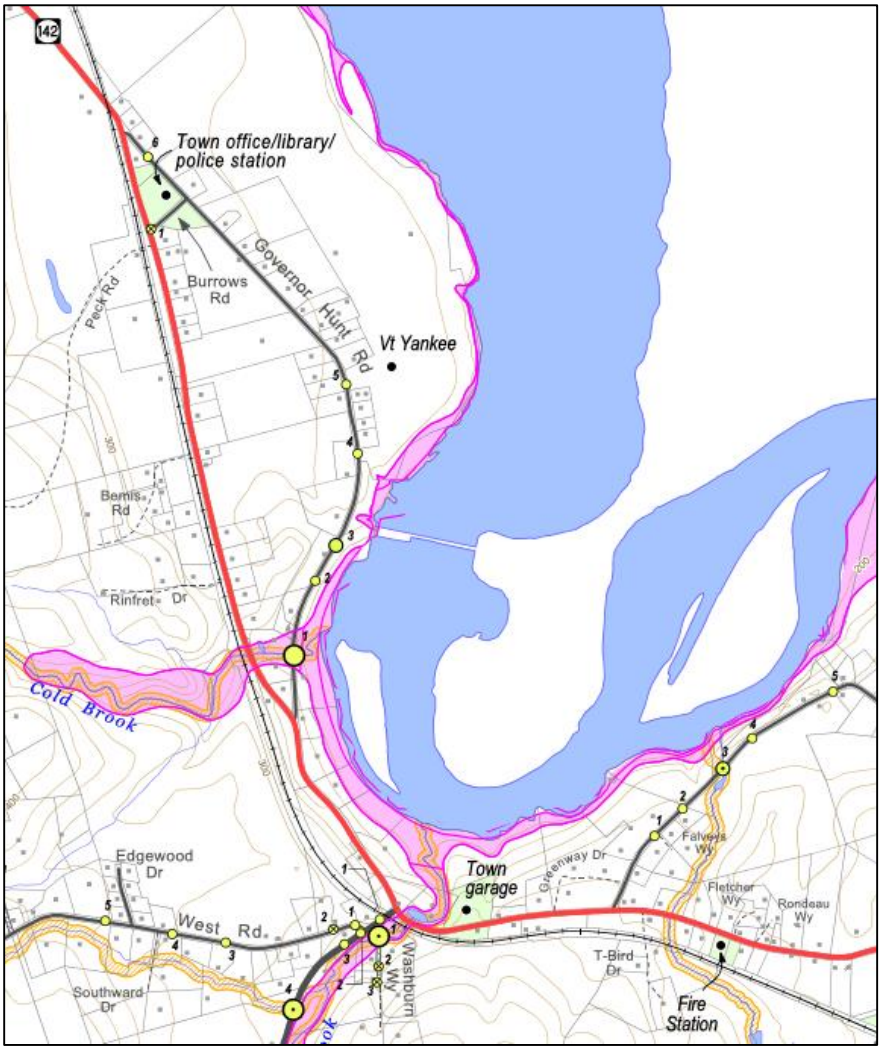
The Town Floodplain Administrator is seeking training and is working with the planning commission, regional and state partners to ensure compliance for the town's participation in the NFIP. An educational campaign to inform and remind residents about the requirements of the program is being done. The 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.

[34] FloodReady Expanded Community Report for Vernon, accessed February 4, 2019. https://anrweb.vt.gov/DEC/FoFReports/SSRSReportViewer.aspx?RepName=ExpandedCommunityReport&Municipality=Vernon

[35] FEMA NFIP Insurance Report, June 2018, accessed January 22, 2019. https://floodready.vermont.gov/sites/floodready/files/documents/cisrpt_NFIP%206.26.18.PDF

Vulnerable Community Assets in Vernon

Vernon is resilient in terms of the fact that they do not have community assets located in flood hazard areas.



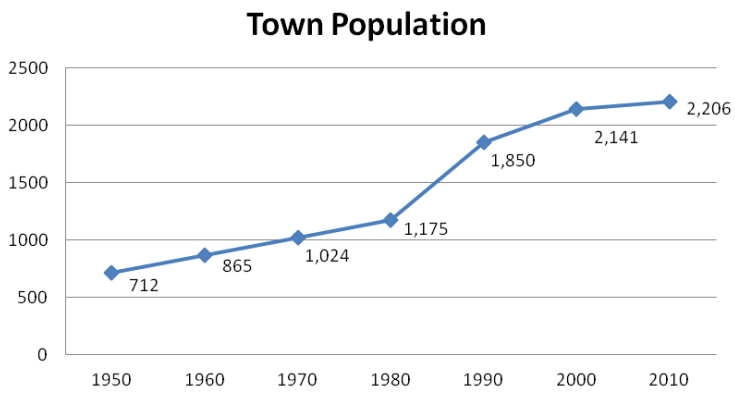
Vital community facilities in Vernon include:

- Town Office/library (one building)
- Town Garage
- Vernon Elementary School
- Vernon Memorial Fire Station
- Vermont Yankee (former nuclear power station that currently stores spent nuclear fuel in casks on-site)

Development Trends

Vernon is a growing town in the region. The Friends of Vernon Center Inc. have identified a

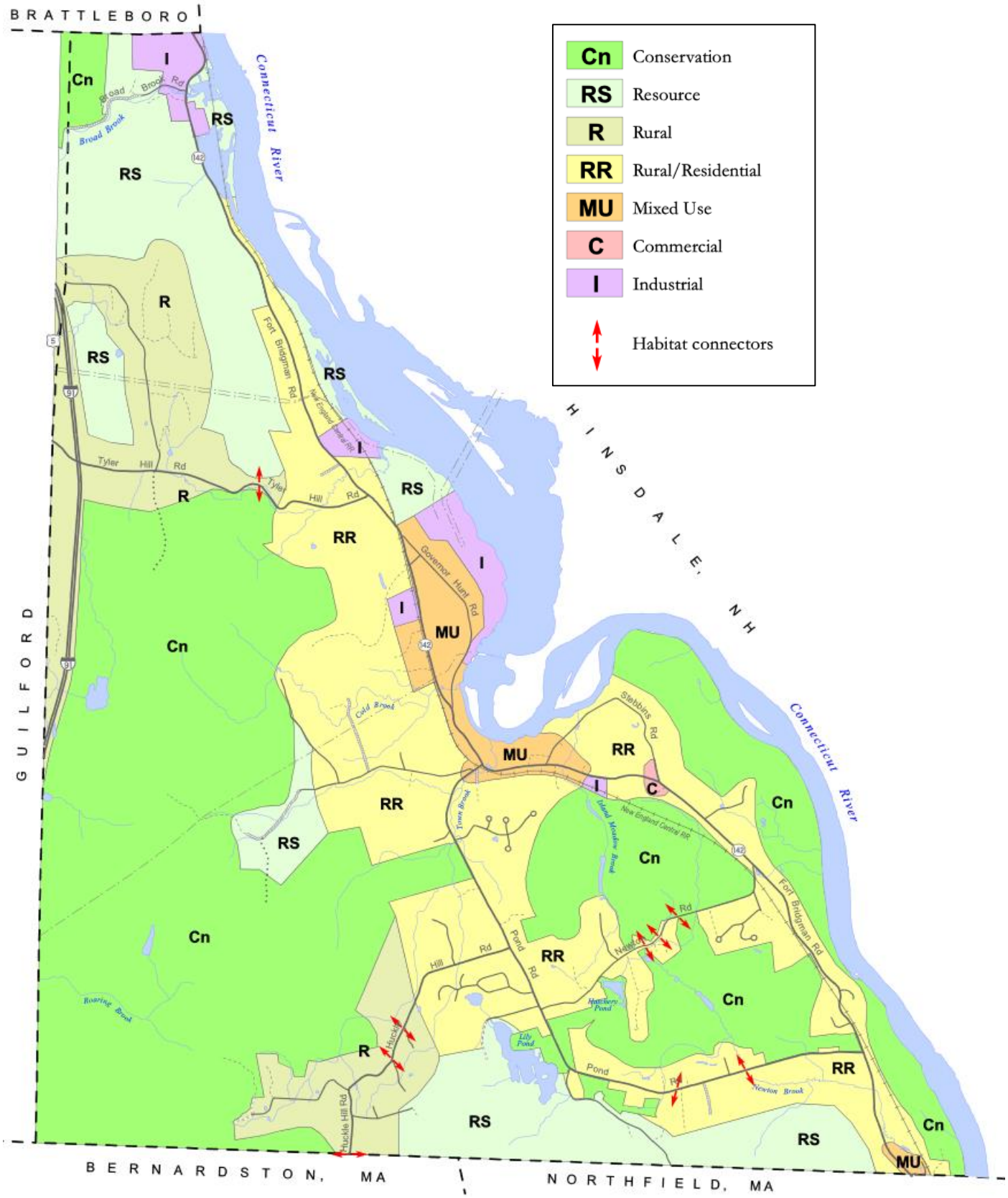
town center and are working with the Planning Commission and Selectboard to plan this area. Identifying the village center will prevent sprawl, which the town is seeking to avoid. Single family home demand is ongoing in Vernon. The housing market is active. Younger families with children are moving into town. The closing of Vermont Yankee was the biggest events in the towns industry, to go along with the building of the train tracks, the building of the dam, and the opening of Vermont Yankee.



The biggest development shift in recent years in Vernon is the closure of Vermont Yankee. Vernon is pleased that North Star, who now owns the site, is planning for redevelopment of the former Vermont Yankee site. That site will be redeveloped for industrial use. The future plans for the storage of the spent fuel that remains on-site are not yet set. Part of the equation is being debated at the top levels of government in the US, as there is no defined long term storage solution. Storage of spent nuclear fuel will need to be stable for hundreds or even thousands of years, and the site for that permanent storage is what's being debated now. There are 58 casks of spent nuclear fuel, that are manned at all times, that remain indefinitely on the Vermont Yankee site. The Town remains vigilant in ensuring that the nuclear fuel storage remains safe. Long term data on storing nuclear fuel is not available.

Vernon is not just about Vermont Yankee, though. The Town has a strong agricultural base and a larger amount of farmland than most other towns in the region. Protecting that farmland has been done successfully locally through purchase of development rights on agricultural land. There is a big demand to put solar on agricultural land which is a relatively new trend the town is experiencing. The Town wishes to concentrate future industrial development on the Vermont Yankee site. The Town would like to remain in the energy realm for the Yankee site and preserve existing agricultural land elsewhere.

Proposed Land Use Map from 2018 Vernon 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.
- Encourage hazard mitigation planning to be incorporated into other community planning projects, such as the Town Plan, Capital Improvement Plan, and Town Local Emergency Operations Plan.
- Ensure that members of the general public continue to be part of the hazard mitigation planning process.

Town Plan (2018) Policies and Recommendations that Support Mitigation

The following recommendations and policies are contained in the 2018 Vernon Town Plan and pertain to mitigation in Vernon.

Wetlands and Connecticut River Policies:

> **Policy 8.10:** Protect the limited number of wetlands in Vernon from development and avoid draining for development purposes unless the long-term public benefit of so doing heavily outweighs the loss of resource value.
>
> **Policy 8.12:** Promote Connecticut River recreation and environmental education activities for Vernon Elementary School students.
>
> **Policy 8.15:** Designate a 500' riparian area along the Connecticut River to protect wildlife habitat, flood hazard areas, and agricultural soils.
>
> **Policy 8.16:** Require the owners of the Connecticut River hydroelectric dams to manage water levels in a manner that minimizes erosion of the river banks, particularly in areas with prime agricultural soils.

Fragile Areas Policies:

> **Policy 8.23:** The Town will protect and maintain Vernon's Black Gum Swamps by preventing sudden environmental changes around the swamps and by limiting vehicle access to these natural areas.

Policy 8.24: The Town will encourage sound forest management practices on the J. Maynard Miller Town forestland which surrounds the Black Gum Swamp and shall prohibit any tree cutting within a 300-foot radius of the swamps.

Policy 8.25: It is the policy of the Town to foster the protection and restoration of river corridors, floodplains, wetlands, and upland forested areas that attenuate and moderate flooding and fluvial erosion.

Recommended Action:

1. The Town will be familiar with up-to-date ANR river corridor maps that delineate the land area adjacent to streams and rivers that are required to accommodate a stable channel.

Policy 8.26: It is the policy of the Town to protect floodplains, river corridors, land adjacent to streams, wetlands, and upland forests through adoption and administration of flood hazard area regulations governing development in designated Special Flood Hazard Areas and River Corridors, in order to reduce the risk of flood damage to infrastructure, improved property, people, and the environment.

Recommended Action:

1. The Town will be familiar with Flood Insurance Rate Maps (FIRMs) that delineate areas that could be covered or inundated by water during flooding.

Policy 8.27: New development in identified flood hazard, fluvial erosion, and river corridor protection areas should be avoided. If new development is to be built in such areas, it should not exacerbate flooding and fluvial erosion.

Recommended Action:

1. The Town will regulate any new development in identified flood hazard areas, fluvial erosion hazard areas, and/or river corridors to ensure that development does not exacerbate flooding and fluvial erosion, and extend these provisions to development activities that might increase the amount and/or rate of runoff and soil erosion from upland areas.

Policy 8.28: The protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion should be encouraged.

Recommended Action:

1. The Town will update the Flood Hazard Area Regulations to include regulation of river corridors, and include provisions for advance notification of and specific limits on new development activities in identified flood hazard areas, fluvial erosion areas, River Corridors and/or upland forested areas based on regulatory templates developed by the ANR Department of Environmental Conservation Rivers Program.

Policy 8.29: Flood emergency preparedness and response planning are encouraged.

Recommended Action:

1. The Town will pursue a flood resilience management approach whose essential components are to identify and map flood hazard areas, fluvial erosion hazard areas, and river corridor protection areas based on stream geomorphic assessment studies and maps provided by the Vermont ANR Rivers Program, and designate those areas for protection to reduce the risk of flood damage to infrastructure and private property.

Ongoing Emergency Planning and Mitigation Efforts in Vernon

1. Vernon Seniors is an informal group that serves as a senior center that provides trips and activities. This type of group ensures that vulnerable residents remain connected to the community, and looked after in times of need.

2. The Fire Department maintains a vulnerable populations list and contacts to home health agencies so that check-in's are a part of the Town's emergency response protocols.

3. Vernon maintains an elderly assistance board that provides services such as plowing, shoveling and other services to elderly residents.

4. 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.

5. The Town manages a 24-hour operational local emergency operations center (EOC) during disasters, with bunks and kitchen for staff members to stay. That will be maintained when the EOC moves locations.

6. EOC staffers are Vernon resident volunteers that have been trained. They received this training because Vermont Yankee funded it. Today the group remains active and is managed by the Emergency Management Director.

7. The EMD meets monthly with the Vernon Elementary School to talk and provide training for school staff about anything from lock downs, to active shooter, to fire alarms, to what to take out of the school with them during an event.

8. The Vernon Elementary School maintains an effective emergency plan that they train with monthly. The EMD watches these drills and gives feedback to school staff. Students are also trained on how to react. The EMD has assessed the school building and changes were made to make the structure more resilient to emergencies.

9. The town owns a lot of emergency equipment that they acquired through Vermont Yankee's support.

10. The town maintains one emergency shelter at the Vernon Elementary School. It is a Red Cross designated shelter and could be operated by the Red Cross as an overnight shelter, as it has a generator. For a smaller event, the shelter would be at the Emergency Operations Center.

11. Vernon 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 Vernon 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.

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. Actions relating to future development were considered, but the plan participants did not find them to be feasible at this time due to lack of political will/community support.

- 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, Vernon 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	ISSUE AND ACTION	RESPONSIBLE PARTY	TIME-FRAME	FUNDING SOURCE	MITIGATION OR PREPAREDNESS	COST / BENEFIT	PRIORITY	STATUS
All Hazards	Relocation of the EOC to the Town Office and installation of a generator to serve the facility. The current EOC is required to relocate with the decommissioning of Vermont Yankee. (see detail following table)	Contractors/ Town Staff/ Road Crew	Beginning now and dependent on funding, hope to be completed by 2022	Town funds and potentially grant funds, if available	Preparedness and Mitigation	$80,000 Medium / High	High	Obtaining bids currently for installation of generator. The space exists at the current Town Office, but the building will require some retrofit and a generator will need to be installed.
All Hazards	Emergency shelter (currently Vernon Elementary School) needs a new generator.	School Administrator with Town support	Beginning now and dependent on funding	Town funds and potentially grant funds, if available	Preparedness	High / High	Medium	Future goal of the Town is to have the facility designated as a Red Cross Shelter.
Fluvial Erosion / Inundation Flooding	Tyler Hill Road box culvert upgrade from undersized 4' round metal culvert to a 5' x 8' box culvert. This is a spot that frequently floods and this bank-full width upgrade will allow flood waters to pass freely.	Contractors with Road Commissioner oversight	2023 start, this will take approximately 1 week to complete	VTrans Structures Grant with town match or FEMA HMGP	Mitigation	$400,000 High / Medium	Medium	The hydraulic study has been done for this project. The engineering and negotiations with landowners will begin 2022 summer and will take a year.
Fluvial Erosion / Inundation Flooding	Sak Road culvert upgrade to box culvert - this is a spot that frequently floods and this project will stop that problem.	Contractors with Road Commissioner oversight	2028 start unless it washes out before	Vtrans grant with town match or FEMA HMGP	Mitigation	nearly $300,000 High / Medium	Medium	engineering and dealing with landowners will take a year. The engineering will begin 2027 summer.
Fluvial Erosion / Inundation Flooding	Stone line ditches that they are required to do per Act 64. Also both Huckle Hill and Tyler Hill ditches need debris removed and cleaned out.	Road Crew	ongoing	Town budget	Preparedness and Mitigation	$100,000 /year – High / Medium	Medium	This work has been done on some roads and continues. This is per state requirements.

HAZARD	ISSUE AND ACTION	RESPONSIBLE PARTY	TIME-FRAME	FUNDING SOURCE	MITIGATION OR PREPAREDNESS	COST / BENEFIT	PRIORITY	STATUS
Fluvial Erosion / Inundation Flooding	Removal of berm on Sak Road. This will keep flood waters from going along the road and will allow an appropriate floodplain area to flood instead.	Road Crew	Finish during building season in 2020	Town budget	Mitigation	$30,000 Medium / Medium	Medium	Plans are in place to complete by 2020. Vernon has been working on other road sections in order to meet the state requirement of 15% completion by 2020.
Fluvial Erosion / Inundation Flooding	Maintaining town representation on the CT River Joint Commission (see detail following table)	CRJC Commissioner for Vernon	ongoing	volunteer	Mitigation	Low / High	Medium	Andy White is the town representative.
Fluvial Erosion / Inundation Flooding	Update the flood hazard bylaw to include river corridors. This process will include training for the newly appointed Floodplain Administrator. A strong understanding of structures built before floodplain regulations were enacted is one training goal.	Town Floodplain Administrator	Complete during the 2019-2020 Fiscal year	MPG In-Kind	Mitigation	Low / High	High	This will be done through the Vernon Selectboard with input from the Planning Commission, in partnership with Vermont ANR or the Windham Regional Commission.
Fluvial Erosion / Inundation Flooding	Increase soil and bank stabilization along Broad Brook to protect the Road which serves 7 homes. Past flooding events have taken out the edge of the Brook – causing erosion under the road. The embankment needs rip rapping to prevent the road from washing out.	Road Crew with Vtrans permission	2022, done within 2 months	CT River Cons. grant?	Mitigation	$30,000 Low / High	Medium	There has been bank stabilization done after TS Irene. The desire would be to increase stabilization in this area.

HAZARD	ISSUE AND ACTION	RESPONSIBLE PARTY	TIME-FRAME	FUNDING SOURCE	MITIGATION OR PREPAREDNESS	COST / BENEFIT	PRIORITY	STATUS
Invasive Species	Signage to prevent firewood transport placed along Route 142 at the State line and on Huckle Hill Road, and on 142 at the north entrance to Vernon.	Town Administrator working with Vtrans to get the sign placed	signs placed by 2021	Vtrans	Prevention and Mitigation	Low / Medium	Medium	Town will petition VTrans to get the sign placed.
Invasive Species	Host a first detector training to train volunteers to detect invasive species.	Windham County Forester working with Town Administrator	Complete within Summer 2020	Volunteer or grant funds	Mitigation	Low / Medium	Medium	The Town Manager and the Town Forest Supervisor will be a part of this.
Invasive Species	Put kiosk at the Town Forest to display invasive species educational materials.	Town Forest Supervisor	Complete within Summer 2020	Town budget / grant funds	Prevention and Mitigation	Low ($5,000) / Medium	Medium	The Town Manager will be working to seek grant funds soon.
Invasive Species	Town to hold a workshop to inform private landowners about grant programs available to assist with controlling invasives.	Planning Commission Chair with NRCS	Complete within Summer 2020	Volunteer time and NRCS grant	Prevention and Mitigation	Low ($300) / Medium	Medium	Current Planning Commission Chair has personal experience working with NRCS on getting a grant for this purpose.
Invasive Species	Survey Town Forest to identify invasives and where they are present work to eradicate them.	Planning Commission Chair with Volunteer forester.	Complete within Summer 2020	Volunteer/ Forestry Dept.	Mitigation	$5,000 or in-kind Low / Medium	Medium	Planning Commission Chair will find a volunteer forester to assist with this.
Invasive Species	Work with Four Winds to arrange an educational program for the elementary school around invasive species. Have a forester come and present and work with the kids.	Four Winds program director, school principal, and Selectboard Chair	School year 2020-2021	School budget	Mitigation	Low ($300) / Medium	Low	Town Manager will be speaking to the Four Winds Director about holding this program.

Detail on Specific Actions

1. Relocation of the local Emergency Operations Center (EOC) to the Town Office:
It is important to be prepared for the worst case scenario and have operational capabilities in a sustainable location during an emergency. With Vernon having the presence of the TransCanada switchyard and the long term storage of radioactive waste within their bounds, they are arguably at increased risk for certain hazards and impacts. The current EOC is in a building that is owned and supported by the owners of the Vermont Yankee site. That support will cease when the plant is decommissioned. The best long term location for the EOC is at the Town Office because it has the infrastructure to support the EOC with the lowest cost. In the event of an incident at the switchyard or the nuclear waste storage facility, the presence of an operational EOC is imperative.

2. The Town has a representative on the Connecticut River Joint Commission. They are active and concerned about the environmental impacts that the dams are having on the river, including erosion issues on the river banks. They are looking at ways to slow down or stop the erosion, though both changes to the dam operations and infrastructure.

Other Mitigation Activities Under Consideration

1) Town is considering the development of a COOP & COG.

2) Purchase of generators for the Huckle Hill Senior Housing complex and the Vernon Green Senior Housing complex.

3) Creation of a webpage on emergency preparedness to add to the town's website.

4) Incident Command System training for Selectboard.

5) Educational programs in schools on emergency preparedness.

Implementation of Mitigation Actions / Capabilities

Barriers to Implementation:

1. Limited staff at town level
2. Dwindling tax base
3. Lack of local zoning and permitting requirements.
4. Not a lot of industry or second home owners that add to the tax base.
5. Vernon does not currently regulate development in the River Corridor, which limits control of this hazardous area.
6. New state regulations for storm water have exponentially increased the cost of upsizing culverts.

Capabilities to build upon for implementation:

1. Town budget is in a good position. There is taxpayer support for safety and mitigation initiatives.
2. There is a budget for emergency operations costs, including stipends for the Emergency staff (EMD), Fire Chief and Assistant Fire Chief.
3. There is a nine-member volunteer emergency management committee.
4. The population is close knit and looks out for each other. There is a neighborhood watch group on Facebook. Elderly Services looks out for vulnerable populations that they serve.
5. Active Selectboard
6. Active Planning Commission
7. Three full-time town employee positions and three part-time town employees
8. Three full-time Road Crew employees
9. Well-functioning EOC
10. Dedicated EMD to carry out emergency planning projects for the Town
11. Windham Regional Commission assistance when needed
12. Floodplain ordinance in place. Town could update floodplain ordinance to include River Corridors and/or more restrictive standards.
13. Residents are generally the hearty and self-sufficient type.

Recognizing that there is no place that doesn't have barriers to overcome in project implementation, Vernon should continue to focus on engaging around emergency management at the town level. Vernon is not struggling financially, though they are finding their way after the shutdown of Vermont Yankee. They are located near the major travel corridor of I-91 and have a railway running through their Town, giving them good linkages to outside resources. However, an event affecting Route 142 means that one part of the town could be entirely separated from the other with no easy shortcut around. They have limited vulnerability compared to all other towns in the region, though they have unique vulnerabilities that stem from having the railway, the dam and the spent nuclear waste within their boundaries.

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, Vernon is fully 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 Vernon. The Hazard Mitigation Planning participants analyzed these programs for their effectiveness and noted improvements needed. Vernon uses all of the tools listed below to help plan for current and future activities with the town. For example: the Local Emergency Management Plan (LEMP) 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 Vernon competed their last culvert inventory in 2018. In the development of this plan, the latest 2018 Town Plan was used.

As Vernon 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. The Local Emergency Management 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. 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.

Vernon updated their Town Plan in 2018, in part to address flood resiliency. The hazard mitigation plan will be considered in the next Town Plan update and incorporated as appropriate. The LEMP is updated yearly and was updated last in 2018. 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 is addressed	Current Town Plan incorporates flood resiliency. Town Plan update was completed by the Planning Commission with assistance from the Windham Regional Commission. Update completed Nov 2018.
Town Local Emergency Management Plan	Municipal procedures for emergency response	Incident Command; Hazard Annexes included	LEMP written by the Town EMD and adopted by Town Select board in 2018; next LEMP should include all of the appendices.

Type of Existing Authority / Policy / Program / Action	Description	Effectiveness/Enforcement/ Hazard that is addressed	Gaps in Existing Protection/Improvements Needed
School Emergency Response Protocol	School procedures for emergency response	School Crisis Plan in place at Vernon Elementary School that is exercised regularly	Town should review the plans with the school administration; plan should continue to 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) dispatch; Vernon and mutual aid support for mutual aid	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. Vernon doesn't have anything formalized, but towns help each other out.
Road Standards	Design and construction standards for roads and drainage systems	Adopted new VTrans Road Standards in 2013.	No gaps identified. Whitingham Road Crew will continue to comply with the most recent Town Road and Bridge standards set by VTrans.
Zoning Regulation	Regulates the division of land, standards for site access and utilities	No zoning in place	Zoning may be considered in the future, but is not in place currently.
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. Town considering updating to include River Corridors. Floodplain Administrator training is recommended.
National Flood Insurance Program (NFIP)	Provides ability for residents to acquire flood insurance	NFIP member since 1991	Further training for Floodplain Administrator recommended
Maintenance Programs	Bridge & Culvert Inventory	Updated in 2018	No gaps identified
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 EMD along with the Town Manager, 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 before Town Meeting Day at a Selectboard meeting along with the review of the town's Local Emergency Management Plan (LEMP). 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 EMD along with the Selectboard Office Administrator in Whitingham with this review, as requested by the Town. Progress on actions will be tracked using a table that WRC will provide to the Town 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 Vernon Selectboard will appoint a team to convene a meeting of the hazard mitigation planning committee. The town's Emergency Management Director will chair the committee, and other members should include local officials such as Selectboard members, Fire Chief, Town Manager, 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 their effect 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 their effect 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.
- Impacts of climate change and how the local environment is changing due to climate impacts

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 Crosswalk* 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 providing 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 Emergency Management Director, 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 VEM and FEMA.

9. The Plan will be reviewed by the VEM 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 VEM 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 Emergency Management Director, 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.

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:
    - Selectboard
    - Planning Commission
    - Public Works
    - School

    - Fire & Rescue
    - Emergency Management/ 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 three bulletin boards, unofficial town website, Facebook, etc.

APPENDIX

1. Adoption Certificate
2. Email sent to adjacent towns for public comment on the draft plan and comments back.
3. Flyer advertising availability of Draft Hazard Mitigation Plan for public comment
4. Email sent 7/22/19 to town staff and Hazard Mitigation Planning Committee for review of the draft
5. Response received from 7/22/19 comment solicitation from town and Hazard Mitigation Planning Committee on the draft plan
6. November 27, 2018 Hazard Mitigation Committee meeting sign-in sheet
7. November 27, 2018 Meeting agenda
8. November 27, 2018 Meeting flyer that was posted around town

Certificate of Adoption
Town of Vernon, VT
Selectboard

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

WHEREAS, the Town of Vernon, VT has worked with the Windham Regional Commission to identify natural hazards, analyze past and potential future damages due to natural disasters, and identify strategies for mitigating future damages; and

WHEREAS, The Town of Vernon, VT Local Hazard Mitigation Plan analyzes natural hazards and assesses risks within the community; and

WHEREAS, the Town of Vernon, VT Local Hazard Mitigation Plan recommends the implementation of action(s) specific to the community to mitigate against damage from natural hazard events; and

WHEREAS, the Town of Vernon, VT authorizes responsible agencies 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 Vernon, VT will follow the Plan Maintenance Process outlined in this plan to assure that the plan stays up to date and compliant; and

NOW, THEREFORE BE IT RESOLVED that the Town of Vernon, VT adopts the *Town of Vernon Local Hazard Mitigation Plan* as well as future revisions and maintenance required by 44 CFR 201.6 and FEMA for a period of five (5) years from the date of this resolution.

Duly adopted this 15th day of October, 2019.
date *month, year*

Selectboard

Josh Unruh, Chair

Sandra Harris, Vice Chair

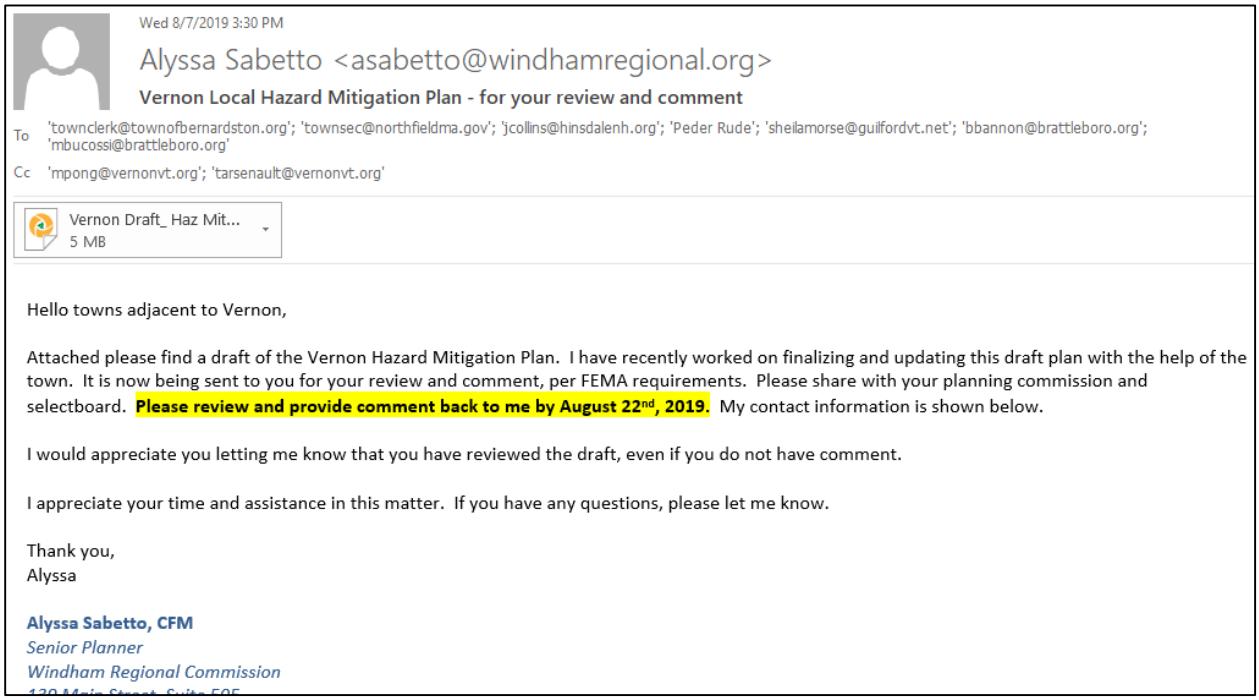
Jeff Dunklee

Chris Parker

ATTEST

Jean Carr, Clerk to Selectboard

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



Wed 8/7/2019 3:30 PM

Alyssa Sabetto <asabetto@windhamregional.org>

Vernon Local Hazard Mitigation Plan - for your review and comment

To 'townclerk@townofbernardston.org'; 'townsec@northfieldma.gov'; 'jcollins@hinsdalenh.org'; 'Peder Rude'; 'sheilamorse@guilfordvt.net'; 'bbannon@brattleboro.org'; 'mbucossi@brattleboro.org'

Cc 'mpong@vernonvt.org'; 'tarsenault@vernonvt.org'

Vernon Draft_ Haz Mit...
5 MB

Hello towns adjacent to Vernon,

Attached please find a draft of the Vernon 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 August 22nd, 2019.** My contact information is shown below.

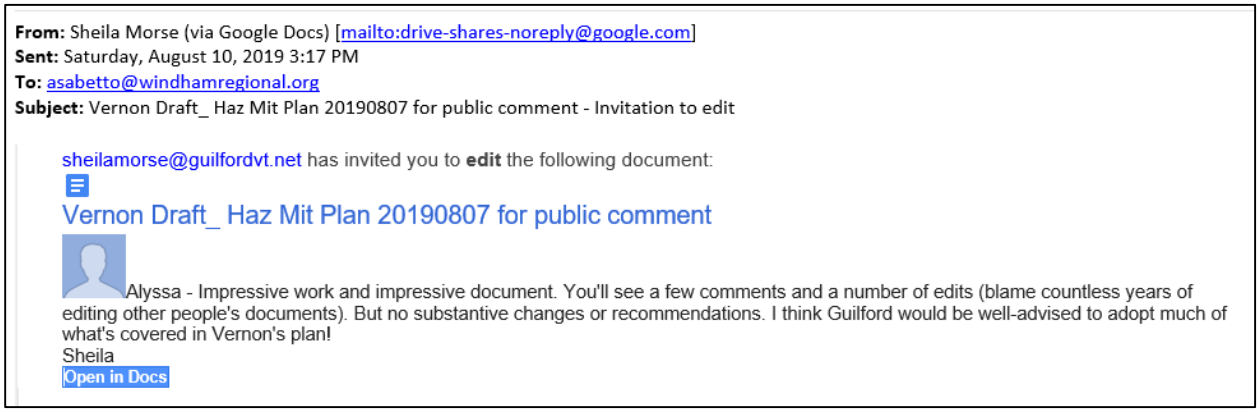
I would appreciate you letting me know that you have reviewed the draft, even if you do not have comment.

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

Thank you,
Alyssa

Alyssa Sabetto, CFM
Senior Planner
Windham Regional Commission

Comment received back from Guilford



From: Sheila Morse (via Google Docs) [mailto:drive-shares-noreply@google.com]
Sent: Saturday, August 10, 2019 3:17 PM
To: asabetto@windhamregional.org
Subject: Vernon Draft_ Haz Mit Plan 20190807 for public comment - Invitation to edit

sheilamorse@guilfordvt.net has invited you to **edit** the following document:

Vernon Draft_ Haz Mit Plan 20190807 for public comment

Alyssa - Impressive work and impressive document. You'll see a few comments and a number of edits (blame countless years of editing other people's documents). But no substantive changes or recommendations. I think Guilford would be well-advised to adopt much of what's covered in Vernon's plan!
Sheila

Open in Docs

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

Vernon Hazard Mitigation Plan

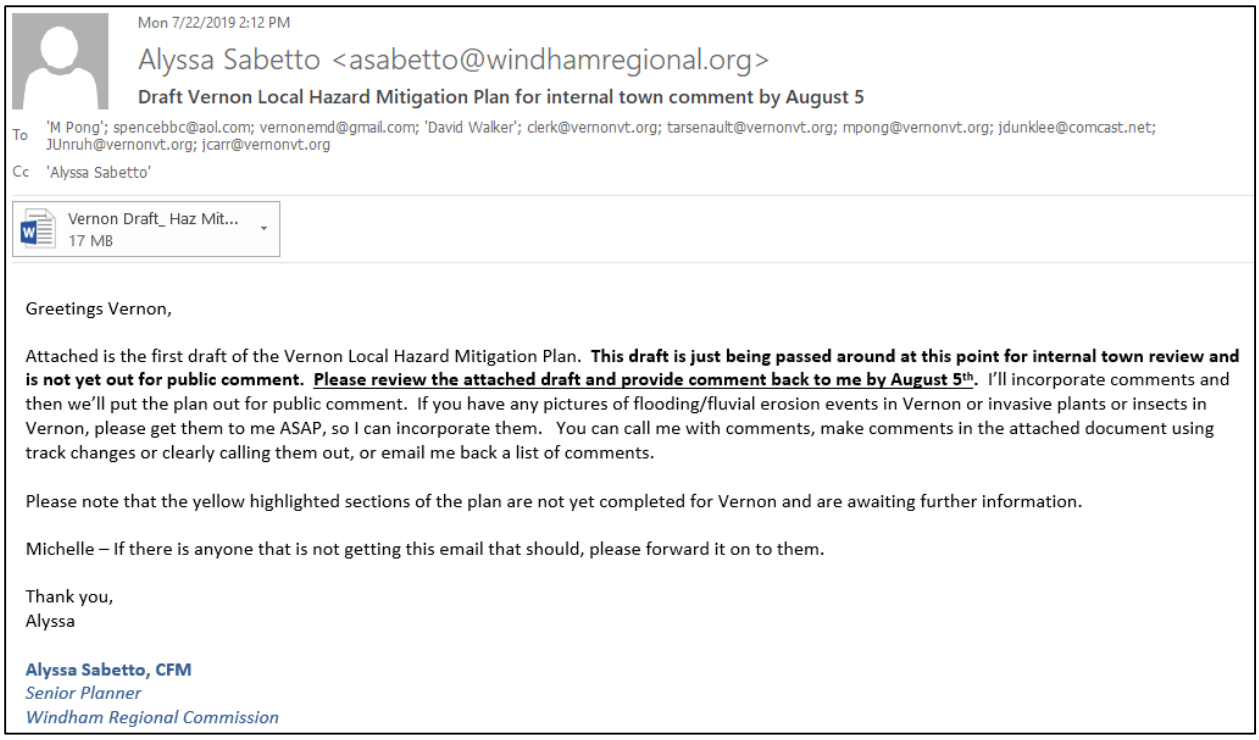
PUBLIC COMMENT PERIOD

The draft Vernon Hazard Mitigation Plan is now available for public review at the Vernon Town Office.

The Plan will be available for comment until the end of the public comment period on August 22, 2019.

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 x113 or email at asabetto@windhamregional.org. We encourage your review and participation!

4. Email sent 7/22/19 to town staff and Hazard Mitigation Planning Committee for review of the draft



Mon 7/22/2019 2:12 PM

Alyssa Sabetto <asabetto@windhamregional.org>

Draft Vernon Local Hazard Mitigation Plan for internal town comment by August 5

To 'M Pong'; spencebbc@aol.com; vernonemd@gmail.com; 'David Walker'; clerk@vernonvt.org; tarsenault@vernonvt.org; mpong@vernonvt.org; jdunklee@comcast.net; JUnruh@vernonvt.org; jcarr@vernonvt.org

Cc 'Alyssa Sabetto'

Vernon Draft_ Haz Mit...
17 MB

Greetings Vernon,

Attached is the first draft of the Vernon 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 5th.** I'll incorporate comments and then we'll put the plan out for public comment. If you have any pictures of flooding/fluvial erosion events in Vernon or invasive plants or insects in Vernon, please get them to me ASAP, so I can incorporate them. You can call me with comments, make comments in the attached document using track changes or clearly calling them out, or email me back a list of comments.

Please note that the yellow highlighted sections of the plan are not yet completed for Vernon and are awaiting further information.

Michelle – If there is anyone that is not getting this email that should, please forward it on to them.

Thank you,
Alyssa

Alyssa Sabetto, CFM
Senior Planner
Windham Regional Commission

5. Response received from 7/22/19 comment solicitation from town and Hazard Mitigation Planning Committee on the draft plan

Mon 8/5/2019 11:01 AM

M Pong <vernonta@vernonvt.org>

Vernon HMG

To Alyssa Sabetto

You replied to this message on 8/5/2019 11:13 AM.

Vernon Draft_ Haz Mit...
17 MB

Hello Alyssa,
Thanks for all the work you have done on this. Attached is some comments, questions in RED CAPITAL LETTERS in the document. These are all the comments that have come through my desk.
Have a wonderful week!
Michelle

Wed 7/24/2019 9:12 AM

Bob Spencer <spencebbc@aol.com>

Re: Draft Vernon Local Hazard Mitigation Plan for internal town comment by August 5

To asabetto@windhamregional.org; vernonta@vernonvt.org; vernonemd@gmail.com; vernonhighway@gmail.com; clerk@vernonvt.org; ta
jdunklee@comcast.net; JUnruh@vernonvt.org; jcarr@vernonvt.org

You replied to this message on 7/24/2019 9:47 AM.

Alyssa:

I looked it over last night and its very comprehensive.
As you pointed out there are a number of references to Whitingham that need to be changed.
If you can prepare an executive summary that would help since its a very large document for most folks to review.
My take-away is that Vernon has relatively low risk, and mitigation can help.
The larger risks of dam failures and train wrecks can't be easily mitigated accept for disaster response.
What about warning systems for such events, such as VY had?
Maybe you could discuss the response to a train wreck in more detail.
Good job and thanks.

Bob Spencer
Environmental Planning Consultant
15 Christine Court
Vernon, Vermont 05354
978-479-1450

Thu 7/25/2019 8:58 AM

VernonVT EMD <vernonemd@gmail.com>

Re: Draft Vernon Local Hazard Mitigation Plan for internal town comment by August 5

To Alyssa Sabetto

Cc Bob Spencer; Michelle L. Pong; David Walker; Tim Arsenault; tarsenault@vernonvt.org; mpong@vernonvt.org; jdunklee@comcast.net; JUnruh@vernonvt.org; jcarr@vernonvt.org

Hello Alyssa,
Due to high maintenance cost the fire chief, the EMD and the Board decided that the siren alert system will be taken out of service and not used any longer, however at this time it is still physically in place and probably operable. The plan it to remove that sirens as time permits. The town is using the Vt Alert system and the residents can sign up as they desire to be included. The town also has a well designed route alerting plan which allows for street to street notification.
The Fire Department is in a Mutual Aid system that has a (MCI) Mass Casualty Incident, plan for any event that includes a train derailment or any other event that may be necessary.

thanks for your hard work on this document
Dave

6. November 27, 2018 Hazard Mitigation Committee meeting sign-in sheet

Vernon, VT Local Hazard Mitigation Plan Development Meeting
November 27, 2018
Location: Vernon Town Office

SIGN IN SHEET

Name and email address	Affiliations – Please list all	Town where you live
DAVID EMERY vernonemd@q.mail.com	EMERGENCY Mgmt.	BRATT.
David Walker Vernonhighway@Gmail.com	Road Commissioner	Vernon
Jeff Dunklee jdunklee@	Select Board Town Planning Comm	Vernon
Michelle Fang ComCast.net Vernontr@VermontVT.org	Town of Vernon, Town Administrator	W. Chesterfield, NH
Josh Unruh junruh@vernonvt.org	Selectboard Chair Assistant EMD	Vernon
Bob Spencer spencebb@aol.com	Planning Commission Chair	Vernon
TIM ARSENAULT clerk@VERNONVT.ORG	Town Clerk WRC REP	VERNON
Jean Carr jcarr@vernonvt.org	Select board Library Director	Vernon

7. November 27, 2018 Meeting agenda

Vernon Hazard Mitigation Plan &
Community Resiliency Meeting
Vernon Town Office – November 27, 2018

Agenda

1. Introduce the Hazard Mitigation Plan

a) Purpose
b) Process

2. Hazards

a) Complete Hazard Ranking Table / Worksheet
b) Discuss past events that should be included in the plan
c) Mark up the town vulnerability/hazard location map as a group

3. Mitigation Actions

a) Review/edit Mitigation Goals
b) Complete Mitigation Actions Table as a group
c) Identify gaps and capabilities with implementation

4. Other Updates

a) Discuss recent mitigation work completed by the town
b) Discuss development trends – new developments, upcoming developments
c) Review of other elements and address questions that weren't discussed

5. Next Steps

8. November 27, 2018 Meeting flyer that was posted around town

Vernon Hazard Mitigation / Resiliency Plan

Public Meeting Announcement

Date: Tuesday, November 27th, 2018

Time: 6:00-8:30 PM

Location: Vernon Town Office, 567 Governor Hunt Road, Vernon, VT 05354

Come help create Vernon'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 x113

WINDHAM REGIONAL COMMISSION