

Local Hazard Mitigation Plan for the Town of Rockingham, Vermont

Including the Incorporated Villages of Bellows Falls & Saxtons River



Laurel Street, Bellows Falls, after July 29, 2021 Rain Event

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INTRODUCTION AND PURPOSE

This Hazard Mitigation Plan is AN UPDATE to a prior Multi-Jurisdictional Plan adopted by the Town of Rockingham and the Villages of Bellows Falls and Saxtons River on March 31, 2015 and approved by the Federal Emergency Management Agency (FEMA) on April 3, 2015.

The purpose of this plan is to assist the Town of Rockingham in identifying all of the hazards facing the town and to identify strategies to begin reducing risks from identified hazards. The Town Selectboard, and its Municipal Manager (shared with Bellows Falls Village) include the following municipal departments: highways, planning and zoning, health officer, town clerk, recreation and economic development. The Bellows Falls Village Corporation and its Board of Trustees and Municipal Manager (shared with the Town) govern fire and police within Bellows Falls village and the Bellows Falls water and wastewater systems. Saxtons River village and its Board of Trustees govern its wastewater system. The volunteer Rockingham Town and Saxtons River Fire Departments receive funding from the Town and Village respectively. For the purposes of emergency management and hazard mitigation planning, the Town and Villages function effectively as one unit. For simplicity sake, the Villages and the Town will be referred to throughout this plan collectively as “the Town of Rockingham” or “Rockingham”, unless referenced individually.

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

Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, averting the hazard by redirecting the impact by means of a structure or land treatment, adapt to the hazard by modifying structures or standards or avoid the hazard by stopping or limiting development, and could include projects such as:

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

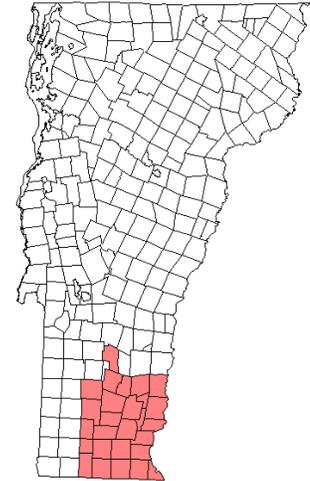
Rockingham’s awareness of the effect of climate change on local hazards has evolved since the previous Local Hazard Mitigation Plan was adopted in 2015. They now recognize that climate change increases the frequency, severity, and variety of hazards affecting their town.

They have made an effort wherever possible to propose mitigation actions which do not in themselves exacerbate climate change. Furthermore, plan participants see opportunity for the

Town to take hazard mitigation actions that actually reduce greenhouse emissions, sequester carbon, and/or stabilize the water cycle. These actions will not only mitigate specific hazards but also contribute toward the reduction or reversal of climate change. Regardless of how small these actions are compared with the global climate crisis, they can be significant as examples of community efforts to address climate change and as models for individual actions.

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.

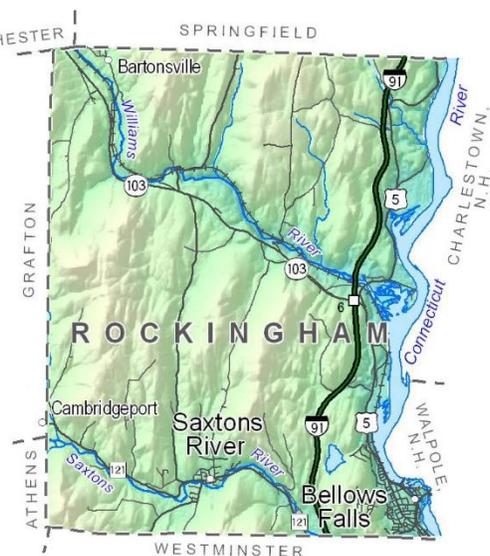


The Region's topography is relatively flat or gently rolling land in the Connecticut River valley in the east, while the western part of the region is characterized by the Green Mountain ridges and peaks with narrow stream valleys. Stratton Mountain is the highest point in the region at 3,936 feet. The 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. In addition, there is the dam at Bellows Falls-North Walpole, N.H. on the Connecticut River.

ROCKINGHAM GEOGRAPHY & TOWN PROFILE

Rockingham is located on the Connecticut River, in the northeastern section of Windham County in southeastern Vermont. It is approximately (41.9) square miles (26,816 acres) in area, and is bordered by the Vermont towns of Springfield and Chester to the north, Grafton and Athens to the west, and Westminster to the south while the Connecticut River forms the eastern boundary of town. The Town of Rockingham encompasses both rural Rockingham and villages of Bellows Falls and Saxtons River and totals 42 square miles in area. The Williams River runs through the town from its northwest corner to the eastern juncture with the Connecticut at Herricks Cove. The Saxtons River runs through the southern portion of the town from the western boundary with Grafton to the town line with Westminster.



Within the Town are the hamlet areas of Cambridgeport in the southwest corner, Bartonville in the northwest corner, and Rockingham village in the center. Three major highways go through the Town including Interstate

91 running south to north, State Rte. 103 running northwesterly to Chester, and U.S. Rte. 5 running south to north. The Town's topography ranges from farm fields along the Connecticut, to the more urban-style development within Bellows Falls Village, to the higher elevations along rural Parker Hill and Rockingham Hill Road. Bridges, both Town-owned and State of Vermont infrastructure, are critical to the Town and its residents. This includes bridges outside of the Town's jurisdiction such as the U.S. Rte. 5 bridge at the south end of Bellows Falls which is actually located in the Town of Westminster. It also includes the critical so-called Arch Bridge (owned by the State of New Hampshire) over the Connecticut River connecting the Town to New Hampshire and points east.

With the exception of Rte. 121 running westerly from Bellows Falls to Cambridgeport and Grafton, and Rte. 103 running northwesterly to Chester, the majority of connecting roads in Rockingham run south to north due to the community's topography. Also, I-91 blocks east-west travel.

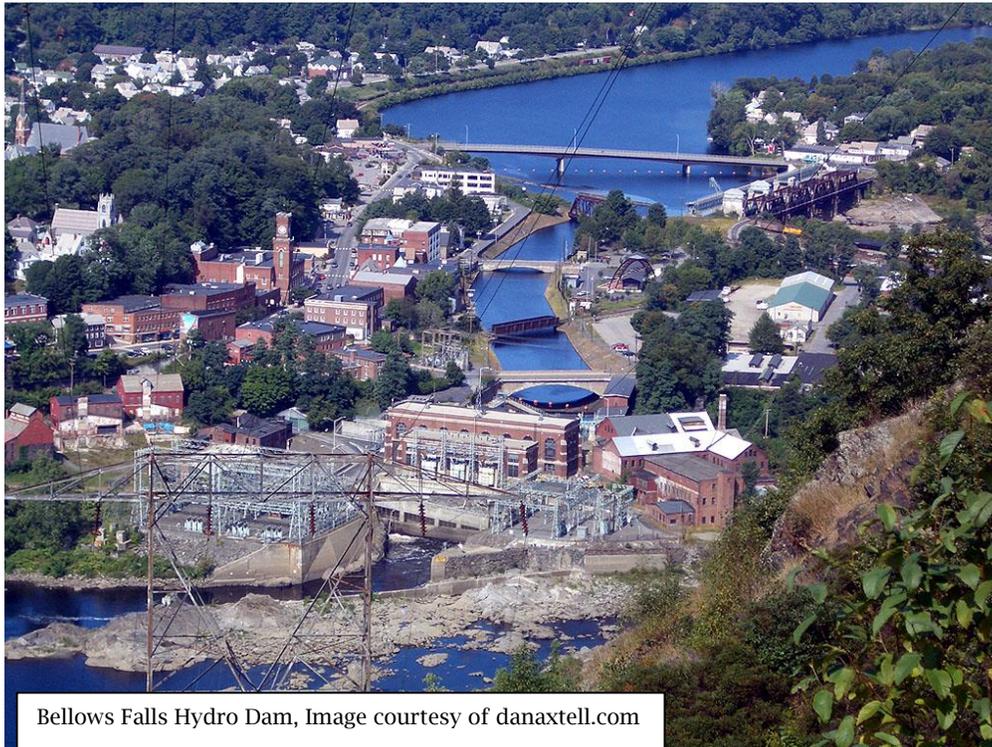
Bellows Falls Village encompasses an area of approximately one square mile with a population of 3,148 or 59.5% of the total population of the Town. It is abutted by the Connecticut River on the east and the Saxtons River on the south. The land rises in terraces to the west from the Connecticut River. A canal which provides water power for the hydro-electric plant divides the central business area from a formerly industrial area. In the past, major flooding of the Connecticut River and blizzards have been the significant hazard events facing the Village. Two railroad lines run through the Village, the New England Central Railroad and Green Mountain Railroad. The latter has recently started operation of the propane off-load facility just north of the Village limits. This and normal freight traffic bring a variety of material through the Village on the rails, including hazardous materials.

Saxtons River Village is the smallest of three municipal entities in the Town and encompasses approximately .53 square miles of area with a population of 565 or 10.6% of the Town. It is located along the Saxtons River approximately five miles upstream from the junction of the Saxtons and Connecticut Rivers. The village is primarily residential with limited commercial activity along Main Street and is the second largest area of population concentration in Rockingham. While the Saxtons River flows through the village, most of the Village is not vulnerable to flooding from it. Vermont Academy, a private school, is located within the village on an upper terrace at the north boundary of the village. Two bridges in Saxtons river (on Main and Westminster Streets) are critical for the village as these connect the village to the main highways to the east and also connects the lower and upper village areas within the village itself.

Smaller residential concentrations occur in the Bartonsville area near the northern town boundary and in Cambridgeport which is five miles west of Saxtons River Village. Bellows Falls and Saxtons River are both incorporated Villages. For simplicity's sake, the Villages and the Town will be referred to throughout this plan collectively as "the Town of Rockingham", "Rockingham" or "Town", unless referenced individually.

The town has two bridge crossings on the Connecticut River and there is a third bridge a few miles south in Westminster. The so-called "Arch Bridge" location has a railroad crossing on the New Hampshire side just west of the bridge crossing. The Vilas Bridge on Bridge Street in Bellows Falls is the most direct access to Walpole, NH, however, it has been closed for construction since 2009. If people needed to exit Bellows Falls quickly and chose east as the direction to evacuate, access to the New Hampshire side of the Connecticut River could be stalled due to train traffic. This would cause a backup in town and the result could be chaotic. This is an issue until the Vilas Bridge is reopened. The reopening is currently scheduled on New Hampshire's DOT 10-year State Transportation Improvement Plan (STIP) for 2029; although, it is not fully funded in their current STIP.

Rockingham is served by Exits 5 & 6 on Interstate 91 which connects to U.S. Route 5 and Route 103. Route 103 is a state highway and is the major east-west roadway through the heart of Rockingham, while Route 121 also provides an east-west travel corridor through the Village of Saxtons River. Interstate 91 is the major north-south travel corridor in the Town. Route 5 is another important north-south travel corridor which runs through the Village of Bellows Falls. Route 5 generally runs along the Connecticut River in a north-south direction. Bellows Falls is a multi-modal hub for transportation in the community providing public transit by Amtrak



Bellows Falls Hydro Dam, Image courtesy of danaxtell.com

commuter train and bus service provided by the MOOver. Bellows Falls is also a “walkable” community with wide streets and well-kept sidewalks allowing for pedestrian walking, jogging, and bicycling.

Great River Hydro is the owner of the Bellows Falls hydroelectric dam on the Connecticut River, among numerous other dams. The dam forms a large impoundment which provides both hydroelectric power and recreational opportunities. The Saxtons River in the

south and the Williams River in the north flow through the town before their confluence with the Connecticut River. The Williams River empties into the Connecticut River at Herricks Cove, and provides both a wildlife and scenic area as well as limited public access to the Connecticut. The Saxtons River empties into the Connecticut just south of the Bellows Falls village limits and public access is limited at this time.

Electric Utility Distribution System

Electric service to approximately 2,918 meters is provided by Green Mountain Power. Outage statistics between 2015 and 2020 are shown below.

	Total Meters that Experienced an Outage	Total Hours Those Meters were Without Power	Total Meters in Town	Avg # of times a customer was without power	Average length of outage (hours)	# Hours the Typical customer was without power
2015	8,144	9,482	2,918	2.79	1.16	3.25
2016	3,685	13,224	2,918	1.26	3.59	4.53
2017	8,228	35,229	2,918	2.82	4.28	12.07

2018	13,243	28,621	2,918	4.54	2.16	9.81
2019	6,338	10,315	2,918	2.17	1.63	3.53
2020	10,245	29,949	2,918	3.51	2.92	10.26
Six Year Average	8,314	21,137	2918	2.85	2.54	7.24

The results above show that 2017 and 2018 were particularly impacted years for power outages, with those years having the most number of outages and the most amount of hours that the average customer was without power. Power outages are of particular concern for vulnerable populations during cold weather months in Vermont.

Existing Authorities

The Town of Rockingham Planning-Zoning Administrator is a Town position appointed by the Selectboard. This position administrates the Town of Rockingham Zoning Bylaw, the Town of Rockingham Subdivision Regulations, and the Town of Rockingham Flood Hazard Area Zoning Bylaw. All three sets of regulations encompass the entire Town, including the Villages of Bellows Falls and Saxtons River. Prior to the Town of Rockingham having any zoning regulations, Bellows Falls Village had adopted its own set of regulations, including its own Interim Flood Plain Bylaw and Bellows Falls Village was accepted into the Flood Insurance Program on June 23, 1975. The Interim Bylaw was extended for one year on July 9, 1979. On January 9, 1984 the Bellows Falls Village Trustees votes to repeal the Bellows Falls Village Flood Hazard Zoning Bylaw adopted on July 9, 1979. And the Rockingham Selectboard adopted the Town-wide Flood Hazard Area Zoning Bylaw on the same date. Saxtons River, like Bellows Falls, is included in this Town-wide bylaw. That Village never has had separate zoning bylaws, including never having separate flood hazard regulations. Currently, the Town adopted Flood Hazard Area Zoning Bylaw remains as the Bylaw for the entire Town, including Bellows Falls and Saxtons River.

Saxtons River Village does not “share” officials or departments with the Town of Rockingham. Saxtons River Village has no hired employees. Saxtons River Village contracts with Bellows Falls Village to have the Bellows Falls Village Wastewater Dept. run the Saxtons River WW plant. The Town Highway Department is a Town department which is under the Town Selectboard. All roads in both Villages are Town Highways, and under the supervision of the Town Selectboard and Town Highway Department. The Planning-Zoning Office answers to the Town Selectboard while administering land use regulations for the entire Town which includes the land uses with the two village areas. The Municipal Manager is hired by the Town Selectboard and Bellows Falls Village Board of Trustees and is responsible to those two boards. He is not responsible to the Saxtons River Village Board of Trustees. Any “town” official is inherently representing the entire geographic area, including town and villages.

PLANNING PROCESS

The development of this update to the Rockingham Local Hazard Mitigation Plan took place over time and with a series of hazard specific meetings held by the local group Sustainable Rockingham. The information collected at those meetings was brought to several meetings held by a core group of plan developers who worked on the Plan update. The update of this Plan was expedited due to Federal Declaration for the July 29, 2021 rain event that caused damage in Rockingham. However, the Sustainable Rockingham meetings had been preplanned for a timeframe that still enabled them to be a part of the development process. Additionally, it is important to note that the Plan update process took place during the Covid-19 pandemic

which required virtual participation methods to be utilized when possible. Over a year into the pandemic, this was something that people were familiar with doing.

Sustainable Rockingham held a series of 17 meetings between August 9 and August 30, 2021, including an introductory meeting, 15 hazard specific meetings, and a wrap up meeting. The meetings were publicized via direct email invitations to members of the Selectboard, Bellows Falls Trustees and Saxtons River Trustees and other individuals that the group thought might be interested in participating. The series and individual meetings were also announced publicly via Front Porch Forum, Facebook, Future of Bellows Falls, Rockingham for Progress, Bellows Falls Area Senior Center, Friends of Bellows Falls, Saxtons River groups and the homepage of the Town's website. The meetings took place in-person, with a wrap up meeting via Zoom.

The following individuals were a part of the Sustainable Rockingham meetings which advised on information to be included in the plan and mitigation action development:

- Laurel Green - Sustainable Rockingham, Conservation Commission, Energy Committee, Rockingham Help and Helpers
- Steve Crofter - Sustainable Rockingham
- Peter Bergstrom - Rockingham Energy Committee, Rockingham Conservation Commission
- Lyn Haas - Sustainable Rockingham, Rockingham Help and Helpers
- Ginger Driscoll - Sustainable Rockingham
- Leslie Goldman - State Representative Windham-3, Rockingham Help and Helpers
- Chuck Wise - Town Planner
- David Bemis - Rockingham Police Chief
- Bernie Hines - Bellows Falls Water Assistant Chief Operator
- Shaun McGinnis - Bellows Falls Fire Chief and Rockingham Emergency Management Director
- Tristan Wandzy - Resident of Bellows Falls
- Bonnie North - Rockingham Selectboard
- Kelley Tully - Rockingham Energy Committee
- Margo Ghia - Resident of Saxtons River and Windham Regional Commission Natural Resources Planner

Following the Sustainable Rockingham meetings, a core Planning Team met on four occasions, September 1, 7, 8 and 15, to update the Plan. The following individuals formed the core Planning Team which advised on the Plan update verbiage and narrowing down mitigation action choices, while also developing the actions to a point they were ready for inclusion in the Plan.

- Scott Pickup - Rockingham Town Manager
- Andy Howarth - Road Supervisor
- Shaun McGinnis - Bellows Falls Fire Chief and Rockingham Emergency Management Director
- Gary Fox - Rockingham Development Director
- Laurel Green - Sustainable Rockingham, Conservation Commission, Energy Committee, Rockingham Help and Helpers
- Steve Crofter - Sustainable Rockingham
- Lyn Haas - Sustainable Rockingham, Rockingham Help and Helpers
- Alyssa Sabetto - Windham Regional Commission, Emergency Planner

Town residents who took part in the planning process for Rockingham tend to be affiliated with multiple roles. In rural Vermont, it is typical that people who are most interested in the safety, health and welfare of their community will serve in several organizations, committees or

boards, and 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 meetings may not have as many in attendance, as in larger communities, those present at the meetings are representing not only a variety of roles, but many roles that would be held by individuals in a more populated town or city.

Rockingham, Bellows Falls, and Saxtons River provide mutual aid when necessary with adjacent communities such as Grafton and Springfield, VT and neighboring New Hampshire towns. The town and the villages have regular communications with their adjacent communities to discuss emergency planning and hazards of concern. During Tropical Storm Irene, for example, Rockingham provided gravel for embankment stabilization to the Town of Grafton and also to the State of Vermont for Route 131 erosion hazard sites. Communications between Rockingham and its adjacent towns, including across the river into New Hampshire, occurs on a continual basis. This is part of the camaraderie that surrounds emergency services in Vermont.

Overall Plan Development Process

The plan was developed through the following process:

August 2021 - Sustainable Rockingham held the following public meetings, which were primarily geared around gathering ideas for mitigation actions. All meetings were offered both in-person at the Town Hall and virtually on Zoom.

- Mon. Aug. 9, 6:30 – 8 PM **Introduction Meeting**
- Mon. Aug. 16, 9 – 10:30 AM Hazard: **Hail**
- Mon. Aug. 16, 10:30 – Noon Hazard: **Wind**
- Mon. Aug. 16, 1 – 2:30 PM Hazard: **Invasive Species**
- Tue. Aug. 17, 9 – 10:30 AM Hazard: **Snow**
- Tue. Aug. 17, 10:30 – Noon Hazard: **Ice**
- Tue. Aug. 17, 1 – 2:30 PM Hazard: **Cold**
- Thurs. Aug. 19, 9 – 10:30 AM Hazard: **Heat**
- Thurs. Aug. 19, 10:30 – Noon Hazard: **Drought**
- Thurs. Aug. 19, 1 – 2:30 PM Hazard: **Wildfire**
- Mon. Aug. 23, 9 – 10:30 AM Hazard: **Landslides**
- Mon. Aug. 23, 10:30 – Noon Hazard: **Earthquakes**
- Mon. Aug. 23, 1 – 2:30PM Hazard: **Fluvial (River) Erosion**
- Tues. Aug. 24, 9 – 10:30 AM Hazard: **Infectious Disease**
- Tues. Aug. 24, 10:30 Noon Extra Time – **Writing Narrative**
- Tues. Aug. 24, 1 – 2:30 PM Hazard: **Inundation Flooding**
- Mon. Aug. 30, 6:30 – 8 PM **Wrap-Up Meeting (aka Progress Report)**

Laurel Green headed up the Sustainable Rockingham effort and shared the information gathered with Alyssa Sabetto of the Windham Regional Commission, which did the technical Plan writing.

Alyssa took the information from the public meetings and arranged a meeting with the above noted core Planning Team. This internal dialogue was necessary to flesh out the 60+ mitigation actions that came from the public meetings. The following meetings were the opportunity for the Town officials to determine what actions they were interested and able to proceed with, as well as provide input on additional actions that were not provided by the public. Alyssa met with the core Planning Team on three occasions, and met once with only the Road Supervisor and the Town Manager, to discuss road actions specific to road infrastructure:

- September 1, 2021 – Core Planning Team meeting

- September 7, 2021 - Core Planning Team meeting
- September 8, 2021 - Meeting with Road Supervisor and Town Manager
- September 15, 2021 - Core Planning Team meeting

Alyssa worked on draft development following these meetings. To meet the Emergency Relief Assistance Fund (ERAF) deadline, a draft Plan was submitted to Vermont Emergency Management on October 28, 2021.

Comments were received back from Vermont Emergency Management on the draft on December 3, 2021. Alyssa worked on revising the draft for internal town review and proceeding with a more normal plan development process with the ERAF goal having been met.

January 10, 2022 - Draft sent to town staff and others directly involved in the plan development process for an internal comment opportunity for a period of two weeks. Comments were directed to be sent to Alyssa at WRC. Comments were received from Steve Crofter, Andy Howarth and Gary Fox. Those comments and corrections were incorporated into the draft.

January 28, 2022-February 11, 2022 - the revised draft was then put out for public comment for a period of two weeks. The draft was posted to the Town's website along with information on how to file comments. Flyers were posted at all the normal town and village posting locations directing the public to review the draft online on the Town's website or the hard copy available at the Town Clerk's office. The flyer, website advertisements and public comments are shown in the Plan appendix.

The following organizations posted the draft comment flyer at their facility and/or sent to their members/boards:

- | | |
|---|---|
| <ul style="list-style-type: none"> • Sustainable Rockingham • Bellows Falls Downtown Development Alliance • Rockingham Conservation Commission • Great Falls Chamber of Commerce • Bellows Falls Historical Society • Parks Place Resource Center | <ul style="list-style-type: none"> • Greater Falls Connections • Friends For Change/Youth Services • Our Place Food Shelf • Main St Arts • Saxtons River Inn/Saxtons River General Store • Rockingham Arts and Museum Project |
|---|---|

Simultaneous to the draft Plan being out for public comment the plan was also emailed to the planning commissions of the adjacent towns of Springfield, Athens, Grafton, Westminster, and Chester, Vermont and Walpole and Charlestown, New Hampshire for review and comment. Comments were directed to be sent to Alyssa at the Windham Regional Commission. Email to towns is shown in the Plan appendix.

February 17, 2022 - Draft submitted to Vermont Emergency Management for review and pre-approval.

In addition to the local knowledge of Planning Team members and other relevant parties, and information in the 2015 Rockingham Local Hazard Mitigation Plan, several existing plans, studies, reports, and technical information were utilized in the preparation of this Plan. A summary of these data sources is provided below and specific references are listed in footnotes throughout this Plan.

- 2021 Local Emergency Management Plan
- Floodready VT Community reports and NFIP information

- 2016 Rockingham Town Plan
- 2015-2020 Green Mountain Power Outage Data
- 2018 State of Vermont Hazard Mitigation Plan
- 2019 American Community Survey Five-Year Estimates
- Rockingham Flood Hazard Area Regulations
- WRC Local Liaison Reports of Storm Damage
- National Oceanic and Atmospheric (NOAA) National Climatic Data Center's Storm Events Database
- FEMA Disaster Declarations for Vermont
- OpenFEMA Dataset: Public Assistance Funded Project Summaries for Vermont
- U.S. Geological Survey National Water Information System- Stream Gage Data
- FEMA Flood Insurance Rate Maps

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 and Vulnerability Analysis

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: How likely is this hazard to occur in my town? How badly could it impact my town? What areas of town would or could be affected by the hazard? This Plan update utilized the 2015 analysis ranking technique in updating the Hazard Assessment table.

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

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

The **Potential Impact** (percentage of the town affected) of the hazard is classified as:

- Negligible: < 10% of properties damaged/Minimal disruption to quality of life.

- Limited: 10% to < 25% of properties damaged/Loss of essential facilities/services for up to 7 days/few (< 1% of population) injuries possible.
- Critical: 25% to 50% of properties damaged/Loss of essential facilities/services for > 7 days < 14 days/Major (< 10% of population) injuries/few deaths possible.
- Catastrophic: > 50% of properties damaged/loss of essential facilities/services for > 14 days/Severe (> 10% of population) injuries/multiple deaths possible.

<u>Likelihood:</u>	<u>Potential Impact:</u>
U = unlikely	N = negligible
P = possible	L = limited
L = likely	CR = critical
HL = highly likely	CA = catastrophic

Additional considerations in the discussion were: the impacts of climate change, seasonal weather patterns, what areas of town are likely to be affected the most, the probable duration of the hazard, the speed of onset and amount of warning time considering the existing warning systems available.

The combination of the **Likelihood** and the **Potential Impact** are used to determine the **Vulnerability Ranking** as being HIGH, MODERATE or LOW.

This Plan update focuses exclusively on natural hazards, with the exceptions of dam failure and rail incident. Dam failure would likely be linked to a natural hazard risk like flooding and/or fluvial erosion. A rail incident could be impacted by fluvial erosion of the area in and around the tracks, which is a concern of the Town. The updated assessment is shown on the following pages.

In doing the assessment and planning for this Plan update, the Town held 16 meetings organized by a local community group called 'Sustainable Rockingham'. Each of the meetings focused on one natural hazard and discussion and mitigation ideas around that hazard. In this way, all the hazards were considered for inclusion in this Plan. The hazards that the Town found most important to focus on, and highest risk to the Town, are the hazards that the Town developed the most mitigation actions around. Those ended up being: Flood (primarily fluvial erosion), landslide, and invasive plant and insect species.

The rationale for why any listed hazard is not addressed in depth is either: a low or moderate vulnerability ranking, the Town feels they adequately mitigate for the hazard currently, or the town does not choose to or cannot mitigate for the hazard at this time. For hazards that are not profiled in this plan, the reader is directed to the current Vermont State Hazard Mitigation Plan.

The 2015 Plan focused on flooding (inundation flooding primarily), snow, ice and winter storm and high winds. The participants chose not to focus this update on snow, ice and winter storm or high winds, as those hazards are appropriately mitigated to the extent that the Town is currently able. Fluvial erosion, landslide and invasive species are more pressing hazards that there is a will and a need to mitigate for in the community. This assessment added in the hazards of heat, infectious disease and cold. Of note in the assessment is that inundation flooding was ranked low, but fluvial erosion flooding was ranked high. This stems from the fact that most of the flood damage experienced in Rockingham has to do with the erosive forces of flood waters versus rising standing floodwaters, which is more uncommon here. Wildfire, heat, and drought are hazards of increasing concern in Rockingham and a future update of this Plan may focus on them. Dam failure and railroad incident are manmade hazards of significant concern for the Village of Bellows Falls. Fluvial erosion and invasive species were not considered in the 2015 Plan. Hail and earthquake both ranked low in the

assessment and the Town does not choose to focus on them at this time, as mitigation is difficult considering their low level of concern in the Town. Outside of the pandemic, the hazard events that have impacted Rockingham since 2015 involve flooding and fluvial erosion, winter storms, and the increasing presence and closer proximity of invasive plants and insects.

Climate change is a widely recognized hazard in Rockingham and it was discussed in the Plan process for its impacts on every natural hazard. Climate change will be addressed in an overarching way as it impacts all hazards. The effects of climate change on the natural hazards addressed in this Plan will be discussed in the hazard profiles.

In relation to hazards faced by the Town of Rockingham, unless specifically noted, these hazards face all areas of the Town, including the incorporated villages of Saxtons River and Bellows Falls. Where differences exist, they are noted. The terms “Rockingham”, “Town” or “Town of Rockingham” should be taken to mean the entire town area, including the incorporated villages.

Possible Hazard	Likely-hood	Impact	Community Risk	Most vulnerable facilities and populations
Fluvial Erosion	HL	L	High	Saxtons, Williams and Connecticut Rivers are impacted; this is a primary concern. Events are causing loss of roads in numerous locations. Some structures have been lost in the past due to damages. Residential and nonresidential structures along the Saxtons and Williams Rivers in Rockingham and Saxtons River; Structures along the Connecticut River in Rockingham and Bellows Falls; Rail lines along Connecticut River and Williams River in Rockingham and Bellows Falls; Power plant next to Connecticut River in Bellows Falls; Roads, culverts and bridges throughout Town; Electric and Telecommunication utilities located near the rivers in Rockingham and the two villages - all affected equally.
Invasive Species	HL	CR	High	Knotweed, bittersweet, multiflora rose, barberry are some primary plant concerns. Emerald Ash Borer, Hemlock Woolly Adelgid and jumping worms are some primary insect pest invader concerns. Jumping worms have been seen at the location of the landslide on Burt Street in Bellows Falls. Knotweed is a major threat to the BF Wastewater Treatment Plant.
Dam Failure	U	CA	High	In Bellows Falls - people, structures and infrastructures downstream of Minard’s Pond. In Saxtons River - low lying areas and structures below small dams just outside Saxtons River Village (trout pond and recreation area) on Pleasant Valley Rd. There are 6 major dams upstream and on the Connecticut; Rockingham would be impacted by failure of any of them. EMD has a connection with Great River Hydro around dam failure planning.
Railroad Incident	P	CA	High	Depending on scale of incident the entire Village of Bellows Falls could be impacted. Fluvial erosion is impacting the rail system in some places and the town is concerned about the potential for resulting railway incidents.

Possible Hazard	Likely-hood	Impact	Community Risk	Most vulnerable facilities and populations
Landslide	HL	L	Moderate to High	Areas of particular impact are: Upper Meadow Road, Route 121 west of Saxtons River Village; Rockingham Road north of Bellows Falls Village; Westminster, Barker, Front and Prospect and Hyde Streets in Bellows Falls; NE Central south of the tunnel under the Square; and Green Mountain RR north of Canal Street in Bellows Falls; and along the Williams River. Rising issue at Imtec Drive impacting some businesses on that road; large slide on 121; between the Rec Center and Burt Street is another slide, coming off the Rec Center onto Playground Road; and Brockway Mills Road. Brockway Mills is the biggest one right now, the Chroma one is a big potential slide.
Snow and Ice	HL	L	Moderate to High	Power outages are a particular concern with winter storms; Electric and telecommunication utilities; Residences that rely on electric heat; Riverview and the Canal House Senior Housing complexes, and Sterling House Assisted Living in Bellows Falls.
Wildfire	P	P	Moderate	Structures in close proximity to the Green Mt. RR tracks in Rockingham and Bellows Falls, and NE Central RR tracks in Bellows Falls.
Drought	P	L	Moderate	Public and private water sources; agricultural lands throughout Town.
Heat	HL	L	Low to Moderate	Generally, the same population that is vulnerable to extreme cold is vulnerable to extreme heat. AC is not common in homes in VT.
Infectious Disease Outbreak	U	CR	Low to Moderate	Currently within the Covid-19 pandemic; Town is guided by state and federal guidelines during a pandemic situation. Schools and public gathering spaces are especially at risk.
Wind	HL	L	Low	Electric and telecommunication utilities; Structures; Ridgelines are more vulnerable in general.
Hail	P	L	Low	Vehicles, rooftops, and crops are vulnerable.
Earthquake	U	CR	Low	Town-wide including the two villages - all affected equally. Older multi-story brick buildings; bridge infrastructure; Minard's Pond dam and hydro-electric dam and areas below the dams in Rockingham and Bellows Falls.
Inundation Flooding	L	L	Low	Stormwater overflows cause some inundation issues; North Shore Trailer park is in the floodplain.
Cold	HL	L	Low	Concern is power outages during cold weather; Vulnerable population is elderly people and homeless; Large amount of the population in Rockingham is on private well water which would also not work in power outage.

HAZARD PROFILES

The following sections include a narrative with a Description, Geographic Area of the Hazard, Impact, Extent, Probability, and discussion of Past Occurrences of three high vulnerability natural hazards affecting Rockingham.

Flooding / Fluvial Erosion

Description

Flooding is the most widespread and destructive hazard in the United States. 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. Rockingham has a floodplain ordinance which does not regulate River Corridors. This bylaw gives residents access to discount flood insurance through the National Flood Insurance Program (NFIP) and enables the Town to regulate development within the Special Flood Hazard Area (SFHA) and River Corridor.

SFHAs are subject to inundation by the 1% annual chance flood (100-year flood). River Corridors are subject to fluvial erosion and are defined and mapped by the Vermont Agency of Natural Resources (ANR). River Corridor 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. Maps of these areas can be found at the Town Office or online at the FEMA Map Service Center¹ (SFHAs only) or on the VT ANR Natural Resources Atlas² (SFHAs and River Corridors).

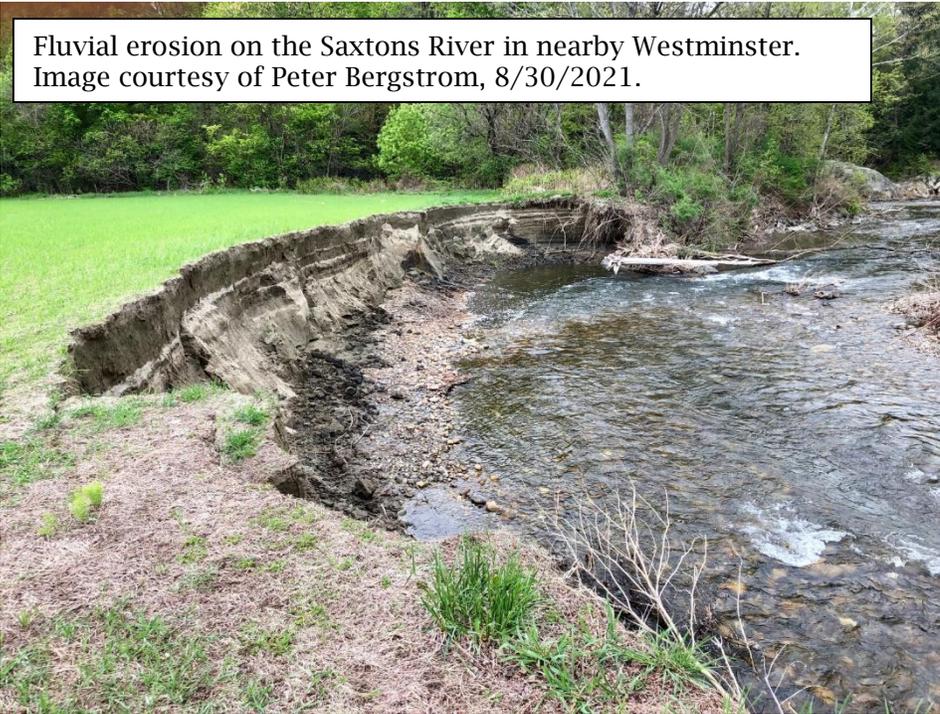
Much of the destruction from flooding in Rockingham is due to fluvial erosion rather than inundation, which is the type of flooding targeted in FEMA mapping. Fluvial erosion is the destruction of river banks caused by the movement of rivers and streams, when stream power overcomes resistance of bed and bank material. This can range from gradual bank erosion to catastrophic changes in river channel location and dimension during flood events. This occurs when the stream has more energy than is needed to transport its sediment load, due to channel alterations or runoff events that increase water speed in the channel, leading to erosion.

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. Associated issues in Rockingham are related to road cutting and bank erosion for the most part, areas where roads have been built between steep slopes on one side of the road, and slopes to a river or brook on the opposite side.

¹ <https://msc.fema.gov/portal>

² <https://anrmaps.vermont.gov/websites/anra5/>

Fluvial erosion on the Saxtons River in nearby Westminster.
Image courtesy of Peter Bergstrom, 8/30/2021.



Bends in the river are prone to movement as part of natural river processes, and their movements can be even more dramatic when manmade impacts and development upstream impinges on these natural stabilizing forces. A local example of this is shown here to the left. The river is moving and eroding the bank, leading to loss of a portion of this field at Basin Farm. This area is in the floodplain and the river corridor. The interaction of the natural and unnaturally dramatic forces of river movement, combined with the stationary location of the closely located roads is what leads to road damages

during heavy weather events. Property owners outside of the FEMA floodplain can purchase flood insurance at a lesser expense, and it still covers damages resulting from fluvial erosion in events that damage multiple properties.

Impact

The historic road network of many Vermont towns and villages typically follows waterways, and this is true in Rockingham. This historic settlement pattern creates vulnerability for the road network, infrastructure and development within and along River Corridors. Rockingham is susceptible to river flooding and fluvial erosion from extensive rainfall events and spring runoff, dam failure flooding, and urban flooding from runoff that cannot be absorbed and can overwhelm the stormwater system.

Fluvial erosion is an issue on the Saxtons and Williams Rivers due to the narrow channels in relatively small valleys. Tropical Storm Irene in 2011, the largest flood in recent memory, created fluvial erosion damage along both the Saxtons and Williams Rivers, some of which is

Fluvial erosion hazards have been increased and exacerbated by historical channel management practices in Vermont such as channel straightening, berming, and floodplain encroachment. Towns can reduce flood recovery and infrastructure maintenance costs and increase public safety by limiting development in areas adjacent to rivers with a high potential for vertical and lateral adjustment.

-Saxtons River Corridor Plan

still evident today. The greatest impact to the built environment was to roads and bridges, a large number of which were significantly damaged or washed away. Flash floods typically occur during summer when a large thunderstorm or a series of rain storms result in high volumes of rain over a short period of time. This type of event occurred on July 29, 2021 and resulted in significant flooding and damage in Rockingham. Higher-elevation drainage areas and streams are particularly susceptible to flash floods. Flash floods are likely in Rockingham, and damage to Route 5 and Route 121 could limit access, as they are major travel corridors through town and throughout the region. Damage to hill roads is

Kayaking in stormwater on Playground Street, Spring 2021. Image courtesy of Tristan Wandzy, 8/30/2021.

likely to occur from flash floods as the amount of rainfall overloads culverts. The storm drains frequently get overloaded in Bellows Falls, resulting in images such as this one to the right during spring 2021, which allowed for kayaking on Playground Street. The two storm drains in this area did not function and the water filled then overflowed the street to the east across a private yard and then down the steep bank to Burt Street, also creating a landslide in that area.

Ice jams have occurred on the Connecticut, Saxtons and Williams Rivers. There is a mapped ice jam on the Williams River (2007) and at the confluence of the Saxtons River and the Connecticut River (1996)³. Jams in this former (Williams River) confluence have resulted in flooding of a trailer park off U.S. Rte. 5 on several occasions. There is also a mapped jam farther west on the Saxtons River in Grafton (1992). Jams on the Saxtons and Williams Rivers have potential to close roads temporarily. Ice jams with flooding resulting have occurred approximately every 15 years in Rockingham, making that hazard a probable event. The most common impact is to the mobile home park on Missing Link Road/U.S. Rte. 5. The last ice jam exceeded the 100 year flood level. Since that time, the flood elevations for the Connecticut River have been increased and more area is included in the FEMA defined floodplain.



Extent

The extent of a flood event can vary from minor, due to a typical rain event, to major as a result of rapid snow melt in spring, rain on frozen ground, or as a result of a tropical depression or storm. It's important to note that this Plan is looking at flooding data for this section primarily in the light that flooding is the cause of fluvial erosion.

There are two stream gauges in Rockingham, one on the Saxtons River and one on the Williams River. Peak streamflow data is shown below for the top 10 events⁴.

³ US Army Corps of Engineers Ice Jam Mapper tool, accessed 10/14/2021
https://icejam.sec.usace.army.mil/ords/f?p=101:17:7379511919458::NO::P17_WATER_YEAR:1.

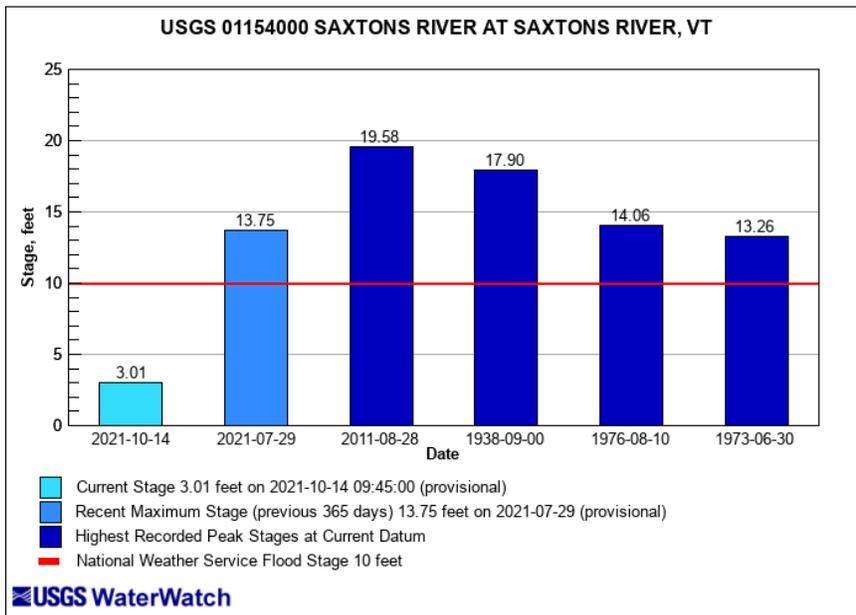
⁴ USGS WaterWatch stream gauge data <<https://waterwatch.usgs.gov/index.php?m=flood&r=vt&w=map>>.

Peak Streamflow			
USGS 01154000 SAXTONS RIVER AT SAXTONS RIVER, VT			
Rank	Date	Gage Height	Stream-flow (cfs)
1	8/28/2011	19.58	21,600
2	1938-09	17.90 ^{Bd}	
3	8/10/1976	14.06	8,460
4	6/30/1973	13.26	7,510
5	9/12/1960	11.57	5,610
6	6/1/1952	11.37	5,430
7	4/10/1980	10.58	4,710
8	12/30/1948	10.51	4,660
9	3/24/1953	10.51	4,660
10	4/3/2005	10.3	4,490

Peak Streamflow			
USGS 01153550 WILLIAMS RIVER NEAR ROCKINGHAM VT			
Rank	Date	Gage Height	Stream-flow (cfs)
1	8/28/2011	17.94	21,300
2	3/31/1987	10.69	8,990
3	3/29/1993	9.98	7,850
4	7/28/2014	9.87	7,680
5	10/4/1987	9.73	7,460
6	4/3/2005	9.69	7,390
7	5/14/2006	9.54	7,160
8	1/19/1996	9.41	6,950
9	9/17/1999	9.27	6,740
10	3/28/2000	9.07	6,430

The peak streamflow data shows that TS Irene was the worst flood event experienced in the period of record for each gauge. The Williams gauge has been active for 38 years, and the Saxtons has been active for 58 years⁵. Flood stage is 10 feet on the Saxtons and 8 feet on the Williams. This data puts TS Irene in perspective for just how large of a flood it was. TS Irene caused a higher rise in streamflow than the 1938 flood, which is one of the worst events in the state's history. The Spring Floods of 1938, which had an effect on all of New

England, caused \$113 million in damage, killed 24 people and made 77,000 people homeless. During this flood alone, the main street of Hooksett, New Hampshire was 18 to 20 feet underwater.

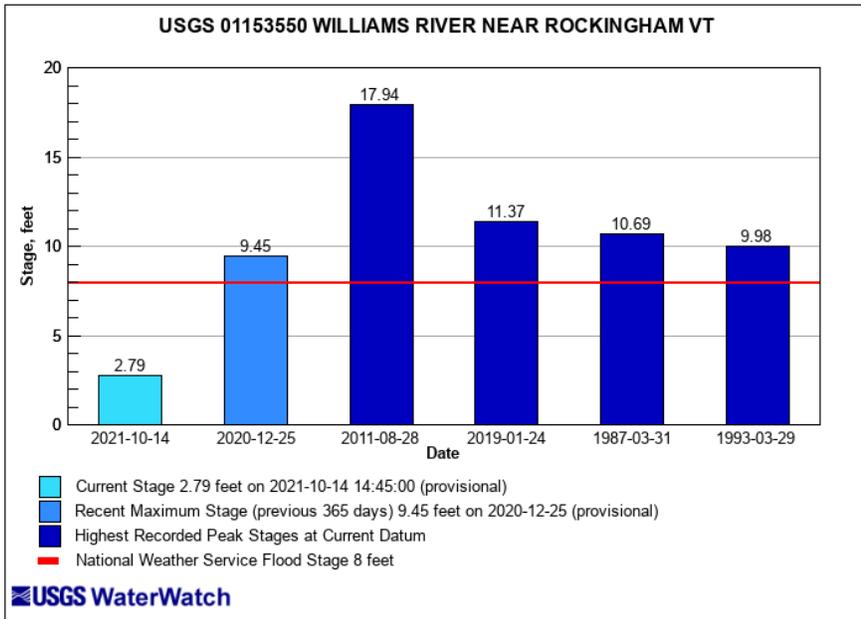


The graphs to the left also show two recent events of note for Rockingham, the 12/25/2020 flood event and the 7/29/2021 flood event that resulted in a federal declaration. The 7/29/2021 event has been the worst event in the Windham Region since TS Irene.

⁵ Data is shown for longer than 58 years.

Extent for fluvial erosion: The biggest area of fluvial erosion in Rockingham is along the

Williams River at 2128 Brockways Mills Road. This event is discussed in the landslide portion of this Plan. The Brockway Mills Road landslide is 100 feet high and is 87 feet wide at the top.



Probability

The hazard assessment process deemed fluvial erosion as highly likely in Rockingham.

Past Occurrences

There have been 19 Presidential Disaster Declarations in Windham County since 1953, with 3 of those occurring since the last Plan update. Of these, 7 were severe storms, 5 were floods, 3 hurricanes, 1 snow event, 1 severe ice storm, and 2 are biological events (both relate to Covid-19 pandemic).⁶

Disaster Declarations for Windham County, VT						
Disaster Number	Incident Begin Date	Incident End Date	Declaration Date	Incident Type	Title	Disaster Close Out Date
3567	8/22/2021		8/22/2021	Hurricane	Tropical Storm Henri	
4532/ 3437	01/20/2020		04/08/2020	Biological	Covid-19 Pandemic	
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	1/14/2020
4022	8/27/2011	9/2/2011	9/1/2011	Hurricane	TROPICAL STORM IRENE	
3338	8/26/2011	9/2/2011	8/29/2011	Hurricane	HURRICANE IRENE	3/10/2014
1816	12/11/2008	12/18/2008	1/14/2009	Severe Ice Storm	SEVERE WINTER STORM	10/15/2014
1698	4/15/2007	4/21/2007	5/4/2007	Severe Storm(s)	SEVERE STORMS AND FLOODING	3/13/2013
1559	8/12/2004	9/12/2004	9/23/2004	Severe Storm(s)	SEVERE STORMS AND FLOODING	1/4/2011
1488	7/21/2003	8/18/2003	9/12/2003	Severe Storm(s)	SEVERE STORMS AND FLOODING	1/4/2011
3167	3/5/2001	3/7/2001	4/10/2001	Snow	SNOW	2/28/2005
1336	7/14/2000	7/18/2000	7/27/2000	Severe Storm(s)	SEVERE STORMS AND FLOODING	6/30/2008
1307	9/16/1999	9/21/1999	11/10/1999	Severe Storm(s)	TROPICAL STORM FLOYD	6/30/2008
1124	6/12/1996	6/14/1996	6/27/1996	Flood	EXTREME RAINFALL AND FLOODING	2/23/2005
1101	1/19/1996	2/2/1996	2/13/1996	Flood	ICE JAMS AND FLOODING	2/17/2005
518	8/5/1976	8/5/1976	8/5/1976	Flood	SEVERE STORMS, HIGH WINDS & FLOODING	4/16/1981
397	7/6/1973	7/6/1973	7/6/1973	Flood	SEVERE STORMS, FLOODING, & 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 Rockingham and Windham County:

Since 1996, when National Climatic Data Center detailed records start, there have been 45 flood events in Windham County, Vermont. Rockingham experiences routine spring flooding, but this is not always documented. There have been 10 events added to the detailed records since the last plan update in 2015, with several notable events discussed below⁷.

July 29, 2021 rains - - Night rain starting about 9:30 pm produced about 4 inches of rain in as many hours. At North Springfield Lake the rainfall for the month of July totaled 8.43 inches as

⁶ 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 9/15/2021

⁷ NCDC data provided on 8/18/2021 by NOAA's National Centers for Environmental Information (NCEI) Center for Weather & Climate (CWC).

of 7a.m. on the 30th, with an additional 0.49 inches reported on the 31st (National Weather Service Cooperative Station 435982). Totals were 200% of normal levels of rain for July. Several roads and culverts were damaged. Some roads were completely impassable; others the edges were washed out. Leach Road was the hardest hit area and the road was completely washed out for about $\frac{3}{4}$ of a mile. Hyde Hill flooded over where the brook comes off the mountain and goes under the roads; the grate plugged up flooding out streets down below. It washed part of the road out and filled the streets with debris. Roughly 100-yards of material were cleaned up from Hyde Hill area. Total of approximately \$664,644.34 town wide road damages linked to July 29th rains.

December 25, 2020 - An area of low pressure tracking from the Great Lakes to Hudson Bay advected in an unseasonably warm air mass into the region from Thursday, December 24 to Friday, December 25, 2020. Rain gradually overspread the region from west to east during the day on December 24 with the steadiest, heaviest rainfall during the overnight hours and early morning hours of December 25. Rain showers continued through the day on December 25 and changed to snow showers during the evening and overnight hours of December 25-26 as colder air returned. The region still had nearly the entire snowpack from the blockbuster winter storm from December 16-17 which dropped 9 inches of snow. While the snow compacted over time, very little water was lost from the snow. Observations concluded that between 1.50 to 3.00 inches of water was in the snowpack prior to this event and most if not all of this snow melted. Rainfall totals in Putney were measured at 2.39 inches (Anderson) to 2.54 inches (Mary Quinn) from local spotters. These amounts do not include the additional 1.50 to 3.00 inches of water that melted from the snowpack. The combination of warm air, rainfall and melting snowpack led to areas flooding across the region. Roads were closed across portions of southern Vermont as a result of flooding with one road being washed out. A tree was also downed onto Interstate 91 in eastern Windham County. Key Impacts: road closures, tree damage, damage to structures.

August 3, 2018 - A slow-moving cold front brought several rounds of heavy rainfall and thunderstorms to eastern New York and western New England. After passing through eastern New York, a severe thunderstorm knocked down trees and caused localized flash flooding in the towns of Putney and West Wardsboro, Vermont.

October 29, 2017 - Damaging winds, power outages, heavy rainfall and flooding in the region. As the system departed, strong winds ensued and caused thousands of power outages and trees down across southern Vermont. Total rainfall amounts reported across southern Vermont ranged from 1.07 inches in Bennington to 7.01 inches near Wilmington.

February 25, 2016 - As the warm front passed through the region during the overnight hours, temperatures became quite mild for late February reaching into the 50s and 60s, despite it being in the middle of the night. Thunderstorms produced a period of very heavy rainfall during the late evening and into the overnight hours. Rainfall fell at rates exceeding one inch per hour at times. This rainfall, combined with a frozen ground in places and some snow melt in mountainous areas, allowed for widespread flooding of urban, poor drainage and low lying areas. Some main stem rivers reached minor flood stage as well. Some additional rainfall during the day on Thursday, February 25th allowed the receding of water of flooded areas to be slow to occur. Several buildings were impacted by flood waters in Rockingham.

September 30, 2015 - A slow-moving cold front approached southern Vermont from the Great Lakes on Tuesday, September 29th. Ahead of this front, a southerly flow out of the Gulf of Mexico allowed plenty of tropical moisture to surge into the region, with an unusually humid air mass in place for late September. As an area of low pressure developed along this boundary, areas of rain showers transitioned into a widespread rainfall during the evening hours, with heavy rainfall falling between the late evening hours and early morning hours on Wednesday, September 30th as the front crossed the region. Rain fell in excess of one half inch per hour at times. The rain finally tapered off by the mid to late morning hours, as the front continued to

move away from the area. By the time the rain ended, most areas saw two to four inches of rainfall, with the highest totals around 4.30 inches in Putney. As a result of the heavy rainfall, many roads were inundated with standing water. Although the recent dry conditions and low stream flows prevented many larger rivers from reaching flood stage, some smaller streams and creeks overflowed their banks. One road was reported to be washed away in North Vernon.

July 28, 2014 - Heavy rainfall from thunderstorms led to flash flooding in the town of Rockingham. The Williams River overflowed its banks, causing flooding at a power plant along the river. About four inches of water was inside the power plant before water receded.

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

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.

August 28, 2011 - Tropical Storm Irene - Record flooding occurred on the Saxtons River and the Williams River at Rockingham. The Saxtons River gage located on Saxtons River Road, Route 121, near the intersection of Hall Bridge Road exceeded its 10 foot flood stage at 10:01 am EST on August 28th, its 12 foot moderate flood stage at 10:43 am, its 15 foot major flood stage at 11:34 am, crested at a record 19.57 feet at 1:30 pm, and fell below flood stage at 7:27 pm on August 29th. Record flooding also occurred on the Williams River. The Rockingham river gage located near Parker Hill Road exceeded its 8 foot flood stage at 10:14 am EST on August 28th, its 12 foot moderate flood stage at 1:33 pm, its 15 foot major flood stage at 2:17 pm, crested at a record 17.94 feet at 3:45 pm, and fell below flood stage at 12:38 am on August 29th.

The greatest impact from Irene across southern Vermont was due to heavy to extreme rainfall, which resulted in catastrophic flash flooding and river flooding across southern Vermont. Rainfall amounts generally averaged 4 to 8 inches. Much of the rain which fell occurred within a 12 hour period, beginning early Sunday morning, and ending Sunday evening. 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 customers affected by power outages included: Windham County 18,000.

Road Closures:

- Lower Bartonville Covered Bridge on Williams River completely destroyed in flood. Resulting in closure of Lower Bartonville Road and additional seven miles of detour.
- Worrall Covered Bridge on Williams River sustained substantial damage; closed for 9 months; and resulting partial closure of the Williams Road.
- Rte. 121 at intersection with Leach Road closed for one week and reduced to one lane for three months due to major washout with road failure. Major rebuilt of embankment and roadway.
- Rte. 121/Saxtons River Road just west of Saxtons River Village washed out and closed for one month by so-called Dump Corner.
- Barbers Park Road washout closed road for two weeks.
- Hall Covered Bridge closed for three months due to frame damage from flooding.
- McBride Road closure due to flooding on the Saxtons River. Closed for one day.
- Westminster West Road flooded and impassable in vicinity of Benson's Trailer Park, just outside Saxtons River Village limits.
- Westminster Street bridge in Saxtons River closed for a period of time while flood waters from the Saxtons River topped over the bridge.

Throughout Vermont, undersized bridges and poorly aligned culverts prevent critical sediment and woody debris transport processes and fish and wildlife migration. These conditions result in
1) channel instability and/or damage to infrastructure and personal property,
2) increased flooding, and
3) decreased fish and wildlife population health.
-Saxtons River Corridor Plan

Property damage:

- Three homes on Rte. 121 east of Saxtons River Village near Ski Bowl Road completely destroyed. FEMA Buy-out complete.
- House on east side of Saxtons River Village destroyed by flooding. Adjacent business flooded.
- One mobile home in Benson's Trailer Park, Westminster West Road, destroyed by flooding from Saxtons River, and Barnes Brook, which flows next to the park.
- Small hydroplant on Williams River, Brockways Mills Road, destroyed by flooding.
- House and accessory buildings on Rockingham Road/Rte. 103 destroyed by Williams River flooding.
- Mobile home on Brockways Mills Road received significant damage from Williams River.
- Bellows Falls Wastewater Treatment Plant, Mill St., damaged by flooding.
- Saxtons River Wastewater Treatment Plant, Plant Road, damaged by flooding.
- Property and home on Barbers Park Road lost significant land to erosion into Saxtons River and flooding of minor portion of house.
- House on Rte. 121 west of Saxtons River Village had basement and yard flooded; mobile home had yard flooded.
- House on Williams Road had foundation damage and yard flooded.
- House on Rockingham Road/Rte. 103 had crawl space flooded.

- Significant erosion to land along Saxtons River in Saxtons River Village, along River Street and Main Street (including Saxtons River Fire Department).

May 20, 2011 Flooding was reported on Edgebrook Park Road with a washout at Route 121 (Saxtons River Road) just east of Saxtons River. Showers and thunderstorms developed in a moist and unstable air mass across the region.

Aug. 7, 2008 - Flash flooding from heavy rainfall resulted in the closure of a portion of Pleasant Valley Road near Bellows Falls. The passage of a strong upper level disturbance, combined with a moist and unstable air mass in place, led to the development of numerous thunderstorms across southern Vermont during Thursday afternoon on August 7th, some of which contained large hail. In addition, locally very heavy rainfall led to flash flooding in some areas.

April 15-21, 2007 - A flooding event occurred which was associated with flash floods and inundation flooding over a period of several days in the spring. Rain and snow caused damage to roads and utility lines across Windham County. Across, the State, nearly 3.6 million dollars was obligated as part of the FEMA Public Assistance Program. While it is not normal for the Town to receive this type of damage from severe flooding and thunderstorms on an annual basis, road washouts and culvert repairs from these associated events have ranged in the ballpark of \$200,000 to \$400,000. Minor flooding occurred along the Williams River at Rockingham, where the river level crested at 8.1 feet at 21:15 EST on the 16th.

January 18, 2006 - During January 18 and 19, flooding occurred on the Williams River at Rockingham. Flood stage is 8.0 feet. A flood crest of 9.12 feet occurred on January 18, at 10:50 PM.

August 12 - September 12, 2004 - A severe period of flooding and thunderstorms engendered Presidential Disaster Declaration DR - 1559.

October 29, 2003 - The combination of two rainstorms, one taking place on October 26-27 and another on October 29, produced 3-6 inches of rainfall across eastern Vermont. This resulted in minor flooding on the Williams River. The Rockingham gage on this river crested at 8.77 feet, 0.77 above flood stage. No problems were reported to the National Weather Service as the result of this flooding.

Aug. 6, 2003 - Slow moving thunderstorms produced torrential rainfall in sections of Windham County during the afternoon of August 6. Widespread street flooding was observed in the village of Bellows Falls.

Feb. 28, 2000 - A warm up at the end of February, began melting the winter snowpack fairly quickly across southern Vermont. The rainfall from a cold front accumulated between one half and one inch across Windham county, late on the evening of February 28 into early February 29. The rains exacerbated the runoff, which resulted in the Williams River cresting at 8.5 feet at Rockingham. Flood stage is 8 feet. The waters flooded the adjacent lowlands.

Dec. 17, 2000 - A complex storm system began to evolve on Saturday December 16 across the Mississippi Valley. A surface low tracked north into the eastern Great Lakes by December 17. At the same time, the associated upper level trough became negatively tilted as it moved toward the northeast on Sunday. This allowed for rapid deepening cyclogenesis. Unseasonably warm and moist air was transported northward from the Gulf of Mexico. This scenario brought a record breaking rainstorm to southern Vermont. Rainfall averaged 2-3 inches. The rain, combined with snowmelt and frozen ground, lead to a significant runoff and flooding. The Saxtons River flooded Route 121.

Tropical Storm Floyd 1999 - The remnants of Hurricane Floyd moved up the eastern seaboard on September 16, 1999 and during the early hours on September 17, 1999. The storm brought both high winds and heavy rainfall to Brattleboro, Dover, Dummerston, Guilford, Putney, Rockingham, Stratton, Westminster and Landmark College, which included a large swath of 3 to 6 inch amounts. Landmark College in Putney lost a culvert on the campus, which had to be replaced. Brattleboro recorded the largest rain total of 5.70 inches during the event. The rain produced significant flooding across the region, which proved destructive. Winds from the passage of Tropical Storm Floyd were estimated to have gusted to over 60 mph, especially over hill towns. The combination of the wind and very saturated ground, produce widespread downing of trees and power lines across much of Southern Vermont. A woman was injured on Tavern Hill in Putney when a tree came crashing down on her Volvo, destroying the vehicle. The rain and wind produced power outages across the region. As many as 2,000 people lost power in Southern Vermont.

Jan. 27, 1996 - A low pressure system over the upper Great Lakes produced a general rainfall of one to two inches across southern Vermont. This amount of rainfall on already saturated soil brought many small streams out of their banks across Windham County. A few road washouts occurred in the county.

January, 1996. Ice jam in the Connecticut River resulted in flooding of North Shore Trailer Park, Missing Link Road/U.S. Rte 5. The park was evacuated twice and several mobile homes were destroyed.

Oct. 28 1995 -Heavy rains produced flooding in Bellows Falls in Windham County.

March, 1968. Ice jam on the Connecticut River resulted in flooding of the North Shore Trailer Park, Missing Link Rd./U.S. Rte. 5. The park was evacuated and twenty-five mobile homes damaged.

In the spring of 1987 there was rapid meltdown of snow over frozen ground with 3" of rain flooding the west end of Reed Road.

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. The town of Ludlow on the Black River was seriously damaged. 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.⁸

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

Sources used

Local town knowledge and town records, National Climatic Data Center storm events database, FEMA's Presidential Disaster Declarations search page

⁸ USGS "Vermont Floods and Droughts" information page <http://md.water.usgs.gov/publications/wsp-2375/vt/>. Accessed 4/3/15.

Flooding and Fluvial Erosion Mapping

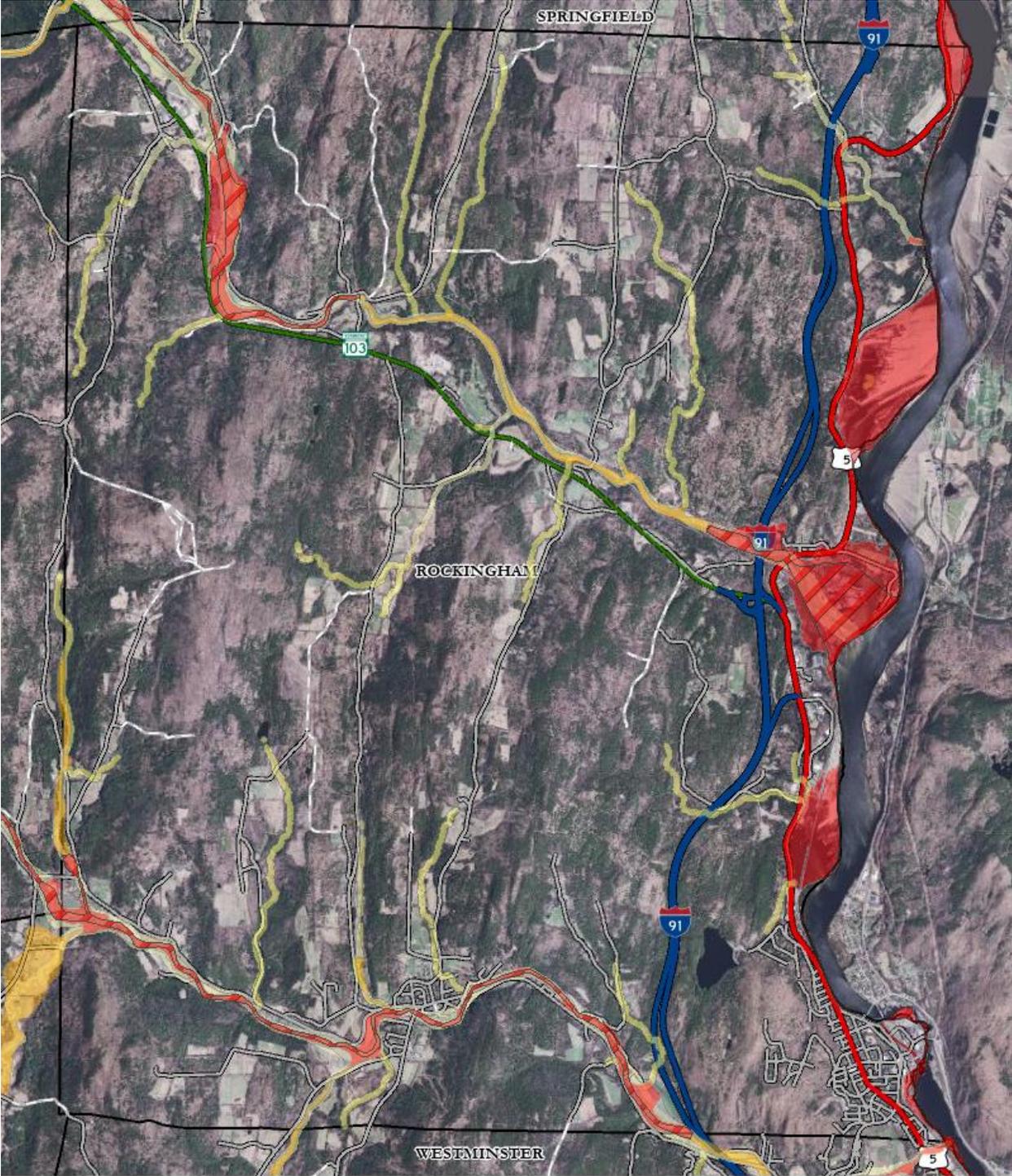
The following maps were created using the Vermont Agency of Natural Resources 'Natural Resources Atlas' which is an online mapping tool⁹. These maps are snips showing all of the special flood hazard areas (SFHAs) that FEMA has designated in Rockingham. The SFHAs are shown in orange and red shading, and the floodways are red hatched. The floodplains shown in these maps are based on the FEMA Flood Insurance Rate Map (FIRM) maps available through the FEMA Map Service Center. The map effective date for the latest FIRM for Windham County is 9/28/2007.

The cream shaded areas on the maps are the Vermont Agency of Natural Resources (ANR) defined River Corridor which lie along streams with watersheds above .5 square miles (there are River Corridors defined for watersheds above .25 square miles, but they are not locally regulated). This area is subject to fluvial erosion. The orange shaded areas are FEMA SFHA designated A-zones, which are mapped floodplains where base flood elevations have not been determined. Red shaded areas are FEMA SFHA designated AE-zones which do have base flood elevations determined. Floodway is shown in red hatch, and is subject to moving flood waters.

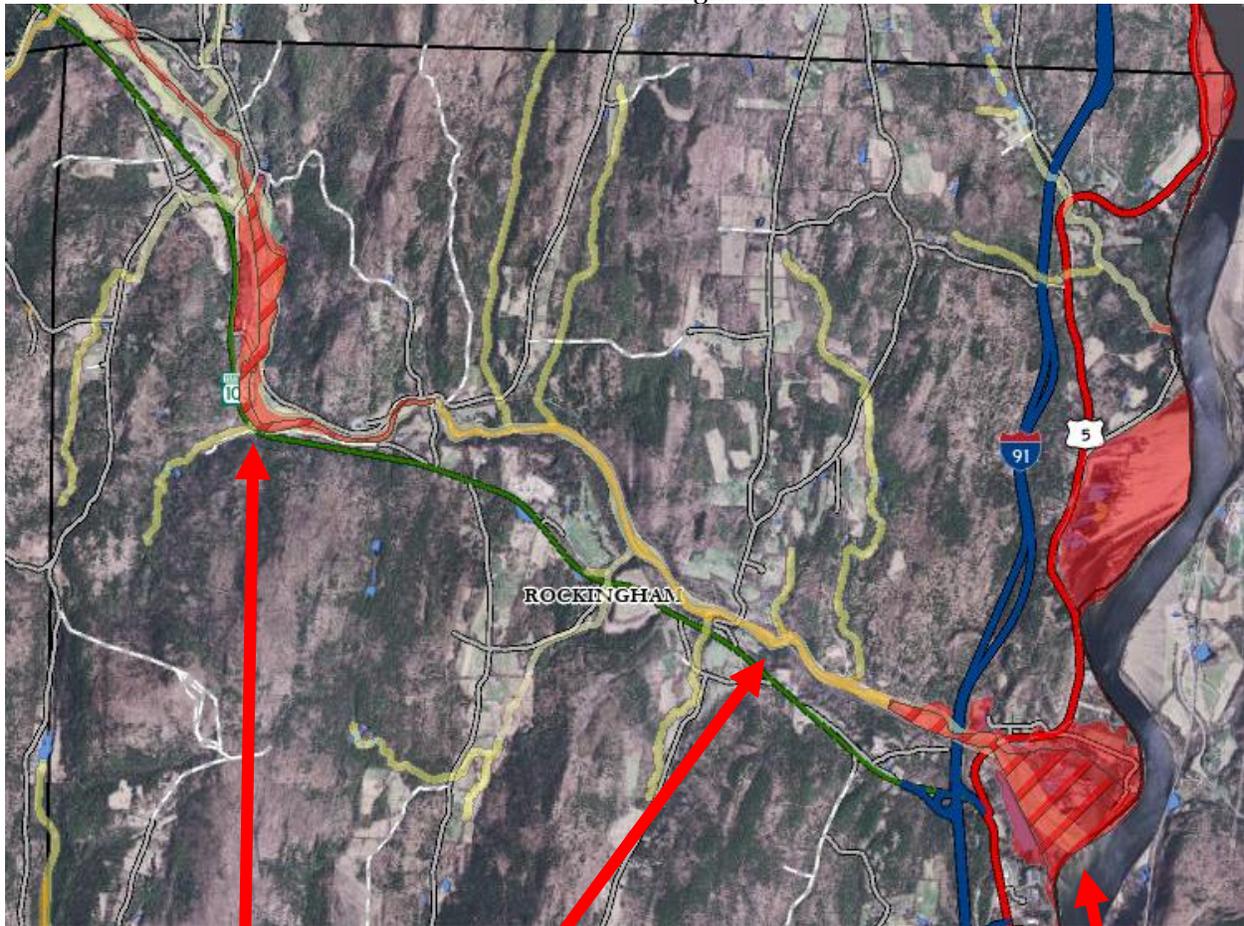
This overall map of Rockingham shows that the floodplain and fluvial erosion areas that are mapped are primarily along the Saxtons River, Williams River and Connecticut River. River Corridor stretches farther up the small streams, as these upland areas can still experience flashy flood hazards.

⁹ <https://anrmaps.vermont.gov/websites/anra5/>

Rockingham Overall:



Northern Rockingham:



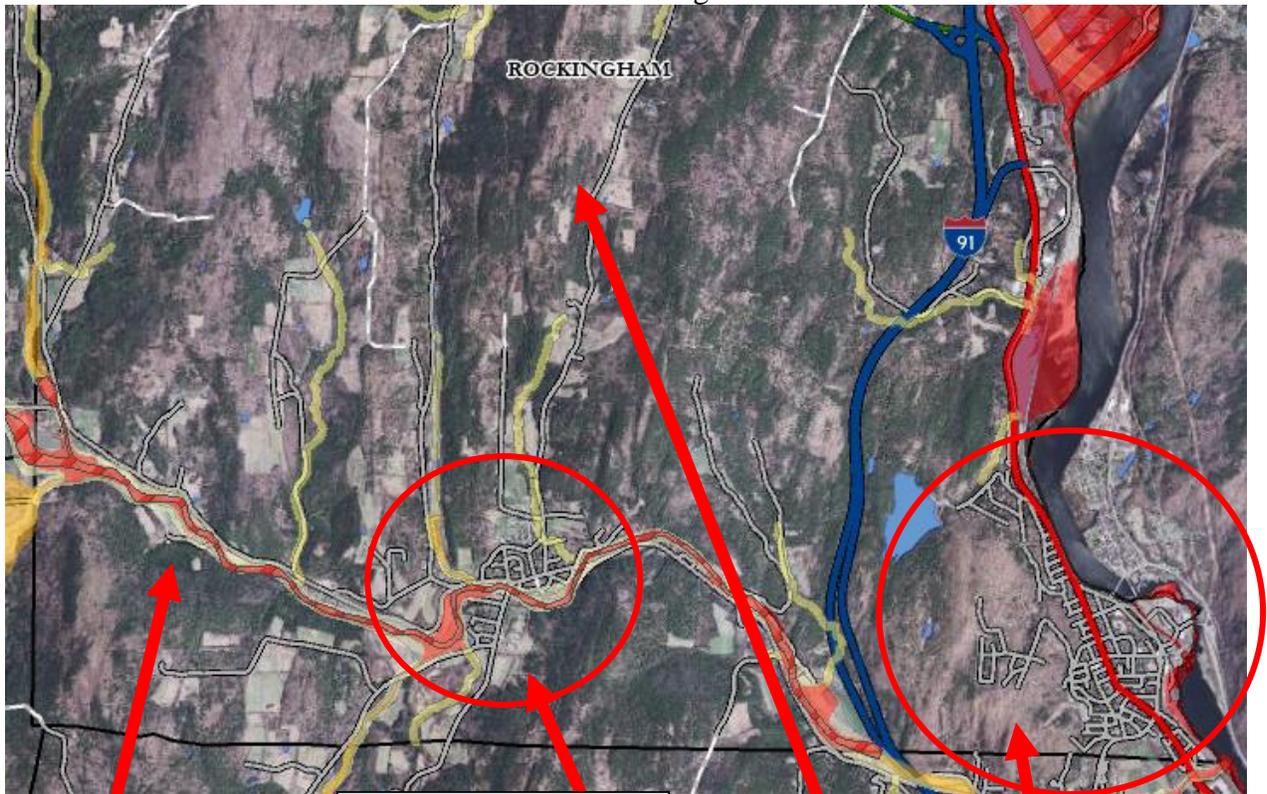
This area of Route 103 is along floodway and vulnerable.

Williams River

Largest portion of floodway in Rockingham, which lies along the Connecticut River

Looking more closely at the northern half of Rockingham, shown above:
The red hatched area is the floodway. This area is where moving floodwaters are prone to go. On the Williams River between Brockways Mills Road and the town line with Springfield is floodway. There are also areas of floodway on the eastern portion of the Williams and along the Connecticut. The orange areas on the map are inundation flood zones, A zones according to FEMA. The mapped River Corridor extends along the Williams and numerous tributaries. River Corridor extends up all of the streams that also have floodplain, with additional areas in River Corridor. There is no designated River Corridor on the Connecticut River due to the dams disrupting normal river processes.

Southern Rockingham:



The Saxtons River has floodway and river corridor the entire length through Rockingham

Saxtons River Village

Bellows Falls Village

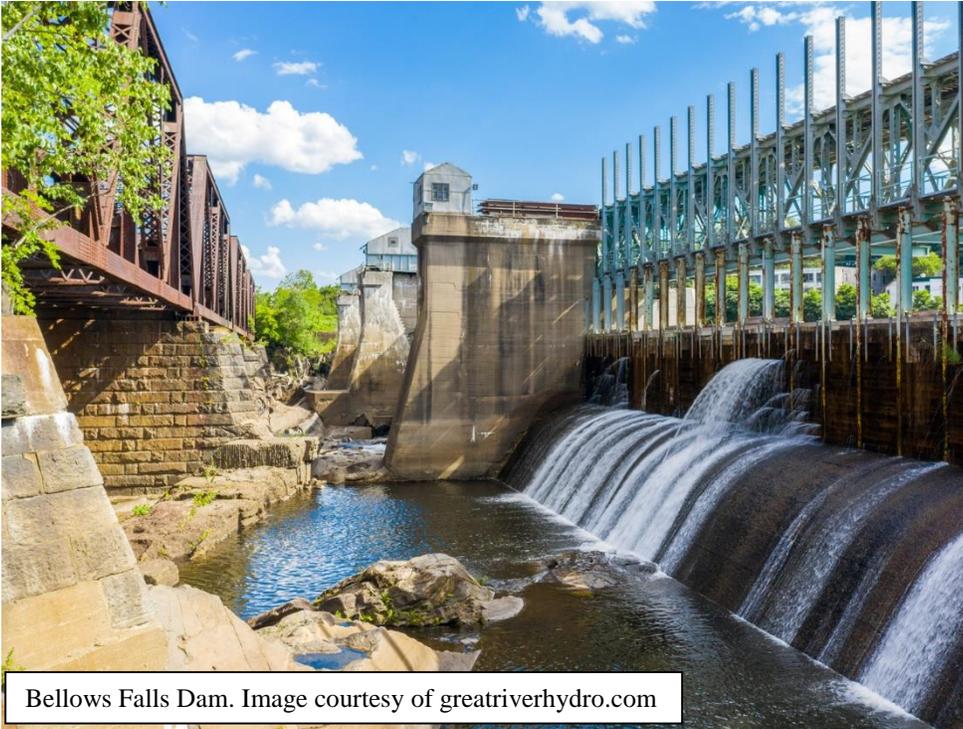
The central part of Rockingham is composed of tributary headwaters and higher elevations, limiting flood issues here to fluvial erosion on small streams.

The above map shows the southern half of Rockingham. The mapped River Corridor extends along the Saxtons and numerous tributaries.

Dam Failure

The Connecticut River is used to create hydroelectric power along its entire length. Dams are located at regular intervals along the river. This includes the dam between Bellows Falls, Vermont, and North Walpole, New Hampshire. Upstream are large dams at Wilder, Ryegate, McIndose Station, Comerford Station, Monroe Reservoir, Gilman Project, Lower Canaan, Murphy Dam, First Ct Lake, Second Ct Lake and Moose Falls. A failure of any upstream dam could create problems for downstream facilities.

There are three dams that lie in and around Rockingham:

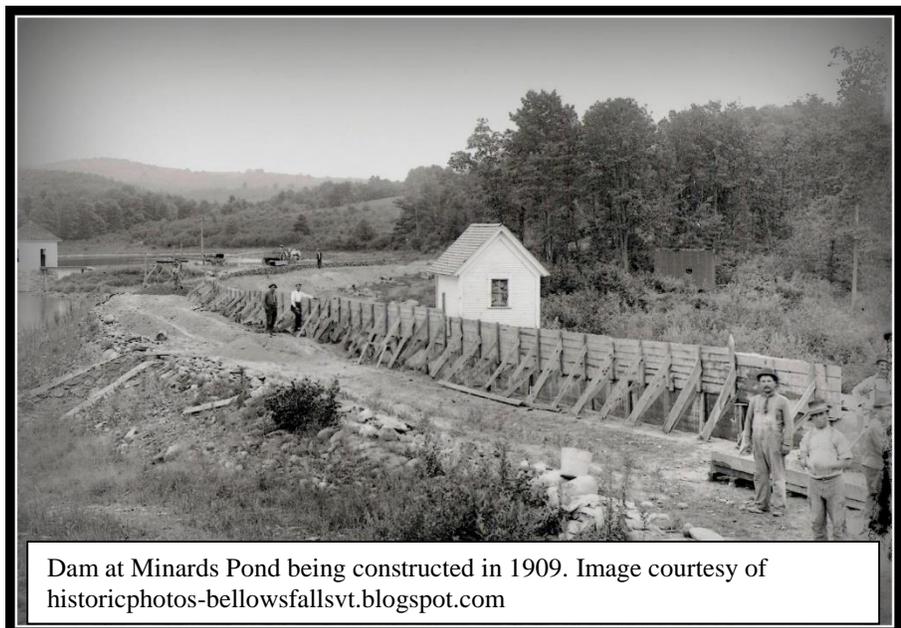


Bellows Falls Dam. Image courtesy of greatriverhydro.com

The Bellows Falls hydroelectric dam located between Bellows Falls and North Walpole, N.H., is within the jurisdiction of the State of New Hampshire and operated by Great River Hydro. The dam is currently undergoing relicensing with the Federal Energy Regulatory Commission. Catastrophic failure of the dam would result in devastating flooding to all areas south of the bridge connecting Bellows Falls and North Walpole, N.H. This is located in the

southeast corner of the Town of Rockingham. While the vast majority of land area within the Town would not be impacted, a small area would be severely damaged.

The Bellows Falls water supply is impounded by an earthen dam which increases the depth of Minards Pond. This water body is located on the mountain to the west of Bellows Falls. A failure of this dam would create damage to



Dam at Minards Pond being constructed in 1909. Image courtesy of historicphotos-bellowsfallsvt.blogspot.com

the areas directly downstream including residences, town and state roads, and businesses.

The Saxtons River Recreation Area swimming pond is served by an earthen dam across Pleasant Valley Brook which runs southerly in the Pleasant Valley area north of Saxtons River Village. The dam does not hold back the Brook. Numerous beaver dams are located both upstream and downstream of the Recreation Area. Failure along this stream would flow southerly resulting in potential damage to several residences and town roadways.

Landslide

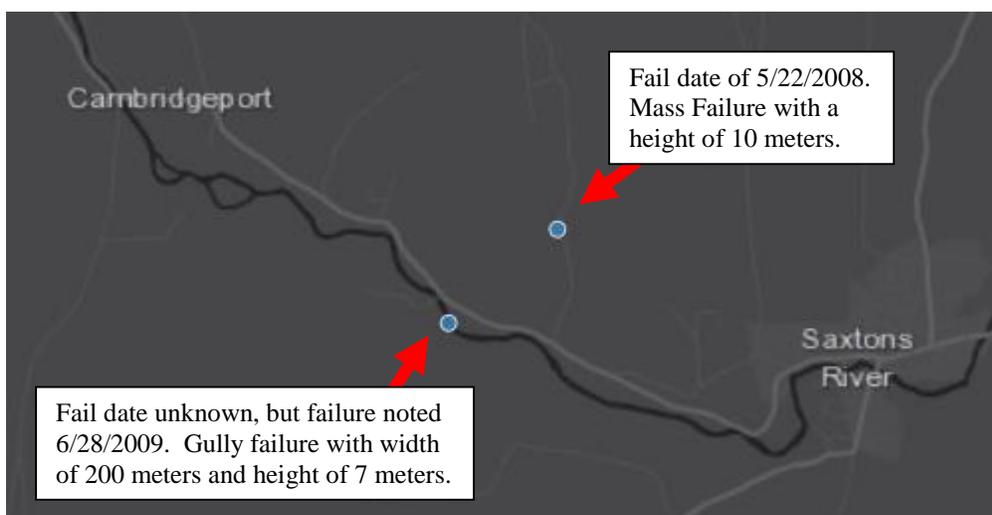
Description

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



Impact, Location, Extent and Events

There are several areas with active landslide risks in Rockingham. Only two of the landslides in Rockingham are mapped on the Vermont ANR Landslide open source data map¹⁰. Those are shown here:



¹⁰ <https://anrgeodata.vermont.gov/datasets/landslides/explore?location=43.155599%2C-72.516933%2C13.43>. Accessed 10/19/2021.

Noted during this plan development, areas of landslide concern in Rockingham are:

- Upper Meadow Road;
- Route 121 west of Saxtons River Village;
- Rockingham Road north of Bellows Falls Village;
- Westminster, Barker, Front and Prospect and Hyde Streets in Bellows Falls;
- Between Playground Street and Burt Street in Bellows Falls
- NE Central south of the tunnel under the Square;
- Brockways Mills Road slide;
- Green Mountain RR north of Canal Street in Bellows Falls; and
- along the Williams River.

There is an additional area of recent landslide concern at Imtec Drive which is impacting some businesses on that Road; this is a big potential slide. There is also a large slide on Route 121. Between the Rec Center and Burt Street is another slide, coming off the Rec Center onto Playground Road (pictured on prior page).

The Brockways Mills Road slide is the biggest one right now in Rockingham and it is pictured below. The slide occurred due to the rains on July 29, 2021 and is located on Brockways Mills Road. Prior to the landslide this area was a wooded hillside. It is pictured here. The home at the top of the slide is currently undergoing a FEMA funded buyout due to the slide.



The Brockways Mills Road landslide is 100 feet high and is 87 feet wide at the top. The overall angle down to the river is 32 degrees, with the upper portions approximately vertical. This is a rotational earth slide/flow. Bedrock is exposed at the river level, and on both sides of the landslide partway up the slopes. About 50 feet up from the base, was observed dense clay-silt matrix till. At 73 feet above

the river, this is overlain by stiff silt-clay lake deposits. Water was seeping out of the face in these units. The upper portion was too dangerous to examine closely, but it appears that the upper 8 to 10 feet of material consists of pebbly sand with a body of loose pebble gravel on the northwest side. The site is within the water level of glacial Lake Hitchcock and we interpret the silt-clay deposits to be lake bottom deposits. The overlying pebbly sand may also have been deposited in the lake, while the pebble gravel may have been deposited by a stream channel that cut into the lake sediments after the lake had drained.

The landslide has taken place within a gully that is clearly the site of earlier slope failures. This

feature is shown in detail in the LiDAR data, which was collected in 2015 for this part of Windham County. However, on color orthophotos taken in 2019 the site of the landslide appears to be vegetated. This also appears to be the case on 2015 color orthophotos. The recent slope failure may be a re-activation of a pre-existing, but long dormant landslide. The cause of this recent failure is probably high groundwater levels due to heavy rains that fell throughout July 2021.¹¹

Sources used

Local town knowledge, AT ANR landslide map, Vermont State Geologist.

Invasive Species: Plants and Insects

Invasive plant 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.

An invasive species can be defined as **an exotic species whose introduction into an ecosystem in which the species is not native and causes or is likely to cause environmental or economic harm or harm to human health**¹². Another definition is **an exotic species that colonizes both disturbed and undisturbed habitats**¹³. For an example of the second definition not being met, Coltsfoot (*Tussilago farfara*) is usually only found in disturbed areas in Rockingham, mainly on the edges of unpaved roads. Thus, it is not considered invasive here, since it is rare in undisturbed woods.

In contrast. Burningbush (*Euonymus alatus*), an invasive shrub often planted in local yards, has its seeds carried by birds to nearby woods, where they grow well in those undisturbed areas, crowding out native plants. The homeowner with them in their yard may not realize this spread is happening. (See photo)



Burning Bush, vtinvasives.org

Keep in mind that “exotic” may be hard to define. For example, Black locust (*Robinia pseudoacacia*) is native to the US, mainly in and near the Ohio River Valley, but it is not native to Vermont. It was brought here by settlers who planted it mainly to use for fence posts. It spreads rapidly to undisturbed woods, so it is considered invasive in Vermont.

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

¹¹ Information on the Brockway Mills Road landslide provided by forwarded email sent from Vermont State Geologist to landowner Jordan Keating, 1/6/2022.

¹² (USDA) https://www.nrcs.usda.gov/wps/portal/nrcs/detail/ct/technical/ecoscience/invasive/?cid=nrcs142p2_011124

¹³ CT Invasive Plant Working Group, <https://cipwg.uconn.edu/criteria-for-listing/>

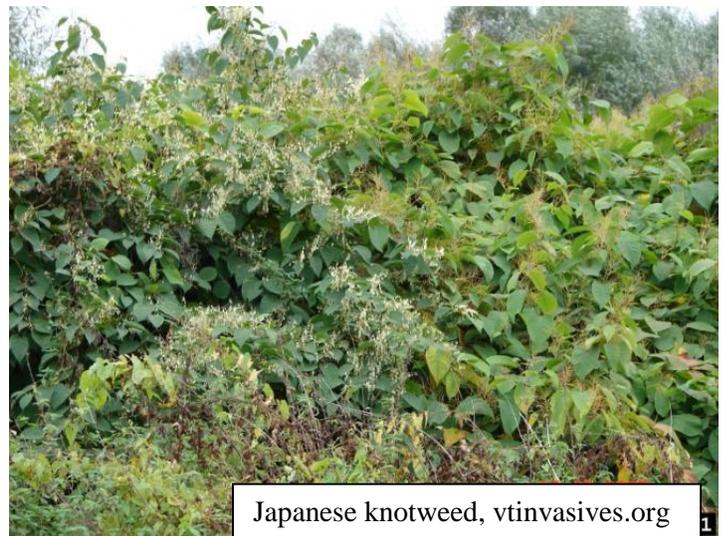
disturbed areas. Within the Windham region, they are more prolific in the towns along the Connecticut River than they are to the west, because the eastern towns are more populated, contain major transportation routes such as I-91 and the rail corridor, which serve as vectors for their expansion, and 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, US Route 5 and VT Routes 103 & 121 in Rockingham are also highways for the spread of invasives. Waterways and riparian areas are also corridors that invasives can overtake and spread along.

Particular invasive plant concerns for Rockingham are listed in two groups based on their estimated threats to natural and hard infrastructure. All (except spindle tree) are quarantined, Class B Noxious Weeds in Vermont¹⁴.

Group A—Higher threats to infrastructure

1. There are heavy infestations of Japanese Knotweed (*Fallopia japonica*) along the Connecticut, Williams, and Saxtons river banks, as well as the lower reaches of several brooks, such as Signal Hill Brook in Saxtons River. It leaves shorelines susceptible to erosion because there is no other vegetation stabilizing the stream bank (Basin 11 Management Plan, Preliminary Draft 2007). TS Irene both (1) eroded stream and river banks, removing many riparian trees, and (2) moved fragments of knotweed to new areas, thus allowing knotweed to flourish on the bare soil left in its wake.



2. Asiatic (Oriental) bittersweet (*Celastrus orbiculatus*), an aggressive climbing vine that can smother trees, utility poles, and buildings.
3. Amur, Morrow's, Tartarian, and Bell's honeysuckle (*Lonicera mackii*, *morrowii*, *tatarica*, *x bella*)
4. Japanese & Common barberry (*Berberis thunbergii* & *B. vulgaris*), which promote Lyme disease by harboring high populations of deer mice, one of the intermediate hosts of deer ticks.
5. common and glossy (European) buckthorn (*Rhamnus cathartica* & *R. frangula*), which slow forest regrowth.
6. Burningbush (*Euonymus alatus*)—still a common ornamental in yards, spreading to woods via birds that eat the low-value fruit, little wildlife value, should be excavated.
7. Water chestnut (*Trapa natans*)—found recently in Albees Cove and nearby CT River shallows. Displaces native aquatic plants, can block boat traffic.

Group B—Lesser threats to infrastructure

8. Mile-a-minute vine (*Persicaria perfoliate*), on Federal invasives list that is included in

¹⁴ Vtinvasives.org is the primary website for information. This list was developed by Peter Bergstrom of the Rockingham Conservation Commission. Email dated 8/21/2021.

state list. Considered a “watch list” species in VT, but it is common in Rockingham and can cover other plants as well as hard infrastructure.

9. Garlic mustard (*Alliaria petiolate*) is common along roads and in fields and riparian areas in Rockingham, and can invade forests.
10. European spindle tree (*Euonymus europaeus*)-locally problematic, along Westminster St. in Saxtons River, and along Bridge St. & Mill St., Bellows Falls. Not on VT invasives list; suggested for addition to it. Very hard to control. You can buy seeds on eBay.
11. Goutweed (*Aegopodium podagraria*)—Highly invasive, has solid green leaves, or variegated green & white leaves. Very hard to control.
12. Norway maple (*Acer platanoides*)—very common along streets and in yards, inhibits growth of nearby plants spread widely by seeds to nearby woods, little food or habitat value to wildlife. Should not plant any new ones. Provides good breeding habitat for Asian long-horned beetles (ALB).
13. Common reed (*Phragmites australis*)—more in wetlands than riparian areas, not sure of distribution in Rockingham.
14. Purple loosestrife (*Lythrum salicaria*)—small patch at Cold Springs in the BF Riverfront Park.
15. Yellow flag iris (*Iris pseudacorus*)—wetland plant, not sure how much we have.
16. Amur maple (*Acer ginnala*)-- not sure how much we have.
17. Tree-of-heaven - not sure how much we have. Looks very similar to sumac and walnuts (black and butternut) but has smelly leaves when crushed, and smooth leaf margins except at the base.

Seven groups of invasive plants found in Rockingham, listed below, are thought to pose the highest threat to native and/or hard infrastructure. Barberry is also a human health threat (Lyme disease).

Common name	Latin name	Locations	Threats	Control
Japanese Knotweed	<i>Fallopia japonica</i>	Banks of all 3 rivers and many brooks	Can grow through asphalt, into basements, and block trails; more likely to wash out than natives	Mowing (endless), repeated cutting & digging (3-10 years), mesh?
Asiatic (Oriental) bittersweet	<i>Celastrus orbiculatus</i>	Roadsides, other disturbed areas	Can cover utility poles, buildings, trees; displaces natives	Excavation including roots
common and glossy (European) buckthorn	<i>Rhamnus cathartica</i> & <i>R. frangula</i>	Clearcuts, woodland edges	Prevents regrowth of native trees	Excavation including roots
Japanese & Common barberry	<i>Berberis thunbergii</i> & <i>B. vulgaris</i>	Planted shrub, escapes to woods	Increases deer mice which harbor deer ticks with Lyme	Excavation including roots

			disease	
Burningbush	<i>Euonymus alatus</i>	Planted as ornamental, birds spread seeds to woods	Displaces native shrubs	Excavation including roots
Amur, Morrow's, Tartarian, and Bell's honeysuckle	<i>Lonicera mackii, morrowii, tatarica, x bella</i>	Planted as ornamental, birds spread seeds to woods	Displaces native shrubs	Excavation including roots
Water chestnut	<i>Trapa natans</i>	Albees Cove and nearby, CT River	Displaces native aquatic plants, can block boat traffic	Hand pulling from paddle craft

Elevations generally below 1,500 feet (which includes all of Rockingham) are most susceptible to invasive species, although 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. Below are some examples of how invasive plants are impacting Rockingham:

Natural infrastructure

1. Japanese knotweed is threatening to overtake hiking or biking trails next to it, including the Bellows Falls Riverfront Trail and portions of the Saxtons River Valley Trail. Some hikers are reluctant to use a trail when the knotweed appears to block it, even if the trail is actually open.
2. Water chestnut (a floating-leaf aquatic plant) was found in Albees Cove (near Joy Wah) in 2021, and it threatens to make boating in that cove (and any other to which it spreads) of less value for fishing, since it clogs boat propellers, and hinders the use of paddle craft when it is dense.
3. Common & Glossy buckthorn is colonizing clear-cut forest areas and may be preventing regeneration of other species.
4. Invasive vines such as Oriental bittersweet can cover and eventually kill a tree.
5. Invasive tree pests are killing some of our valuable trees such as ash and hemlock.
6. European spindle tree is highly invasive and displaces native species. Digging out its roots with an excavator seems effective, but the materials removed must be burned or otherwise destroyed so they will not spread to other areas. It is present in several yards along Westminster Street and Clark Court in Saxtons River, and has been found along the Riverfront Trail in Bellows falls, south of the wastewater plant. It probably occurs elsewhere in Rockingham.

Hard (human) infrastructure

1. Any human structures near Japanese knotweed are vulnerable to invasion by its stems. It can spread up to 30 feet underground, and come up through asphalt. The main example that comes to mind is the Bellows Falls Wastewater Treatment Plant at 80 Mill Street, with dense stands of knotweed on its east (river), west (railroad), and south sides. Regular mowing is used to keep knotweed out of the plant and its asphalt, but shoots

sometimes come up through the asphalt.

2. Roadside trees killed by invasive insect pests can fall and damage roads, utility lines, and human structures, and cause accidents. Some towns (such as Guilford) are mapping their roadside ash trees and identifying the ones that are highest priority of removal due to these risks.
3. Invasive vines can cover utility poles and make servicing the lines, transformers, and junction boxes on them very difficult.

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-site¹⁵.

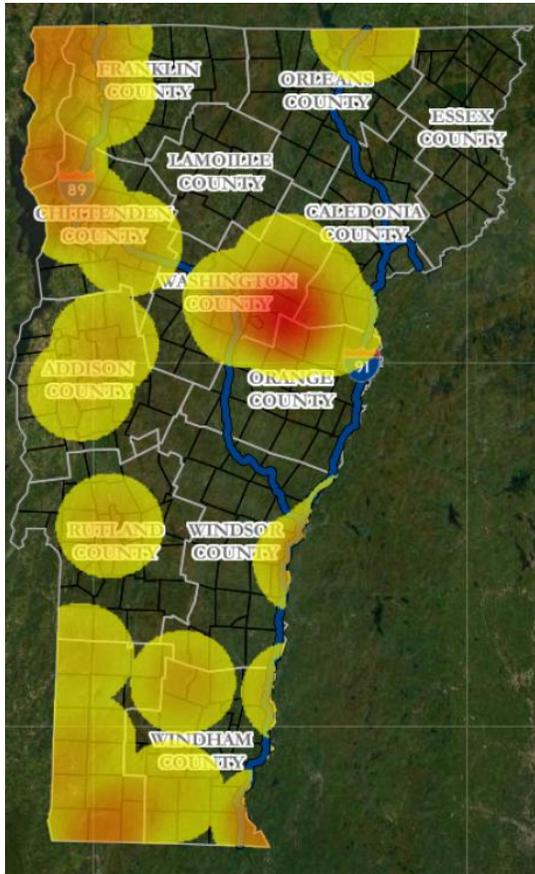
VTinvasives.org is a great resource for towns interested in engaging in activities around invasives, including using their template to develop a custom invasive species plan for your town. The idea is to continue to create as much awareness as you can so residents know who to call when they see things. The sooner an outbreak is found, the better the chances of containment. Bio-controls are being worked out currently but aren't yet a solution. Insect pests are often found first by concerned citizens, members of the Conservation Commission, arborists and foresters.

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. Initially discovered in Orange County in February 2018, Emerald ash borer (EAB) has been spread quickly and as of this writing been determined to be in orange areas on the map. 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 invasive insects.¹⁶

¹⁵ 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

¹⁶ vtinvasives.org (accessed 2/20/15)



Map provided by VTinvasives.org and current as of 8/24/2021.



Emerald ash borer (shown above)

Emerald ash borer (EAB), *Agrilus planipennis*, is an exotic beetle that was discovered in southeastern Michigan near Detroit in the summer of 2002. The larvae feed in the cambium between the bark and wood, producing S-shaped galleries that girdle and kill branches and trees. Emerald ash borer probably arrived in the United States on solid wood packing material carried in cargo ships or airplanes originating in its native Asia. It first came into Detroit and killed off all the ash trees in the city, which had been planted after the city’s elm trees had been killed by Dutch elm disease. The United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) does inspections at ports and terminals, but only inspects about 7% of materials coming into the US. Emerald ash borer has spread rapidly in the United States, killing millions of trees. Emerald ash borer has been

confirmed in nearby New Hampshire, putting Rockingham within a 10 mile area of an active infestation. EAB has also been confirmed in other towns within the Windham Region. Rockingham is now entirely covered under what VTinvasives.org calls the “Slow the Spread Movement”. Carefully planning and managing the movement of infested or potentially infested material will slow the spread and provide greater protection for uninfested forests. EAB is currently present in 33 states (most recently in Maine).

White ash is one of the ten most common tree species in Vermont, so this insect will have a major impact in Vermont. EAB only feeds on Ash trees, but that is 7% of Vermont’s tree species. EAB can travel faster than Asian longhorned beetle. 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.¹⁷

A native ground-nesting wasp, *Cerceris fumipennis*, is providing a handy solution to the EAB 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 placed in Rockingham by the State ANR to catch the EAB for early detection; none have been detected thus far.

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.



HWA is present in Rockingham. 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 yet 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.

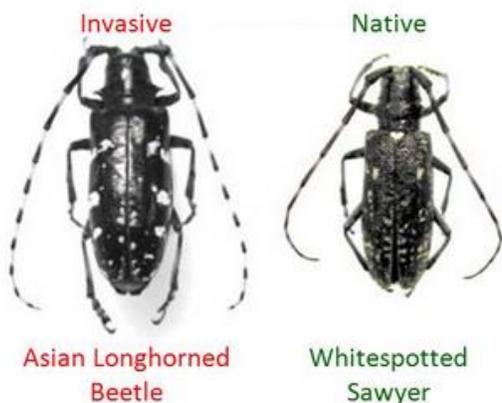
Hemlock trees and even whole stands are showing signs of decline, but trees in Vermont have not been reported to have been killed from HWA alone. Foresters have been watching infested trees for eight years, and the trees haven't been killed yet most likely because winter

¹⁷ 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.

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 fungi 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 beetle¹⁸

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 Worcester County, Massachusetts in 2008. And they have an active quarantine and public notification campaign about the pest.¹⁹ 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 effect 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.

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 in winter because of the cover a healthy tree provides, so there could be a detrimental impact to the deer population, and hunting, caused by the loss of hemlock. Hemlocks provide shade to waterways, so their loss could mean warmer streams and lower water quality, potentially impacting aquatic life. The

¹⁸ <http://www.maine.gov/dacf/php/caps/ALB/ALBdamagepics.shtml>

¹⁹ <http://www.worcesterma.gov/city-manager/asian-longhorned-beetles>. Accessed 3/2/15.

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. Ash trees are about 12% of the forest cover in Vermont, and there are pockets of lots of ash in Rockingham. The greatest density of ashes (mostly green ash) occurs on Atkinson and its side streets. In Saxtons River, there is a cluster of roadside white ash on the north side of Main Street just east of Pleasant Valley Road, and several are scattered along Mill, Maple, and River Streets. There is also a large open-grown one on Vancor. It does not appear that Saxtons River got the plantings of roadside green ash that Bellows Falls did, after the elms died of Dutch elm disease²⁰. Rockingham has not done an ash tree survey to know where vulnerable trees are located. They have also not completed an EAB plan. Interested private citizens can obtain purple traps for assistance with early detection of EAB on their property. The Tree Warden has been checking individual ash trees in Bellows Falls & Saxtons River for the past 18 months. No evidence has been found of EAB infestation so far.

The loss of maple trees to ALB, could mean a devastation to the maple syrup industry, which is a big industry in Vermont, including in Rockingham. A lot of people sugar, 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 is a big draw for visitors to Vermont. The loss of "leaf peepers", who are a driver of the tourism economy for the area, would have a negative economic impact.

The Rockingham Conservation Commission has policies related to preventing the spread of invasive species:

1. No one should plant or move highly invasive plants in or out of Rockingham, including any part of the plants, either alive or apparently dead.
2. Safe methods (mechanical, if possible) to remove these highly invasive plants should be used where they threaten either natural or hard (human) infrastructure. The safety of using glyphosate to remove Japanese knotweed and other invasive plants is still unclear.
3. No one should move firewood in or out of Rockingham, since it may include invasive insect pests (EAB, ALB, HWA, and others).

Probability

As mentioned earlier in this section, emerald ash borer and hemlock wooly adelgid are currently known to be present in the state of Vermont. Asian longhorned beetle has been found within fifty miles of Vermont's border. Rockingham's proximity to a known EAB infestation area makes them highly susceptible to EAB. HWA has been confirmed in Rockingham and 13-14 other towns in the Windham region. Additionally, certain invasive plant species are present in every town in the region.

Extent

²⁰ Note in email from the Conservation Commission, 1/6/2021.

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 is 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. Green Mountain Power expects EAB to severely impact their grid over time, so they are proactively removing vulnerable Ash trees near their power lines in confirmed affected areas. Areas that haven't been confirmed must contract for tree removal for trees they are concerned with.

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 Worcester County, Massachusetts. This problem has been going on since 2008, although upon detection it was well established, as much as 15 years went by before it was discovered. The Massachusetts ALB Cooperative has confirmed a regulated area of 110 square miles, which has been expanded over time from the original 17 square miles considered infested. This area is under strict regulation by order of the Commonwealth of Massachusetts, no one can cut, move, harvest, carry, transport or ship firewood, green lumber and other material within or outside of the affected area unless authorized. These are significant restrictions, so the impact of ALB detection should be taken very seriously as it affects numerous hardwood species.

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 Rockingham. Invasive plants are present in Rockingham. 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. 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 is a frequent occurrence in Rockingham as approximately 8% of the town land parcels are in the Current Use program, this includes 14,128 acres. Current use qualification requires 25-acres minimum to be enrolled in the forestry program. Many parcels are in the range of a hundred acre or more. Forestry is the dominant enrollment in Rockingham (which allows for up to 20% to be open ag land in the property). Logging is recognized as an important industry in Rockingham 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.²¹ The idea is to continue to create as much awareness as you can so residents know who to call when they see things. The sooner an outbreak is found, the better the chances of containment. Bio-controls are being worked out currently but aren't yet a solution. Insect pests are often found first by concerned citizens, arborists and foresters.

Sources Used

Invasive plant lists from Peter Bergstrom of the Rockingham Conservation Commission, send 8/21/2021; Email with VT State Forester Jim Esden on 2/21/20 (802-885-8822 or jim.esden@vermont.gov); Email with Windham County Forester Sam Schneski on 2/21/20 (sam.schneski@vermont.gov); Interview with Windham County forester Bill Guenther on 3/2/15 (802-257-7967 or bill.guenther@vermont.gov); Interview with First Detector Jordan Fletcher on 4/29/15; VT Fish and Wildlife website; VTinvasives.org; Cerceris.info webpage; Maine Forest Service webpage²²; Images courtesy of Google images and Maine Forest Service.

ASSESSING VULNERABILITY

National Flood Insurance Program (NFIP) Participation and Compliance

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 FEMA designated 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.

²¹ < <http://www.vtinvasives.org/tree-pests/community-preparedness> >

²² http://www.maine.gov/dacf/mfs/forest_health/invasive_threats/index.htm

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 FEMA designated floodplain. In 2012, Congress passed the Biggert-Waters Flood Insurance Reform Act to reduce subsidies for structures built before the NFIP was instituted (called pre-FIRM structures). Over 50 percent of Vermont's NFIP policies are pre-FIRM, which means that flood insurance premiums for many will increase over the ensuing years.

While the NFIP floodplain management criteria are administered by states and communities through their floodplain management regulations, FEMA's role is to provide technical assistance and to monitor communities for compliance with the minimum NFIP criteria. Rockingham, including the Village of Saxtons River, joined the NFIP on May 15, 1980 and is a member in good standing (CID 500135). Bellows Falls Village is separately enrolled in the NFIP and joined 7/16/1979 (CID 500125). The latest floodplain ordinance, for the Town and both Villages, was adopted in 2011 and is within the zoning 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 Zoning Administrator also serves as the Floodplain Administrator and reviews all development to determine if it is located in any floodplain boundaries. If so, the Administrator reviews the application to ensure that all relevant regulations are proposed to be adhered to and does any needed inspections before working with the Development Review Board or issuing a permit. ANR has 30-days to review all applications in floodplain boundaries and may offer comment to the town. ANR review opportunity is required before the town can issue a permit, and serves as a second technical review of applications which can assist the town in deciding whether to issue or deny a permit.

The latest record indicates that there are 12 active NFIP policies in Rockingham, and 1 policy in Bellows Falls. These policies have a total value of \$3,113,500²³. There have been four NFIP claims filed in Rockingham since joining, with a total payout of \$285,113. There are 2,173 major buildings in Rockingham. There are 54 buildings in the Special Flood Hazard Area (SFHA) only, 82 in the river corridor only, and an additional 17 that are in both the SFHA and the river corridor. This totals to 153 floodprone buildings in the Town, only 8% having flood insurance coverage. The wastewater treatment plant is in the SFHA. The Saxtons River Fire Station is in both the SFHA and the river corridor. The map showing the location of these buildings is on the following page. The floodplain administrator in Rockingham also serves as the Zoning Administrator.

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.

Repetitive Loss Properties

Rockingham and Bellows Falls have no repetitive loss properties.²⁴ 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 1978.²⁵ 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

²³ NFIP policy report, updated June 26, 2018:

https://floodready.vermont.gov/sites/floodready/files/documents/cisrpt_NFIP%206.26.18.PDF

²⁴ Repetitive loss report, updated June 26, 2018:

https://floodready.vermont.gov/sites/floodready/files/documents/cisrpt_RL%206.26.18.PDF

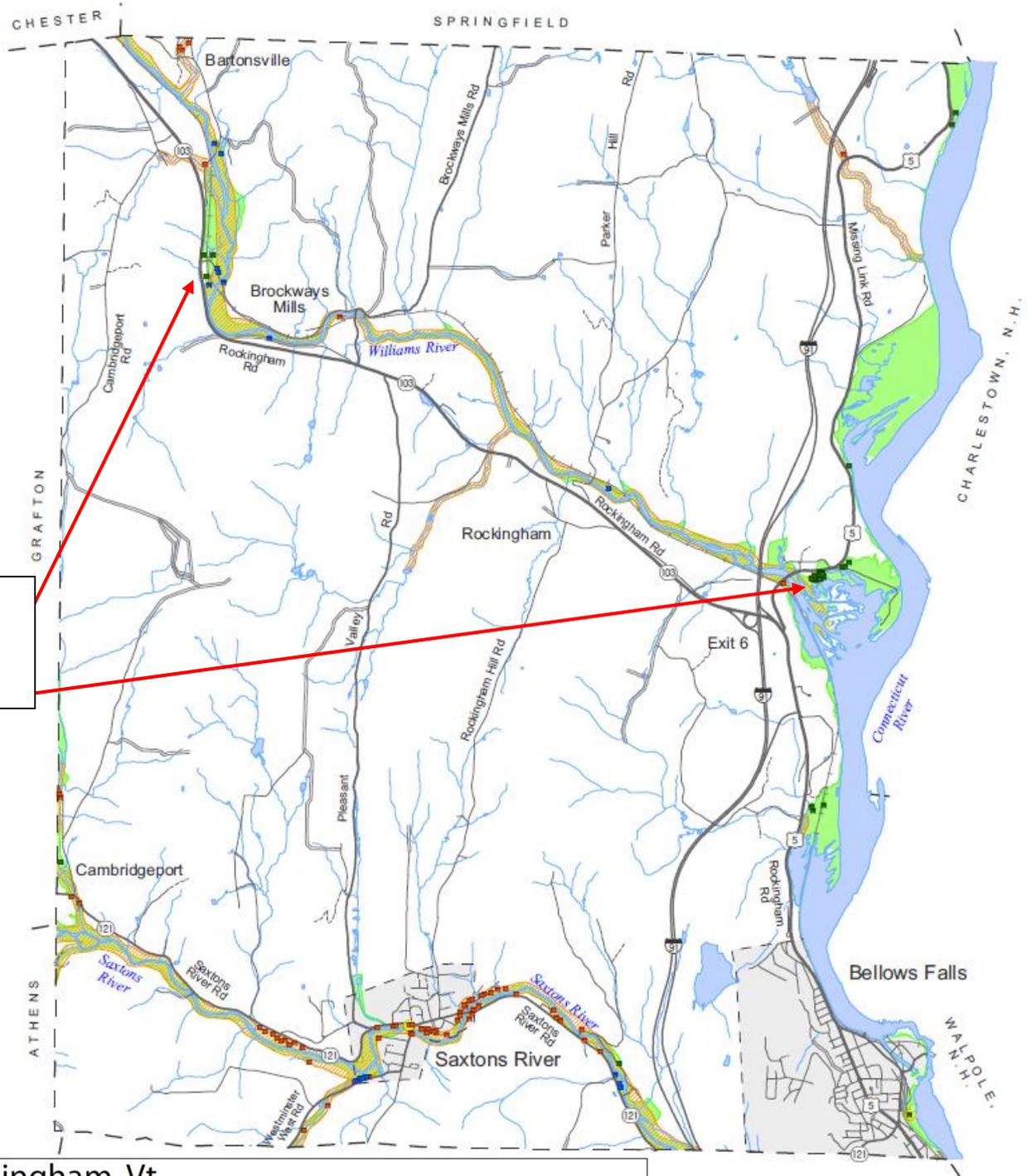
²⁵ <https://www.fema.gov/national-flood-insurance-program/definitions>

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.

Risk Assessment

The map here shows the location of the buildings in the SFHA and the River Corridor. The map shows that most of the affected buildings are in Saxtons River, with a concentration at the mouth of the Williams River. Bellows Falls is surprisingly less affected. See the inset map on the next page for more detail of the Saxtons River area.



Concentrations of buildings in the SFHA only

Town of Rockingham, Vt.

-  Mapped River Corridor
-  Special Flood Hazard Area (SFHA)
-  Major building in SFHA only
-  Major building in River Corridor only
-  Major building in both SFHA and River Corridor
-  indicates a town facility (WWTP, fire station)



Saxtons River, shown above, is where the majority of flood-prone buildings in Rockingham are located. Most of the buildings, shown in red squares, are located just in the River Corridor.

The Town has identified a number of properties and municipal infrastructure that they consider vulnerable and they are listed here:

Town of Rockingham vulnerable properties:

POTENTIAL HAZARD	TOWN OF ROCKINGHAM LOCATIONS
	MUNICIPAL PROPERTIES:
Ice storm	Rockingham Meeting House 11 Meeting House Rd., Rockingham
Flood, hurricane	Worrall Covered Bridge, Williams Rd., Rockingham Hall Covered Bridge, Hall Bridge Rd., Rockingham Lower Bartonville Covered Bridge, Lower Bartonville Rd., Rockingham Parker Hill Rd. bridge, Rockingham Brockways Mills Rd. bridge, Rockingham Barbers Park Rd. bridge, Rockingham McBride Rd. bridge, Rockingham
Flood, hurricane	Large culvert, Westminister West Rd. Culverts along Rte. 121/Saxtons River Rd. west of Saxtons River Village Shepard Lane culvert, Saxtons River Village and Rockingham
	PRIVATE PROPERTIES:
Ice storm, blizzard, high winds	Entire Town and both residential and nonresidential structures.
Flood	Residential and nonresidential structures along the Saxtons, Williams and Connecticut Rivers. Including low lying areas in Cambridgeport, Bartonville and along Barbers Park Rd.

Bellows Falls Village vulnerable properties:

POTENTIAL HAZARD	BELLOWS FALLS VILLAGE LOCATIONS
	MUNICIPAL PROPERTIES:
Ice storm, high winds	Town Hall, 7 Square, Bellows Falls
Flood	Waypoint Center 17 Depot St., Bellows Falls
Flood	Wastewater Treatment Plant, Mill St., Bellows Falls
Flood	Bridge St. bridge, Bellows Falls Depot St. bridge, Bellows Falls
Flood	Pump station, 20 Depot St., Bellows Falls
Flood	Hyde Hill Brook storm drain system, Bellows Falls
Flood	Pump station, 29 Canal St., Bellows Falls
Flood	Minards Pond dam, Pond Rd., Bellows Falls
	PRIVATE PROPERTIES:
Winter or Ice storm, high winds	Entire Village and both residential and nonresidential structures.
Flood	Residential and nonresidential structures along Canal, Depot, Bridge, and Mill St. and the Square.
Winter or Ice Storm, high winds	Riverview, 73 Westminster St. (senior housing) Rockingham Canal House, 45 Rockingham St. (senior housing) Sterling House, 33 Atkinson St., (Asst. Living) (all vulnerable populations).
Flood	Great River Hydro hydroelectric dam and plant, Connecticut River at Bellows Falls, and Mill Street, Bellows Falls VT
Flood	New England Central Railroad tunnel, under the Square in Bellows Falls and adjacent to canal.
Flood	New England Central Railroad bridge over canal in Bellows Falls

Saxtons Rivers Village vulnerable properties:

POTENTIAL HAZARDS	SAXTONS RIVER VILLAGE LOCATIONS
	MUNICIPAL PROPERTIES:
Flood	Municipal Building and Fire Station, 44 Main St., Saxtons River
Flood	Main St. bridge, east side, Saxtons River Main St. bridge, west side, Saxtons River Centennial Bridge, Westminster St., Pleasant Valley Brook. Oak St. bridge, Signal Hill Brook Pleasant St. bridge, Signal Hill Brook Burk Hill St. bridge, Saxtons River Hatfield Lane bridge, Signal Hill Brook
Flood	Shepard Lane culvert, Saxtons River Village and Rockingham
Flood	Saxtons River Wastewater Treatment Plant, 21 Plant Rd., Saxtons River
Flood	Saxtons River Recreation Center dam and trout pond dams, Pleasant Valley Rd., Rockingham
	PRIVATE PROPERTIES

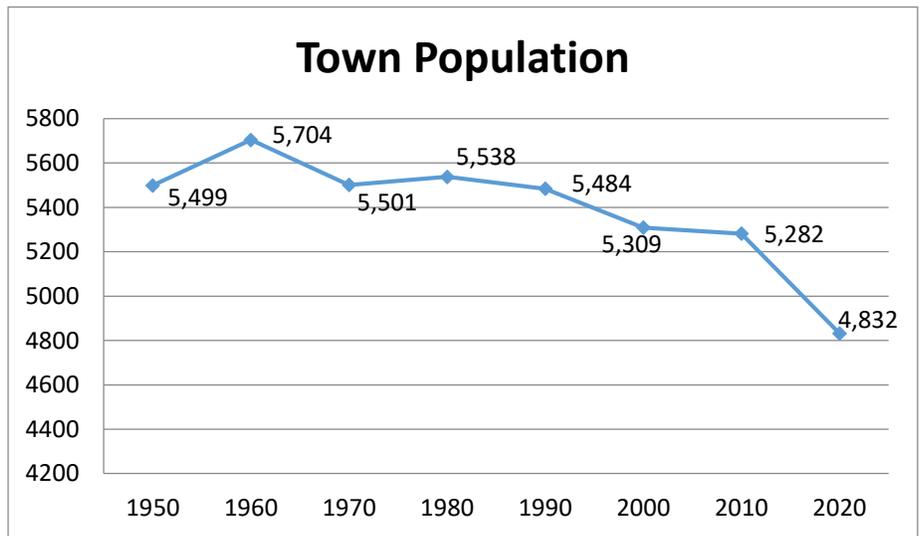
Flood	Residential and nonresidential structures along Oak, Mill, River, and Main Sts. and Westminster West Rd.
Winter or Ice storm, high winds	Entire Village and both residential and nonresidential structures.
Winter or Ice storm, high winds	Vermont Academy, Shepard Lane (boarding school (vulnerable population))

The Hazard Mitigation Plan, per FEMA standards, deals with natural events. However, it should be noted that in Rockingham, a major concern is a hazmat incident related to a fixed site or possible transportation accident. As mentioned in the beginning of the plan, two railroad tracks run through the center of Bellows Falls Village. Specifically, one of the railroad tracks passes through a tunnel under major buildings in the village center. Residential housing in such close proximity to the tracks is a concern. While the text of this document does not deal with man-made events, the Town is aware of the vulnerability of the downtown area of Bellows Falls Village should a derailment occur.

Vulnerability Assessment and Population Trends

There are some population trends in Rockingham that could affect hazard mitigation and emergency management.

The town’s population did decline from 5,282 in 2010 to 4,832 in 2020, a loss of 8.52%. The population of the Town as a whole has been generally declining since 1960. However, most of that decline was from the two villages, Bellows Falls and Saxtons River. Rural Rockingham (all of Rockingham outside the two villages) actually saw a 2.36% gain in population, from 1,569 to 1,606, between 2010 and 2020.



Although population figures are not available since 2020 and the pandemic influence, there is a sense that in the Town that the population is now on an upward trajectory. Anecdotal evidence is that a number of people have moved to our region from northeastern US urban areas in response to the COVID-19 pandemic. Many of those people have been able to keep their jobs by working remotely, and now realize they can enjoy an urban-based income while living in Vermont. The local real estate market supports this assumption; prices have risen sharply and homes are sold almost as soon as they are listed.

Looking ahead, it would seem a more significant factor for in-migration than COVID is climate change. The *2018 Vermont State Hazard Mitigation Plan*²⁶ states:

“Another climate change concern in Vermont is the potential for climate refugees. As portions of the U.S. become more arid and as sea levels continue to rise, Vermont may

²⁶ <https://vem.vermont.gov/plans/SHMP>

begin to see significant increases in population. One study on sea-level rise displacement projects over 4,000 migrants to Vermont from across the U.S.... This study does not account for people moving from increasingly arid areas within the U.S. or from outside of the U.S., which may also increase net immigration. Based on the unpredictable nature and potential impact of an influx of climate refugees into the State, the Steering Committee decided to acknowledge climate refugees as a potential future hazard facing Vermont, to be reassessed during the next SHMP update.”

There is no way to accurately predict the number of people who will ultimately move to Vermont because their part of the country or of the world has become uninhabitable. But we know we already have some people in our area who have moved here because of climate change concerns. One local resident, who moved to Vermont from Mississippi about a decade ago, has this to say:

“I have deep Mississippi roots and spent years living in the state as well as Louisiana, but I never quite got used to the oppressive heat which was getting worse. It was an odd feeling to have stretches of 100+ degree days with near 100 percent humidity concurrent with serious drought conditions. And then there was the seeming increase in tornados – especially during the winter months – that could ostensibly distribute entire neighborhoods and small towns across the landscape, and just violent storms in general. Living there was increasingly inhospitable, at least for my tastes, so the north country’s call only became stronger.”

Now that people are experiencing heat domes, droughts, deadly flooding, extensive wildfires, and sea level rise in other parts of the United States as well as in other countries, it seems very plausible that we will see our population increase significantly due to an influx of climate refugees. It would be prudent to take this into account as we consider the capacity of our emergency shelters, our ability to coordinate emergency responses for additional people, and other aspects of our planning for local hazard mitigation.

Vulnerability Assessment and Hazard Trends

Since the Town of Rockingham's previous Multi-Jurisdiction Hazard Mitigation Plan was adopted in 2015, climate change has become increasingly recognized as a significant factor in our weather and the resulting hazardous events. A significant number of participants at the Let’s Take Action Rockingham town-wide planning meetings in 2019 acknowledged the role of climate change in contributing to hazards, and as a result they formed the organization Sustainable Rockingham. In addition, every Rockingham resident who attended the study groups in August 2021 held as part of the development of this Hazard Mitigation Plan also agreed that climate change is a significant factor in local hazards.

However, the significance of climate change is not simply an opinion held by a certain percentage of citizens. Professionals in the field of hazard mitigation concur. For example, in the Executive Summary of the *2018 Vermont State Hazard Mitigation Plan* (SHMP), the authors urge that our changing climate be considered in planning, including at the local level:

“Warming temperatures, shrinking winters and increasing incidence of intense storm events are beginning to have a significant impact on Vermont’s economy, people and environment and require immediate attention across all planning efforts at the local, regional, state, federal and global levels.”

The Vermont SHMP, on page 44, goes on to say:

“Increasing temperatures are forecasted to have significant impacts on weather-related disasters, which will also increase risk to life, economy and quality of life, critical infrastructure and natural ecosystems. The IPCC [Intergovernmental Panel on Climate Change] notes that the range of published evidence indicates that the costs associated with net damages of climate change are likely to be significant and will increase over time. It is therefore imperative that recognition of a changing climate be incorporated into all planning processes when preparing for and responding to weather-related emergencies and disasters.”

Even the federal government agrees. On the FEMA website <https://www.fema.gov/ja/emergency-managers/national-preparedness/climate-change>, climate change is referred to as “an urgent issue” and its significance in community emergency planning is emphasized:

“The challenges posed by climate change, such as more intense storms, frequent heavy precipitation, heat waves, drought, extreme flooding and higher sea levels could significantly alter the types and magnitudes of hazards faced by communities and the emergency management professionals serving them. Emergency managers should adapt to the impacts of climate change.”

A specific aspect of climate change that makes a trend of increasing hazards more likely is that some of the results of climate change build on one another. The 2018 Vermont SHMP offers us this:

“An example of a concerning compounding impact of climate change is that warming temperatures will allow for increased survivability of forest pests, such as the Emerald Ash Borer. This invasive species can decimate Vermont’s ash population, not only shifting the composition of our forests, but also creating additional debris that may exacerbate impacts of other hazards, such as flooding or wildfire.”

Rockingham is witnessing the damage from heavy rain events that cause not just flooding, but also landslides, when soils, super-saturated by previous rains, cannot contain any further water and give way as slopes collapse. We also can see that fluvial erosion is creating a new landscape in which the invasive species Japanese knotweed becomes dominant over native plants which have better ability to hold soil in place. This creates a cycle of further fluvial erosion as the next precipitation event raises river levels.

The importance placed on climate change by professional and governmental sources, along with the observations of ordinary citizens of our Town, as well as the fact that climate change impacts build on one another, combine to form convincing evidence that climate change has begun to have, and will continue to have, the effect of increasing the frequency, severity, and variety of hazardous events facing us. As we assess the risk of potential future hazards, relying only on the history of past events will no longer be sufficient, as it will be prudent to assume the likelihood of a wider variety of more serious hazards will be higher than past history would indicate.

...Climate change has begun to have, and will continue to have, the effect of increasing the frequency, severity, and variety of hazardous events facing us. As we assess the risk of potential future hazards, relying only on the history of past events will no longer be sufficient...

Mitigation Strategy

Local Hazard Mitigation Goals

The Hazard Mitigation Goals as outlined below were developed by consensus among the emergency management committee during meetings for the town of Rockingham local hazard mitigation plan. This update verified the goals and the group chose to add the highlighted goal listed below.

- 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 the Local Emergency Management Plan
- Ensure that members of the general public continue to be part of the hazard mitigation planning process.
- Increase public awareness of hazards and educate the community in mitigation actions that can be undertaken by individuals, households, and neighborhoods.

Related to the above new goal, citizens participating in the planning process for the 2021 Multi-Jurisdiction Hazard Mitigation Plan of the Town of Rockingham suggested the following items as important information to be periodically disseminated to the public through such means as the Annual Town Report, Town and Town Department websites and social media, public access TV, public service announcements, local newspaper articles, etc.:

- The advantages of receiving notifications from VT-ALERT, and how to sign up;
- How the Town will communicate with the public in the event of a disaster, and whether to shelter-in-place or evacuate to an emergency shelter;
- Information about specific hazards such as wind, inundation, fluvial erosion, hail, severe thunderstorms, snow, ice, extreme temperatures, landslides, drought, and wildfire;
- Suggestions of mitigation actions that can be undertaken by individuals, households, and neighborhoods.

Furthermore, it was suggested that the Emergency Management Director reach out to vulnerable populations and the organizations which support them, including:

- Elders,
- People with disabilities,
- Un-housed people, and
- non-English speakers.

Mitigation Progress since the Last Plan

The following table lists all of the actions in the prior Plan, and the updated status on each. The blue highlighted items continue to be listed, in some fashion, in the future actions listed

further in this updated Plan. Other actions have become ongoing efforts of the Town. A few items have not been completed and their priority has been diminished. Numerous actions have been completed since 2015.

	Action	Responsible Party	Project Priority	Current Status
1	Tree Inventory to determine trees that will affect power lines, Town-wide	Green Mt. Power Co.	High	Ongoing
2	Checking Culverts and under bridges debris jams, Town-wide	Town of Rockingham Road Foreman & Town Highway Supt. Town of Rockingham Road Foreman & Town Highway Supt.	High	Ongoing
3	Have utility lines going into public buildings be buried, rather than exposed on outside of building to weather elements and wind. Town-wide	Town of Rockingham - Selectboard / Bellows Falls Village Trustees/Saxtons River Village Trustees /Rockingham Town of Rockingham - School Board/Town of Rockingham & Bellows Falls Village - Municipal Manager	Low	Not completed. This is not a concern of the Town.
4	Use of FEH mapping of the Saxtons River will influence land use decisions Town-wide	Town of Rockingham - Zoning Administrator	High	The Town consults floodplain mapping in land use decisions.
5	Buy-out of three properties along the Saxtons River that were substantially damaged in TS Irene	Town of Rockingham - Selectboard	High	Completed
6	Improvements to Hitchcock Hill underground drainage system and paving project, Town of Rockingham	Town of Rockingham - Selectboard	High	Completed July 2021
7	Barbers Park Rd. embankment stabilization or relocation, Town of Rockingham	Town of Rockingham - Selectboard	Medium	Completed
8	Rte. 121/Saxtons River Road Embankment stabilization, Town of Rockingham	Town of Rockingham - Selectboard	High	Completed
9	Class 4 Road improvements: culverts, ditches, gravel, Town-wide	Town of Rockingham - Selectboard	Medium	Inventory Class 4 Roads, Turn into Town Trails
10	Relocation & redesign of snowmobile bridge over Saxtons River Town of Rockingham	Snowmobile Club	Low	Gone, trails moved

	Action	Responsible Party	Project Priority	Current Status
11	Culvert replacements - larger size; drainage improvements; hydraulic studies. *Leach Road culverts; *Old Load Road culvert at intersection with Leach Road; *Golden Hill Road; *Oak Street & Acorn St. intersection; *Oak St., east end; *Cambridgeport Rd., south end. *Rockingham Hill Road, north and south ends *Williams Road Town-wide	Town of Rockingham - Selectboard	Medium	Ongoing, Funding Needed
12	Bridge replacements *Cambridgeport Road, south end; *Pleasant St. & Hatfield Lane; *Oak St. west end near Main St. *Green Mt. Turnpike Town-wide	Town of Rockingham - Selectboard	Medium	Funding needed
13	Culvert improvement for Halladay Brook coming out of Minards Pond Bellows Falls Village	Bellows Falls Village - Water Department	Medium	Goal to complete in 2022
14	Update floodplain ordinance to include fluvial erosion bylaw to prevent new development in high risk areas.	Zoning Administrator with assistance from the Windham Regional Commission	Medium	Select Board
16	Future projects to include burying power lines/utility lines hooked into critical facilities such as school emergency shelter and EOC Town-wide	Town of Rockingham - Selectboard/ Bellows Falls Village Trustees/Saxtons River Village Trustees /Town of Rockingham - School Board	Low	Not completed. This is not a concern of the Town.
17	Generators purchased / backup power supply for critical facilities Town-wide	Town of Rockingham - Selectboard/ Bellows Falls Village Trustees/Saxtons River Village Trustees/Town of Rockingham - School Board	High	Town Hall, Blake Street and Rec Center need to be done
18	Training of EMD for Level I certification and Town Officials in ICS 100 & 402 Town-wide	Town of Rockingham - Selectboard and employees/ Bellows Falls Village Trustees/Saxtons River Village Trustees	High	This remains a need with current and new board members and staff.
19	Evacuation plan for Riverview Senior Housing, Bellows Falls Village	Eastland (contact responsibly party for additional information)	High	Completed 2021
20	Evacuation plan for Canal House Senior Housing, Bellows Falls Village	Stewart Property Management (contact responsible party for additional information)	High	Completed 2021

Development of Mitigation Actions and Projects

The Rockingham 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, Rockingham 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 Table

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPAREDNESS	COST EST	PRIORITY	Notes / Status
1	Flooding / Fluvial Erosion / All hazards evacuation	This is owned by the State of NH, however the bridge impacts and is utilized more by the Town of Rockingham. Federal funding will be needed to pay for the replacement. The bridge has been on a NH bridge replacement list for more than 10 years, and it has received no maintenance. There are sewage pipe utilities on the bridge so bridge failure would impact Rockingham and Walpole sewage treatment. Walpole uses Bellows Falls for sewage treatment. Currently closed to traffic due to condition.	Upgrade/replace ment of the Vilas Bridge.	NH DOT and Federal Transport ation Departme nt	Contractor s, Selectboard, VT DOT	2023-2029	Federal grant funding	Mitigation / Maintenance	17.7 million	High	Pending approval of NHDOT to be listed on 2023-2032 10-year Transportation Improvement Plan. Preliminary Engineering - 2023, Right of Way 2026, Construction 2028-2029
2	Flooding / Fluvial Erosion / All hazards evacuation	This is used for traffic and if it failed it would cut off some truck routes to industrial employers, as Depot Street bridge is weight restricted. This is town owned. Rated poor condition and already has weight restrictions on it.	Upgrade/replace ment of Bridge Street bridge.	VT DOT and Federal Transport ation Departme nt	Contractor s, Selectboard,	2023-2028	Federal grant funding	Mitigation / Maintenance	10 million	High	Town is trying to get this on VT 5 year TIP.
3	Flood / Fluvial Erosion	There are 2x 18" culverts that run next to each other and they need to be converted to one larger culvert. This is on the water plant property.	Culvert improvement for Halladay Brook coming out of Minards Pond Bellows Falls Village	Bellows Falls Village - Water Departme nt	Town Highway Departme nt	Spring 2022	Water Department budget	Mitigation	5K	High	
4	Flooding / Fluvial Erosion	Certified Floodplain Manager on staff would benefit the Town.	Town Planner / Zoning Administrator will become Certified	Zoning Administrator		By September 2023, 2 years	Town funds	Mitigation / Preparedness	Low	High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
			Floodplain Manager.								
5	Flooding / Fluvial Erosion	The Town needs to own a second excavator.	Purchase of a second Cat 311 (or similar type) excavator.	Highway Superintendent	Town Manager	2022 ideally	ARPA funds; other grant funding; town funds	Mitigation / Preparedness	200K	High	The Town has been needing to rent a second one to handle debris removal during and after storm events.
6	Flood	Not having a vactor truck means the town has to rely on contractors to clean out storm drains after events, and this is very expensive.	Purchase of a vactor truck.	Highway Superintendent	Town Manager	2023 ideally	ARPA funds; other grant funding; town funds	Mitigation / Preparedness	400-500K	High	
7	Flooding / Fluvial Erosion / Landslide	Increased incidence of heavy rain and snow events are causing more runoff than the existing stormwater drainage systems in the villages are able to handle.	Review surface drainage patterns and correct deficiencies within the stormwater drainage systems. Town is in the process of working on a stormwater planning process town; Imtec Lane is a high priority area; erosion happening off of recreation area is another priority area.	Highway Department	Town Planner, , Selectboard, Village Trustees	1-2 years to complete	Town budget	Mitigation	Medium	High	town is also looking to implement more green infrastructure

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
8	Fluvial Erosion, Inundation Flooding	Floodwaters move debris from high in the watershed of Hyde Brook to the headwall above Hyde Street, blocking the catchment basin and causing floodwaters to flow over and around the headwall and thereby inundating 20 to 30 homes in the Hyde, Laurel, Wells Streets neighborhood.	Town is looking to do upgrades above Hyde Hill Brook to divert water above Hyde Street, and move it towards Griswold Drive where there is more adequate system to handle flow. Engineering study is needed.	Highway Superintendent	Town Manager, Contracted Engineer, Town Planner, Selectboard	2021 for study; implementation thereafter in 2022	FEMA mitigation grant, ARPA funds	Mitigation	Medium	High	5-10 year goal is to have an upstream detention pond.
9	Flooding/ Fluvial Erosion	During most/every flash flood event these culverts are overtopping or washing out. They are all undersized.	Culvert upgrade to culvert number 33 at Cambridgeport Road, south end. Upgraded from a larger concrete box culvert that is in deteriorated condition.	Highway Superintendent	Town Manager	The Town hopes to complete one or two of these projects per year, expecting that the totality will take up to 10 years to complete all. Each project takes a couple of months to complete between design, bidding and construction.	Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	Highway Superintendent needs to get a hydraulic study from Vtrans.
10	Flooding/ Fluvial Erosion		Culvert upgrade to culvert number 56 on Pleasant Street. Upgraded from a larger concrete box culvert that is in deteriorated condition.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	Highway Superintendent needs to get a hydraulic study from Vtrans.
11	Flooding/ Fluvial Erosion		Culvert upgrade to culvert number 2 on west end of Oak Street. Upgraded from a stone culvert that is in deteriorated condition.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	Highway Superintendent needs to get a hydraulic study from Vtrans.

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
12	Flooding/ Fluvial Erosion		Culvert upgrade to culvert number 1 on Green Mountain Turnpike. Upgrade to metal culvert that is in deteriorated condition.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	Highway Superintendent needs to get a hydraulic study from Vtrans.
13	Flooding/ Fluvial Erosion		Leach Road culvert upgrades - three box culverts, 29, 34, and 35. Converting three undersized metal culverts to upsized concrete box culverts.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	Each of these are complex and time consuming in and of themselves, and require bypasses.
14	Flooding/ Fluvial Erosion		Golden Hill Road culvert number 7. This is converting a metal culvert to a larger capacity culvert.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	
15	Flooding/ Fluvial Erosion		Upgrade culvert # 52 on route 121. This is a metal culvert that needs converted to larger concrete box culvert.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	
16	Flooding/ Fluvial Erosion		Upgrade culvert # 38 on route 121. This is a metal culvert that needs converted to larger concrete box culvert.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
17	Flooding / Fluvial Erosion		Rockingham Hill Road culvert upgrade to culvert #50. This is 18" round plastic round culvert that needs to be upsized.	Highway Superintendent	Town Manager		Grant funding in combination with annual town budget set aside	Mitigation	Medium	High	
18	Flooding / Fluvial Erosion	Regulation of river corridors will provide greater development control of one of the highest risk areas in Rockingham.	Update floodplain ordinance to include regulation of river corridors.	Zoning Administrator	Windham Regional Commission	1-3 years	Town budget line item or seek MPG funding	Mitigation	Low	Medium	
19	Flooding / Fluvial Erosion	Fluvial erosion and inundation flooding are historically the most common hazards in Rockingham. Because climate change has altered the conditions in town, leaders need to have current understanding and good tools to manage our watershed resources and prevent flooding and erosion where possible.	<i>Making Room for Rivers</i> training for all Selectboard members, Village Trustees, Road Foreman and Emergency Management Director. This training would be required for the above, and also open to the public.	Selectboard	Zoning Administrator, VT ANR (for the training)	by the end of 2022	Town budget	Mitigation	Low	Medium	Ask all new members to watch training online: https://floodtraining.vermont.gov/

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
20	Flooding / Fluvial Erosion	Conservation and management at the top and the bottom of the watersheds will provide the most benefit in terms of flood damage prevention.	Consider adding a zoning district that would protect high value land in the top of the watershed.	Town Planner / Zoning Administrator	Planning Commission, Conservation Comm.	2022-2023	Town budget	Mitigation	Low	Medium	There are co-benefits in terms of water quality, flood resilience, forest health and native habitat connectivity.
21	Flooding / Fluvial Erosion	Conservation and management at the top and the bottom of the watersheds will provide the most benefit in terms of flood damage prevention.	When parcels of high value in the watershed become available the town and/or village will consider purchasing and conserving them. Create a reserve fund for these purchases so it is available when needed. Educating property owners about conservation easements is also a strategy.	Development Director	Town Manager / Planning Commission / Selectboard / Conservation Comm.	Create reserve fund at 2022 TMD with Selectboard support	Town reserve fund	Mitigation	Medium	Medium	There are co-benefits in terms of water quality, flood resilience, forest health and native habitat connectivity.
22	Flooding / Fluvial Erosion / Landslide	Increased incidence of heavy rain and snow events are causing more runoff than the existing stormwater drainage systems in the villages are able to handle.	Incorporate green infrastructure as much as possible in any future development. Incorporate green infrastructure into zoning and	Town Planner / Zoning Administrator	Development Director	Incorporate in all future plans and zoning bylaw updates	Town budget	Mitigation	Low	Medium	Hetty Green parking area, parking along Canal, Bridge Street

Mitigation Actions											
HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status	
		town plan updates.									
23	Landslide	Overflow from the Recreation Center parking lot often runs across Playground Road and has caused a significant landslide down to Burt Street.	Correct surface drainage pattern by lowering the catch basin to divert storm runoff from the Recreation Center parking lot into the stormwater drainage system. This will correct the issue that caused the landslide.	Highway Superintendent	Contractor	start and complete in building season of 2022	Town funds	Mitigation	under 5K	High	
24	Landslide	Recent landslides in Rockingham have shown that they can occur well above traditional flood zones.	Include in planning regulations potential landslide areas outside traditional flood zones. (more than 3 meters above river level)	Zoning Administrator	Planning Commission	1-2 years to complete	Town budget	Mitigation	Low	High	
25	Landslide	As we are now experiencing increased soil saturation due to more frequent and severe precipitation events, excessive loading on slopes is a trigger for landslides.	Change planning regulations to prohibit excessive loading above potential landslide slopes shown with a hazard overlay layer in the zoning. Set slope thresholds for development on or near steep slopes.	Zoning Administrator	Planning Commission	1-2 years to complete	Town budget	Mitigation	Low	High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
26	Invasive Species	Trees and limbs from trees that fall in extreme weather can affect town roadways and cause erosion, flooding and power outages. EAB and other pests can make hazard trees more quickly.	Inventory Ash trees in town right of ways in preparation for plans to remove and/or treat trees as EAB comes into town.	Tree Warden	GMP	Annually	Hwy Budget	Preparedness	Low	High	highway crew likely already removes hazardous trees within their jurisdiction. This would be better to be more specific to Ash trees, and working with GMP
27	Invasive Species	Knotweed, bittersweet, multiflora rose, buckthorn, water chestnut and barberry have potential negative effects on human health, natural resources, hard infrastructure.	Time mowing of town lands and right of ways AND training to clean mowers at the mowing site to avoid spreading them on the mowers to prevent the spread of seeds.	Road Foreman	Conservation Commission	New protocol for 2022	Town funds	Mitigation	Low	High	
28	Invasive Species	Active removal of invasive plants is necessary for some species and in some areas to control and prevent spread.	Identify areas where invasive plant species are taking over and organize removal efforts.	Conservation Commission	Volunteers	yearly starting in 2022	Conservation Commission budget	Mitigation	low	High	There is a volunteer day yearly organized by the Saxtons River Valley Trail initiative to remove knotweed at the Riverfront Park and between the Wastewater Treatment plant and the Liberty Mill facility along the riverfront trails. There is more than one day of removal needed yearly.

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
29	Invasive Species	Prevent spread of invasive insects that negatively affect forest health.	Petition Vtrans to put up signs on the bridge from NH prohibiting the transport of firewood across state lines.	Town Manager	Vtrans / NH DOT	2022	Town budget or DOT	Mitigation	low	high	
30	Invasive Species	EAB is very close to Rockingham and likely to be present in the future.	Training for detection and proper removal of infested Ash trees for the Highway Superintendent and the Road Crew	Highway Superintendent	VT Local Roads, Vtrans, ANR	complete by mid-2023	Town funds	Preparedness	Low	Medium	
31	Invasive Species	The Town wishes to have an organized way to approach management of their public lands, yards and gardens.	Develop a Biodiversity Plan that lists appropriate and recommended tree and plant species, and Increases the amount of tree cover by planting and maintaining native trees that are adaptable to climate change. This plan will also include a policy prohibiting planting non-native species.	Tree Warden	Conservation Commission	2 years	Town and Village(s) budgets,	Mitigation	Low	Medium	
32	Invasive Species	Prevent spread of invasive insects that negatively affect forest health.	Host an annual workshop for the public about detecting and eliminating invasive plant and insects.	Conservation Commission	Tree Warden / Library / Windham NRCD	yearly starting in 2022	CISMA grant	Mitigation	low	medium	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
33	Infectious Disease	Diseases caused by ticks and mosquitos have been increasing in Rockingham. Reducing areas where these insects breed and congregate is helpful toward reducing disease.	Identify locations where mosquitos and ticks breed and mitigate those populations without pesticides. Direct residents to information on tick and mosquito control from the CDC and VT Dept of Health.	Town Health Officer	Conservation Commission	start in 2022, 2-3 years to complete town-wide assessment	Town Budget	Mitigation	Low	Medium	Tire disposal is a cost that the town is dealing with yearly. Tires are disposed of through green up day but the state supported portion doesn't cover the disposal cost. The town will need to budget for tire disposal and may consider a 'tire forgiveness day' in the summer or fall.
34	All hazards	Lack of a coordinated, reliable information channel throughout the Town creates lack of understanding and misinformation among residents.	Create a page on the town website related to emergency planning and emergency preparedness for residents	Emergency Management Director	Town Manager, Technical support contractor	2022 development with page up by the end of 2022	Town funds	Preparedness / Mitigation	Low	High	
35	All hazards	Mass communication capabilities are necessary for all phases of emergency management.	Urge all residents to sign up for VT-Alert and respond to warnings through social media, town website, and during all town meetings; flyers from VEM	Emergency Management Director	Town Manager	2022, ongoing	Town funds	Preparedness	Low	High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPAREDNESS	COST EST	PRIORITY	Notes / Status
36	All Hazards	Universal support for vulnerable populations is key to health and safety in disasters.	Organize neighborhood networks to provide mutual support in any emergency situation.	Sustainable Rockingham	EMD	2022 start, 2-3 years	Community Resilience Organizations - Community Sufficiency Grant	Preparedness	Low	High	Rockingham Helping Helpers exists it is a mutual aid connectivity group; fills in the gaps for social needs
37	All hazards	Planning for handling, evacuating and sheltering animals needs to be proactively considered.	Complete the Animal Resources annex as part of the 2022 LEMP.	Emergency Management Director	Local animal experts	Will be in the 2022 LEMP update	Town budget	Mitigation / Preparedness	Low	High	
38	All hazards	A base level of understanding of the Incident Command System is needed by all town officials during response to an event.	All town Officials within 3 months of onboarding will take ICS 100 or 402 training.	Town of Rockingham - Selectboard and town officials	Bellows Falls Village - Trustee Board and employees / Saxtons River Village - Trustee Board	yearly after TMD for new officials or those not trained	Volunteer time / Training provided by HSU	Preparedness	low	High	
39	All hazards / Hazmat	This is a hazmat facility that the town should be in partnership with around planning for a hazmat emergency.	Develop a pre-plan for the Dead River propane facility.	Fire Chief	Rockingham Fire Department / Bellows Falls Fire Department / Dead River Company	1-2 years to complete	Town budget and Dead River Company private funding	Mitigation / Preparedness	low	High	
40	All hazards / power failure	There is no backup power source for this critical facility.	Install a generator at the Bellows Falls town highway garage.	Highway Superintendent	Town Manager	2023	FEMA mitigation grant, ARPA funds	Mitigation / Preparedness	Medium	Medium / High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
41	All hazards	Residents are not aware of local hazard mitigation and local emergency management plans.	Include information about local hazard mitigation and local emergency management plans in the Town Annual Report.	Emergency Management Director	Town Planner, Town Manager, Select Board	Annual report 2022 begin	Town funds	Mitigation	Low	Medium	
42	All hazards	Rockingham Helping Helpers needs some assistance in maintaining itself in a position to activate when needed.	Rockingham Helping Helpers will coordinate with the Municipal Manager and formalize a Committee structure accountable to the Selectboard. This will formalize the group and bring funding and staff support to the group.	Emergency Management Director	Town Manager; Selectboard; Rockingham Helping Helpers	2022 start, ongoing	Town set aside from Selectboard	Preparedness	Low	Medium	
43	All hazards	For a town the size of Rockingham, the EMD should be Certified.	Emergency Management Director will seek to become Certified.	Emergency Management Director		by the end of 2023	Town budget		low	Medium	
44	Climate Change	Food waste that goes to landfills generates methane, a powerful greenhouse gas. Composting converts organic waste into soil carbon, averting landfill methane emissions in the process.	Within this plan cycle, the Town will host 2 composting workshops in the town on building rodent-proof compost bins and how to properly make compost on the home or neighborhood scale.	Mount Ascutney Solid Waste District	Town Manager; Sustainable Rockingham	host two workshops at a minimum between 2021-2026	Solid Waste District funds	Mitigation	low	High	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
45	Climate Change	Food waste that goes to landfills generates methane, a powerful greenhouse gas. Composting converts organic waste into soil carbon, averting landfill methane emissions in the process.	Establish town-wide targets to reduce food waste and policies to encourage reduction of food waste.	Mount Ascutney Solid Waste District	Town Manager; Sustainable Rockingham	By 2025	Solid Waste District funds; Town budget	Mitigation	low	High	Town is a member of Mount Ascutney Solid Waste District. The long term 5-10 year goal is to have a digester in the town.
46	Climate change	Walking and bicycling are ways to reduce the use of cars, thus reducing emissions of greenhouse gases, with the added benefit of improving health. Appropriate town planning and design can encourage more walking and bicycling.	Integrate bike ped infrastructure and connectivity upgrades into the next town plan update, renewal will occur in 2024, and the town will be doing updates for the 2024 update.	Town Planner / Zoning Administrator	Dev. Director / Selectboard, Windham Regional Commission, Vtrans, Saxtons River Trail Initiative / BF Community Bike Project	done in conjunction with town plan update	Vtrans Bike Ped grants	Mitigation	Medium	Medium	Create a pedestrian- and bicyclist-friendly community by specifying in the Town Plan and zoning regulations appropriate development such as density of homes and businesses and infrastructure such as good connectivity with public transport; well-designed intersections and crossings; and safe and welcoming sidewalks, pathways, and bike corridors within and between the villages, connecting neighborhoods with the Rec Center,

Mitigation Actions											
HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status	
										Downtown, the schools, Industrial Parks, and other important points in Town.	
47	Climate change	Conversion to lighting using LEDs reduces electricity consumption and air-conditioning load, saves money, and reduces global warming.	Plan and execute the orderly replacement of all non-LED bulbs and light fixtures with LEDs in Town and School District buildings and outdoor lighting.	Town Manager	Economic Development Director, Selectboard and Energy Committee	Replace all by end of 2023.	Town and School budget	Maintenance	Medium	Medium	This is being incorporated in all facility upgrades.
48	Climate Change / Drought / Stormwater flooding	As various climate change effects negatively impact both local and global agriculture, food insecurity is likely to increase in Rockingham.	Conduct a study to determine the capacity of a municipal gray water system and the potential for expanding it for local agriculture and recreation.	Water Department	Village Trustees, Selectboard, Conservation Commission	by 2024	Town funds	Mitigation	low	Medium	town is interested in gray water utilization - longer term goal
49	Climate Change	The use of fossil fuels to generate power increases global warming. Rockingham has appropriate sites for additional solar arrays which could produce renewable energy, thus reducing global warming and providing income for the Town.	Develop solar photovoltaics fully on preferred sites in Rockingham including gravel pits and rooftops on town buildings and schools, to generate power that is fossil fuel free and to generate income for the Town.	Energy Committee	School Board, Conservation Commission, Select Board	Depending on project proposals	Developer funded	Preparedness	Medium / High	Low / Medium	town is interested in looking more at rooftop solar, particularly looking at the town hall now when they are looking at roof maintenance; with any rooftop needs the town will look to see if it makes sense to build for holding rooftop solar, and installing that; weight of installation and

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
											capacity would need to be certified by a structural engineer
50	Climate Change	Climate change is a reality and the Town wants to do everything in their power to lower their cumulative impact and build resiliency in the town.	In the next Town Plan update consider climate change resiliency goals and actions, such as encouraging the use of regenerative practices in gardens and farms, use of non-hazardous refrigerants where controllable, open space preservation, reuse and infill housing; use of energy efficient technologies in town and school buildings and infrastructure	Town Planner	Conservation Commission / Sustainable Rockingham	In conjunction with next town plan update	Town budget and/or MPG	Mitigation	Medium	Low / Medium	
51	Climate Change / Drought / Stormwater flooding	The Town is interested in proactively positioning themselves to use and need less water.	Put in place a municipal gray water system. Long term goal is large scale gray water system.	Water Department	Village Trustees, Selectboard, Town Manager, Development Director	10-20 years	Town funds	Mitigation	Medium / High	low for this plan cycle	

Mitigation Actions											
	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
52	Climate Change	As various climate change effects negatively impact both local and global agriculture, food insecurity is likely to increase in Rockingham.	Engagement of local resources to meet the food needs of residents on a town-wide or farm shed basis and Promote regenerative agricultural practices on local farms, home gardens and community gardens to increase locally grown food.	Town Development Director	Town Library, Foodshelf, Parks Place, Windham Locavores Network	by 2024	Town funds	Mitigation	Low	Low	Windham Locavores network
53	Extreme Heat	In extreme heat people experiencing health effects need safe places in which to cool off.	Town will designate cooling shelter(s) in the Local Emergency Management Plan. Consider extending operating hours to include evening and nighttime hours during periods of extreme heat.	Emergency Management Director	Town Manager and Selectboard	Will be in the 2022 LEMP update	Town budget	Preparedness	Low	High	
54	Drought	Increased demand for water because of dry wells in drought combined with increase in population because of climate refugees is likely in the future.	Coordinate and plan for expanded water needs in the future for the Villages, Town, rural firefighting, and water sources. Short term goal is to make sure that there are adequate rural fire flows, and	Town Manager	Selectboard, VT Rural Water Association, private engineering contractor	Within the 5 year cycle for the next 5 years	Bond	Mitigation	TBD by engineers; 2-5 million	Medium	Town is in conversation with Rural Water and this work is underway. This is a short and long term issue.

Mitigation Actions

	HAZARD (S)	ISSUE DETAIL	ACTION	LEAD PARTY	PARTNER-SHIPS	Start/Complete TIMELINE	POTENTIAL FUNDING	MITIGATION / PREPARED-NESS	COST EST	PRIORITY	Notes / Status
			adequately support institutions such as Vermont Academy and other businesses looking to move into Saxtons River.								

Stream Geomorphic Assessment studies have been conducted on the Saxtons River in the Town of Rockingham titled *The River Corridor Plan for the Saxtons River Watershed Windham County, Vermont*²⁷ dated September 30, 2010. The plan was prepared by Fitzgerald Environmental Associates under contract with the Windham County Natural Resources Conservation District and the Windham Regional Commission. Actions for Rockingham lands listed in that Corridor Plan will be reiterated here as they relate to flood and fluvial erosion hazard mitigation. The below was made using snips from a pdf of the document so please excuse the formatting.

Table 5.8 Site-Level Project Identification for the Saxtons River Main Stem, Bull Creek, and the South Branch

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
#6: East of Route 121 Saxtons River Segment M04 43.12956 N 72.48003 W	Passive Restoration <i>Corridor Protection</i>	Channel historically straightened and manipulated upstream of I-91 crossing. Channel currently incised and widening. Lateral migration predicted in future.	Protect stream corridor, especially mid-reach where adjacent agricultural fields encroach on river corridor from the east.	High	Moderate	Potentially reduced property loss from erosion; Mitigation of floodplain loss upslope and within reach.	Potentially moderate to high costs for easements due to private ownership; Needs further investigation	WCNRCD; NRCS (CREP); VRC
#7: East of Route 121 - west of Saxtons River Village Saxtons River Reach M06 43.13598 N 72.51519 W	Active Restoration <i>Berm Removal</i>	Berm extends 700 feet along left bank, disconnecting floodplain. Berm elevated 3.5 feet above floodplain on average. Healthy established trees along berm. 10-year storm discharge would access adjacent floodplain with berm removed.	Remove berm or puncture short segments of the berm and re-grade near bank floodplain to encourage overbank flooding in adjacent hay field.	High	Moderate	Reduced fine sediment loading to channel and downstream areas; Reduced property loss from high flow events and ongoing erosion	Potentially high construction & permitting costs for berm removal and floodplain restoration; Needs further landowner investigation.	VTANR
#8: Downstream of Bull Creek Confluence Saxtons River Reach M08 43.14438 N 72.54657 W	Passive Restoration <i>Corridor Protection</i>	Main stem confluence with Bull Creek is very active depositional area; Downstream reach (M08) is in state of channel widening and is an attenuation zone for sediment transported from upstream reaches.	Protect stream corridor from development and further channel management (i.e., armoring or encroachment).	Moderate	Moderate	Important sediment and floodwater attenuation reach due to channelization in upstream reaches and high bed load in Bull Creek.	Potentially moderate to high costs for easements due to private ownership and reach length; Needs further investigation	VTANR, VRC, VLT

²⁷ 2010 Saxtons River Corridor Plan, Fitzgerald Environmental Consultants, <https://dec.vermont.gov/water-investment/watershed-planning/tactical-basin-planning/basin11>

Table 5.8 Site-Level Project Identification for the Saxtons River Main Stem, Bull Creek, and the South Branch

Project #, Location, Reach, Lat/Long	Type of Project	Site Description Including Stressors and Constraints	Project or Strategy Description	Hazard Mitigation Priority	Ecological Benefits Priority	Project Benefits	Costs	Potential Partners & Funding
<p>#9: Restoration West of Mandigo Road</p> <p>Saxtons River Reach M08 43.14657 N 72.55009 W</p>	<p>Passive Restoration</p> <p><i>Buffer Plantings; Corridor Protection</i></p>	Upper section of reach west of Mandigo Road along north bank has cattle actively grazing in river corridor and along banks. Banks and vegetation are degraded.	Exclude cattle from grazing within 25 feet of banks. Plant buffer with native woody vegetation where vegetation has been grazed.	Low	Moderate	Reduced fine sediment loading to channel and downstream areas; Improved biotic habitat within reach	Relatively low costs for native plant materials and labor; CREP easement possible along entire north bank.	WCNRCD; NRCS (CREP)
<p>#10: Confluence with Bull Creek</p> <p>Saxtons River Reach M09</p> <p>43.14721 N 72.55561 W</p>	<p>Passive Restoration</p> <p><i>Corridor Protection</i></p>	Main stem confluence with Bull Creek is very active depositional area; Lateral migration and spring flooding are problematic for landowner. Landowner interested in public access and possibly easement.	Protect stream corridor and plant buffer with native woody vegetation. Provide public access trail to river – area should have excellent fish habitat in long term as corridor vegetation recovers.	High	High	Important sediment and floodwater attenuation reach for protection of downstream areas. Improved biotic habitat within reach.	Potentially high costs for easements due to private ownership; Needs further investigation	VTANR, VRC, VLT

Plan Maintenance

Monitoring, Evaluating, and Updating the Plan – Yearly Review

Once the plan is approved and adopted, the Emergency Management Director in Rockingham, along with an emergency stakeholder group that includes: a member of the Selectboard, Planning Commission, Town Manager, Road Foreman, Town and Village Fire Chiefs, Town Highway Superintendent, Saxtons River Trustee, Bellows Falls Trustee, and EMD. The person who will ensure this task is accomplished each year will be the EMD. The Town and Villages 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 at an April 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 Rockingham Emergency Management Director with this review, as requested by the Town. 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 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. Participants outlined below will work with the Emergency Planner at the Windham Regional Commission (WRC) in accordance with the following procedure:

1. The Rockingham Selectboard, with input from the Village Trustees, 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, planning-zoning administrator, constable/police chief, road commissioner, Planning Commission members, health officer, 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.
 - Progress in implementation of plan initiatives and projects.
 - Incorporation of new mitigation initiatives and projects.
 - Effectiveness of previously implemented initiatives and projects.
 - Evaluation of unanticipated challenges or opportunities that may have occurred between the date of adoption and the date of the report.

- Evaluation of hazard-related public policies, initiatives and projects.
 - How mitigation strategy has been incorporated into other planning mechanisms
 - Review and discussion of the effectiveness of public and private sector coordination and cooperation.
3. From the information gathered at these meetings, and other interactions the Emergency Planner has with the Town, along with data collected independently during research for the update, the WRC Emergency Planner will prepare the updated draft in conformance with the latest FEMA Region 1 Local Hazard Mitigation Plan Review Crosswalk document.
 4. The Selectboard will review the draft report. Consensus will be reached on changes to the draft.
 5. Changes will be incorporated into the Plan by the WRC Emergency Planner.
 6. The Selectboard will notify the public that the draft is available for public comment and review. The Town will advertise and make available the draft plan for provide comments both electronically and in hard copy. The draft plan will simultaneously be distributed electronically to adjacent towns for review and comment.
 7. Public and adjacent town comments will be incorporated by the WRC Emergency Planner.
 8. WRC Emergency Planner will finalize the plan and submit electronically to DEMHS 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 Coordinator, 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:

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.

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.

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

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.

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.

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
- All meetings regarding the plan will be open to the public
- Post the hazard mitigation plan on the town website
- Selectboard will review past hazard mitigation committee members and consider whether new members should be added. Representatives of local businesses, nonprofits, academia, etc. should especially be considered.
- Notify the public of committee meetings through town bulletin board, website, newsletter, newspaper, Facebook, Front Porch Forum, etc.

Incorporating into Existing Planning Mechanisms

The following policies, programs and activities related to hazard mitigation are currently in place and/or being implemented in the Town of Rockingham and the Villages. The Hazard Mitigation Planning participants, especially the Town Manager, analyzed these programs for their effectiveness and noted improvements needed. The Local Emergency Management Plan has a contact list that is used for response purposes in the case of a hazard event, and is updated every year after Town and Village Meetings. Town Road and Bridge Standards are followed by the town and Rockingham plans to update their culvert inventory for the Town and the Villages. In the development of this plan, the latest 2016 Town Plan was used, this includes the Villages.

As the Town of Rockingham and the Villages go 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. At the Town Meeting every March, policies and action items in the Town Plan are reviewed and integrated into hazard mitigation as needed. The Local Emergency 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 by the responsible party identified in the table. 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.

The Town Plan, which includes all of the Town and Bellows Falls and Saxtons River Villages, was rewritten and adopted in 2016. The latest amendment to the Rockingham Zoning Bylaw also in 2016, but floodplain regulations did not change in that update. Both of these Bylaws include the entire Town including the two villages.

Utilization of the prior LHMP in Rockingham was limited in terms of incorporating it into other town planning mechanisms. This was due to a number of things, from staff turnover, volunteer turnover, lack of understanding of the plan, and the pandemic that happened between then and now. The town plan update done in 2016 did include a lot of information on flood resilience which is now a required element of town plans in Vermont. The LEMP is updated yearly and was updated last in 2021. Other mitigation/emergency planning related documents and their status are outlined in the below table:

Type of Existing Protection	Description	Effectiveness/ Enforcement /Hazard addressed	Gaps in Existing Protection/ Improvements Needed/Other
Town Plan	Plan for coordinated town-wide planning for land use, municipal facilities, etc.	Flooding Addressed	Town Plan Adopted August 30, 2016 and does address flood resilience
Local Emergency Management Plan	Municipal procedures for emergency response	All hazards response plan for EOC purpose	Updated and adopted annually after Town Meeting; last updated in 2021.
Rockingham School Emergency Response Protocol	School procedures for emergency response, Town-wide	School Crisis Plan	There has been turnover in the Superintendent's position/office. A new superintendent is in place and there will be emergency planning, training and drills developed during the 2022 calendar year.
Mutual Aid - Emergency Services	Agreement for regional coordinated emergency services - Town of Rockingham, Bellows Falls Village and Saxtons River Village	Keene (NH) Mutual Aid - written agreement/contract for Fire/Ambulance and HazMat	None identified
Mutual Aid - Public Works	Agreement for regional coordinated emergency highway maintenance services Town-wide	The Town is not part of any mutual aid agreements for public works. They rent equipment as needed.	Consider mutual aid agreements with surrounding towns to streamline assistance needs following events.
Vermont Road & Bridge Standards	Design and construction standards for roads and drainage systems	Town has adopted latest 2019 standards.	None identified

Subdivision Regulations	Regulates the division of land, standards for site access and utilities	Subdivision regulations	None identified
Vermont Sewage Regulations	Regulates on-site sewage systems	State Regulations apply	None identified
Flood Hazard Area Regulations	Regulates development in FEMA flood hazard areas	Flood Hazard regulations in place	Most recent SFHA FIRMs date from 2007; River Corridors not included in regulations
Bridge & Culvert Inventory	Assessment of condition	Update in process and expected to be completed early-mid 2022	None Identified
Site Plan Review (SPR)	Site development standards for conditional use development	Town Zoning Regulations	None Identified
Building Code	Regulates building construction standards	State building codes for commercial and apartment buildings. Inspections are only done for fire safety.	Town doesn't have its own code.
Bellows Falls Village Life Safety Code	Regulates fire code requirements for public buildings within Bellows Falls Village Corporate limits	Fire safety	None identified
Bellows Falls Village Unsafe Building Ordinance	Regulates unsafe buildings; emergency procedures included; within Bellows Falls Village Corporate limits	Public safety	None identified
Basin 11 Plan	Record of Stream Geomorphic Assessments and River Corridor Planning on Rivers in Vermont's Basin 11	Saxtons River Corridor Plan done in 2010	Update needed

Appendix

1. Adoption Sheet
2. Website ad for Sustainable Rockingham public meetings
3. Agenda for September 1, 2021 Rockingham LHMP update core planning team meeting
4. Email soliciting comment on draft from town staff and plan developers
5. Email soliciting comment on draft from adjacent towns
6. Flyer soliciting public comment on draft posted on the town website
7. Plan posting on the town's homepage from 1/28-2/11/2022
8. Comments received during public comment period

**1. A Resolution Adopting the updated Multi-Jurisdiction Hazard Mitigation Plan
for the Town of Rockingham, VT
including the Villages of Saxtons River and Bellows Falls**

WHEREAS, the Town of Rockingham and the Villages of Saxtons River and Bellows Falls have 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 Rockingham and the Villages of Saxtons River and Bellows Falls Multi-Jurisdiction Hazard Mitigation Plan analyzes natural hazards and assesses risks within the community; and

WHEREAS, the Town of Rockingham and the Villages of Saxtons River and Bellows Falls Multi-Jurisdiction Hazard Mitigation Plan recommends the implementation of action(s) to mitigate against damage from natural hazard events; and

NOW, THEREFORE BE IT RESOLVED that the Town of Rockingham, the Villages of Saxtons River and Bellows Falls, VT adopt the Multi-Jurisdiction Hazard Mitigation Plan for Town of Rockingham, Vermont Including Bellows Falls Village & Saxtons River Village.

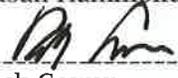
Duly adopted this 5th day of April 2022
date month, year

Rockingham Selectboard:



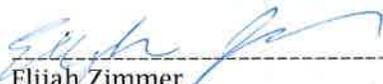
Peter Golec, Chair

Susan Hammond



Rick Cowan

Bonnie North



Elijah Zimmer

ATTEST

Town Clerk

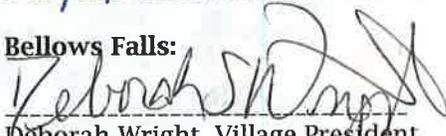
Saxtons River:



Amy Howlett, Chair of Village Trustees
Date of Saxtons River adoption:

5/2/22

Bellows Falls:



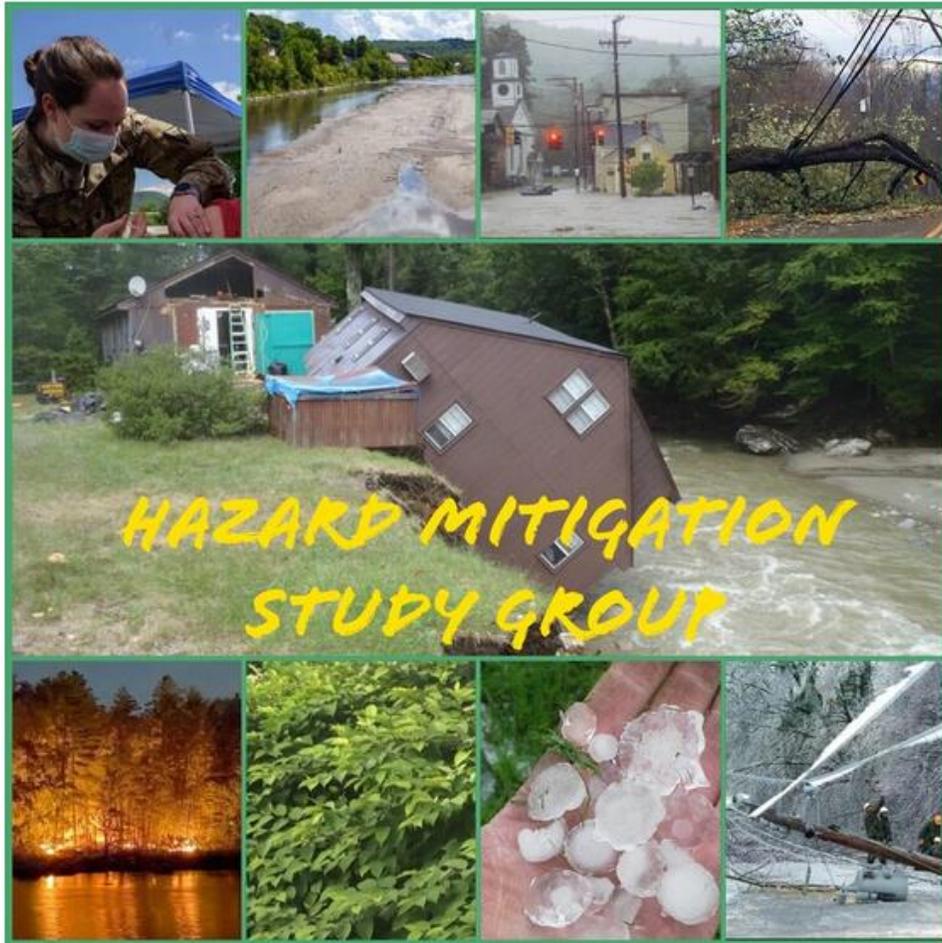
Deborah Wright, Village President
Date of Bellows Falls adoption:

4/26/22

2. Website ad for Sustainable Rockingham public meetings

[tps://www.rockinghamvt.org](https://www.rockinghamvt.org)

We need your participation!



Hazard Mitigation (HazMit) Study Group Series will focus on the 14 climate change related hazards listed in the Vermont State Hazard Mitigation Plan. We have 14 climate change related hazards for Windham County: Fluvial Erosion, Inundation Flooding, Snow, Invasive Species, Ice, Landslides, Wildfire, Drought, Hail, Cold, Infectious diseases, Wind, Heat, and Earthquake. The meetings will begin the week of August 16th to discuss each hazard in detail and to help author a new hazard mitigation plan for the Town of Rockingham.

Rockingham HazMit Study Guide and Schedule

3. Agenda for September 1, 2021 Rockingham LHMP update core planning team meeting

AGENDA FOR TODAY'S MEETING

1. Expedited update of the Rockingham Local Hazard Mitigation Plan

- Purpose
- Process

2. Hazards

- Outline chosen hazards that the Plan will address

3. Mitigation Goals and Actions

- Review/edit Mitigation Goals
- Brief review of the current Mitigation Actions that the Town updated
- Create an updated Mitigation Actions Table for the updated Plan
- Identify gaps and capabilities with implementation

3. Other Updates

- Changes since 2015 and new or planned development to consider?

4. Next Steps

4. Email soliciting comment on draft from town staff and plan developers

Mon 1/10/2022 1:40 PM

 Alyssa Sabetto <asabetto@windhamregional.org>
Rockingham Local Hazard Mitigation Plan for internal town comment until January 24

To 'Laurel Green'; pwbergstrom@gmail.com; manager@rockbf.org; bffire@rockbf.org; 'Rockingham Development'; 'Rockingham Highway'; planning@rockbf.org; 'Steve Crofter'

Cc 'Alyssa Sabetto'

 You forwarded this message on 1/24/2022 5:07 PM.

 Rockingham LHMP up...
5 MB

Hello Rockingham,

Attached is the first draft of the Rockingham 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 January 24th.** I'll incorporate comments and then put the plan out for public comment. If you don't get the chance to comment during this internal opportunity, you can comment during the public opportunity. You can mark up the attached document and scan it back to me, call me with comments or email me back a list of comments. I'm not able to send in a word version, as the file is too large for email.

Please note that the **yellow highlighted** sections of the plan are *not yet completed* for Rockingham and are awaiting further information. They will be customized and un-highlighted as the process moves forward. There are also a few of the appendices that are not yet developed, but will be in the final plan.

Scott and Gary - If there are any town staff or plan development participants who are not getting this email that should, please forward it on to them.

Thank you,

Alyssa Sabetto, CFM
Senior Planner
Windham Regional Commission

5. Email soliciting comment on draft from adjacent towns

Thu 1/27/2022 1:16 PM

 Alyssa Sabetto <asabetto@windhamregional.org>

Rockingham Local Hazard Mitigation Plan for review and comment until Feb 11

To 'manager@westminstervt.org'; 'townadmin@grafonvt.org'; 'townofathens@hotmail.com'; 'david.bemis@vermont.gov'; 'spikessf@vermontel.net'; 'tosmanager@vermontel.net'; 'julie.hance@chestervt.gov'; 'TownClerk@WalpoleNH.US'; 'jessica@charlestown-nh.gov'; 'patricia@charlestown-nh.gov'

Cc 'Rockingham Development'; 'Alyssa Sabetto'; 'manager@rockbf.org'; 'planning@rockbf.org'

 Rockingham LHMP up...
5 MB

Hello towns adjacent to Rockingham,

Attached please find a draft of the updated Rockingham Hazard Mitigation Plan. The Windham Regional Commission has recently worked on updating this plan with the help of the town. It is now being sent to you as an opportunity for review and comment per FEMA requirements. Please share this draft with your town Planning Commission and Selectboard. **Please provide any comments back to the Windham Regional Commission by February 11, 2022.** Please use the contact information in my signature.

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

6. Flyer soliciting public comment on draft posted on the town website

Rockingham Hazard Mitigation Plan

PUBLIC COMMENT PERIOD

The draft Rockingham Hazard Mitigation Plan is now available for public review on the town website: www.rockinghamvt.org. A hard copy is available at the Town Clerk's office Monday-Friday from 7:00am-4:00pm.



The Plan will be available for comment until
February 11, 2022.

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!

7. Plan posting on the town's homepage from 1/28-2/11/2022.

https://www.rockinghamvt.org 60% ☆ 🔍 rock

Click Here for Upcoming Municipal Meetings Information

TOWN OF ROCKINGHAM [HOME](#) [CALENDAR](#) [TOWN CRIER](#) [BOARDS & COMMITTEES](#) [DEPARTMENTS](#) [MUNICIPAL PROJECTS](#) [I WANT TO...](#)

[Warning - Town of Rockingham Informational and Annual Meeting](#) [Warning - Town of Rockingham School District Annual Meeting](#)

[Warning - Union High School No. 27 Annual Meeting](#) [Warning - River Valley Technical Center School District Info & Annual Meeting](#)

The draft Rockingham Local Hazard Mitigation Plan is now out for public comment until February 11th, 2022. Please send any comments to asabetto@windhamregional.org. If you are unable to download or access this electronic version, a hard copy is available at the Town Clerk's office from Monday-Friday from 7am-4pm. [View Plan here](#)

Rockingham Hazard Mitigation Plan

PUBLIC COMMENT PERIOD

The draft Rockingham Hazard Mitigation Plan is now available for public review on the town website: www.rockinghamvt.org. A hard copy is available at the Town Clerk's office Monday-Friday from 7:00am-4:00pm.

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8. Comments received during public comment period.

"When I compare the proposed draft of Rockingham's Local Hazard Mitigation Plan with the previous 2015 version, I think it is completely appropriate that this revision takes into account the impacts of climate change on our town and how those impacts are increasing the variety, frequency, and severity of the hazards we face. I especially appreciate the wisdom shown in the process of assessing the town's future vulnerability by including the likely effects of climate change in predicting both hazard and population trends. It is prudent for us to assume that we will experience more and stronger hazards of a variety of types, and that we will have a larger population to protect from those hazards."

Good Morning Alyssa,

I have reviewed the Hazard Mitigation Plan. It looks good.

When we updated ours last year with the Upper Valley Lake Sunapee Regional Planning Commission, they had us add Solar Storms & Space Weather. I can't remember if they said it's a requirement, but that's the only thing I didn't really see covered.

Liz Emerson
Planning & Zoning Administrator



Town of Charlestown, NH

Additional minor changes and corrections were received from: Peter Bergstrom, Laurel Green, Richard Cowan, Steve Crofter, and Betsy Thurston. All comments were reviewed and addressed accordingly to create a final draft for submittal. Thank you to all who took the time to review and comment on the draft Plan.