

Town of Strafford, Vermont
2022 Local Hazard Mitigation Plan

***Prepared by the Two Rivers-Ottawaquechee Regional Commission and
the Town of Strafford***

Date of Town Adoption: 02/08/2023

Date of Final Approval by FEMA: 02/09/2023



FEMA

February 14, 2023

Stephanie A. Smith, State Hazard Mitigation Officer
Vermont Emergency Management
45 State Drive
Waterbury, Vermont 05671-1300

Dear Stephanie Smith:

As outlined in the FEMA-State Agreements for FEMA-4621-DR-VT, FEMA-4532-DR-VT, and FEMA-4474-DR-VT, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Town of Strafford, Vermont 2022 Local Hazard Mitigation Plan and approved it effective **February 9, 2023** through **February 8, 2028** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

With this plan approval, the jurisdiction is eligible to apply to Vermont Emergency Management for mitigation grants administered by FEMA. Requests for funding will be evaluated according to the eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in this community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

The plan must be updated and resubmitted to the FEMA Region I Mitigation Division for approval every five years to remain eligible for FEMA mitigation grant funding.

Thank you for your continued commitment and dedication to risk reduction demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please contact Sean Loughlin at (617) 832-4780 or Sean.Loughlin@fema.dhs.gov.

Sincerely,

DEAN J SAVRAMIS Digitally signed by DEAN J SAVRAMIS
Date: 2023.02.15 08:45:48 -05'00'

Dean Savramis
Mitigation Division Director
DHS, FEMA Region I

DS:sl

cc: Brian McWalters, State Hazard Mitigation Planner, VEM
Caroline Paske, State Hazard Mitigation Planner, VEM
Ben Rose, Recovery and Mitigation Section Chief, VEM

CERTIFICATE OF ADOPTION

<<DATE>> - 2/8/23

TOWN OF Strafford, Vermont Selectboard

A RESOLUTION ADOPTING THE Town of Strafford, Vermont 2022 Local Hazard Mitigation Plan

WHEREAS, the Town of Strafford has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Town of Strafford, Vermont 2022 Local Hazard Mitigation Plan**, which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Strafford has developed and received conditional approval from Vermont Emergency Management (VEM) for its **Town of Strafford, Vermont 2022 Local Hazard Mitigation Plan (Plan)** under the requirements of 44 CFR 201.6; and

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

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

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

RESOLVED by Town of Strafford Selectboard:

1. The **Town of Strafford, Vermont 2022 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Strafford;
2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and
4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Strafford this 8 day of Feb 2023.

ATTEST


Town Clerk


Selectboard Chair

Selectboard Member

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I. Introduction

Natural and human-caused hazards may affect a community at any time. They are not usually avoidable; however, their impact on human life and property can be reduced through community planning. Accordingly, this Local Hazard Mitigation Plan (hereafter referred to simply as the Plan) seeks to provide an all-hazards mitigation strategy that will make the community of Strafford more disaster resistant.

“Mitigation” is defined as any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Previous Federal Emergency Management Agency (FEMA), State and Regional Project Impact efforts have demonstrated that it is less expensive to anticipate disasters than to repeatedly ignore a threat until the damage has already been done. While hazards cannot be eliminated entirely, it is possible to identify prospective hazards, anticipate which might be the most severe, and recognize local actions that can be taken ahead-of-time to reduce the damage. These actions, also known as ‘hazard mitigation strategies’ can (1) avert the hazards through redirecting impacts by means of a structure or land treatment, (2) adapt to the hazard by modifying structures or standards or, (3) avoid the hazard through improved public education, relocation/removal of buildings in the flood zone, or ensuring development is disaster resistant. The process of identifying mitigation strategies and measures can be undertaken during the other Emergency Management phases: preparedness, response, and recovery.

II. Purpose of the Plan

The purpose of this Plan is to assist the Town of Strafford in identifying all hazards facing the town, ranking them according to local vulnerabilities, and identifying strategies to reduce risks from hazards of highest concern. Implementation of this plan will make our community more resistant to harm and damages in the future, and will reduce public costs.

The Town of Strafford seeks to be in accordance with the strategies, goals, and objectives of the State Hazard Mitigation Plan.

The 2016 Strafford Local Hazard Mitigation Plan was the first stand-alone mitigation plan drafted for the Town. Previously, the Town had a town-specific 2009 Annex in the Regional Pre-Disaster Mitigation Plan. This new Plan has been reorganized and new sections have been added:

- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about the community

Old assumptions have been challenged throughout, and new information has been added to make the plan stronger and more useful for the Strafford town officials and residents who will implement the hazard mitigation strategies in the future.

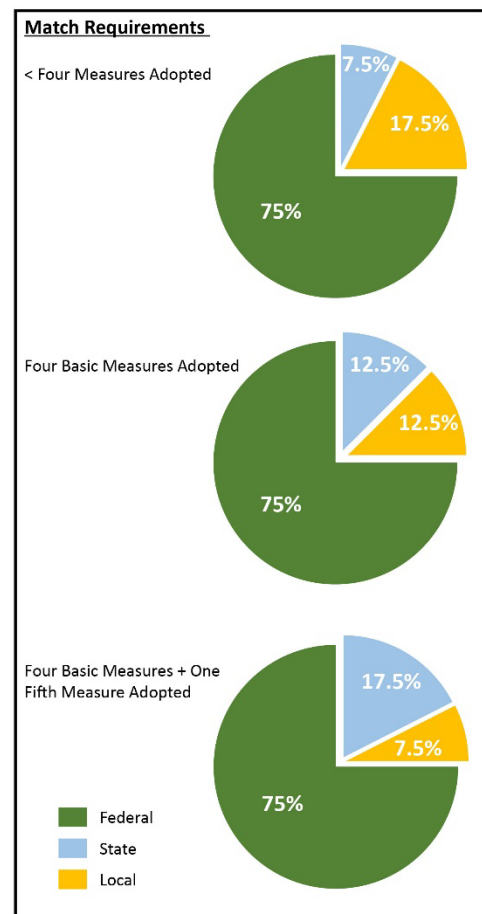
This 2022 Plan expands upon the 2015 plan by analyzing new hazards, adding new and relevant data, and creating new mitigation actions for the Town to follow over the next five years. In addition, there is also an important financial incentive for towns to update their hazard mitigation plans. The Vermont

Emergency Relief and Assistance Fund (ERAF) provides State funds to match FEMA Public Assistance grants following a federally declared disaster. In a federally declared disaster, 75% of the funding would be federal contribution, while 25% would need to come from state and local contributions. In 2014, the state revised its criteria for the Emergency Relief & Assistance Fund (ERAF), reducing the State match to 7.5%. This means municipalities are required to contribute 17.5% match for Public Assistance projects. However, municipalities can qualify for a 12.5% State match if they take the following proactive measures:

1. Adopt updated road standards
2. Participate in the National Flood Insurance Program by adopting flood hazard area regulations.
3. Adopt an annual Local Emergency Management Plan
4. Have a Local Hazard Mitigation Plan approved by FEMA

If municipalities take the four actions above, the State will contribute half of the required 25% match for federally declared disasters.

A fifth action, that few Vermont communities choose to take, is to either adopt a River Corridor bylaw or participate in the Community Rating System (CRS). River Corridor bylaws regulate land areas mapped by the State of Vermont that usually fall outside of the FEMA mapped flood zone, with the purpose of preventing erosion that could undermine structures. The CRS is a complex administrative process with a simple premise – that taking additional flood prevention steps will lessen flood damages. Communities in the CRS enjoy lower flood insurance rates. Implementing either of these two actions will decrease the local contribution under the ERAF rule to only 7.5% match for municipalities. At the time of this writing, the town is financially responsible for 17.5% match due to the expiration of the Local Hazard Mitigation Plan.



III. Community Profile

The Town of Strafford, comprising approximately 44 square miles, is located in the southeasterly portion of Orange County. The west branch of the Ompompanoosuc River is the principal stream and winds its way through the town from its source in Vershire. In the southeast corner of Strafford lies the Elizabeth Mine, which has played a significant role in Strafford's history and, as a hazardous waste site, will continue to be a preoccupation of the Town.

As of 2020, there were 583 housing units (i.e., residences) in Strafford, representing a slight decrease of about 3 units over the previous decennial census. According to the American Community Survey, most

housing units in Strafford were built either prior to 1939 (32.5%) or between 1970 and 1989 (35%)¹. Importantly, only a very small percentage of housing (4.8%) is estimated to have been built after 2010.

Green Mountain Power (GMP) supplies most electricity for Strafford. A small portion of electricity is supplied by Washington Electric Cooperative.

Fire protection for the town is provided by the Strafford Firemen's Association. The Strafford Fire Department is composed of 15-20 volunteer staff and two fire stations. The firehouse in Strafford Village has two bays and space in the building to conduct meetings. This station also houses the 1997 F450 Utility truck. Both fire department buildings are in need of significant repair, such as improvements for storage capacity and energy efficiency upgrades. A second three-bay sub-station completed in 1976 is located on Rte. 132 a half-mile east of South Strafford which contains a 2001 American Eagle E1 Rescue Pumper, 2019 E-One 1500/1000 Engine and 2020 F250 Rescue Truck. Strafford is a member of the Upper Valley Mutual Aid System, instituted to provide more comprehensive fire protection for member townships.

Strafford's membership in the Upper Valley Ambulance Service (UVA), tied into the Dispatch Center in Hanover, provides high-quality emergency ambulance service for Strafford residents. In addition to emergency services, UVA also provides non-emergency services, including transportation to hospitals, nursing homes, and CPR/First Aid trainings. The Strafford First Aid Squad, or FAST Squad provides immediate emergency response while an Upper Valley Ambulance is en-route. The FAST Squad has combined operations with the Firemen's Association.

Strafford has one constable who is elected by town vote, though the constable has limited law enforcement capabilities. In addition to the constable, the Vermont State Police, Troop "D", headquartered in Royalton, are on call when needed, along with the Orange County Sheriff's Office in Chelsea. Strafford contracts annually with the Orange County Sheriff's office for law enforcement services.

Strafford maintains an Emergency Management Director (EMD) as one of its appointed officers. The role of the EMD is to coordinate local and regional emergency services and to ensure that the town is prepared in the event of an emergency. The EMD ensures the Local Emergency Operations Plan is kept up to date, and provides resources for town residents on how to prepare for and respond to hazards.

IV. The Planning Process

A. Plan Developers

Kyle Katz, Planner at the Two Rivers-Ottawquechee Regional Commission (TRORC) assisted the Town of Strafford with updating its Local Hazard Mitigation Plan.

This section of the Plan satisfies 44 CFR 201.6(b)(1) and 201.6(c)(1) (or, A3.a and A3.b of FEMA's Local Mitigation Plan Review Guide, 2011).

LHM Committee members who assisted with the revisions include:

¹ U.S. Census Bureau; American Community Survey, 2020 5-Year Estimate, Table DP04.

Name	Role/Organization	How Participation Was Solicited
Brian Johnson	Zoning Administrator, Strafford Selectboard	On 06/23/2022, Kyle Katz (TRORC) reached out to the Strafford Selectboard Chair, offering assistance in updating and developing their new Local Hazard Mitigation Plan. TRORC staff coordinated with Strafford town officials to set up an introductory meeting. The first meeting was scheduled for 08/02/2022. A committee was established to update and develop this Local Hazard Mitigation Plan. See below for more meeting-specific details.
Shawn Harlow	Fire Department	
Beth Preston	Emergency Rescue	
Jason Schumacher	Strafford Emergency Management Director	
Greg Colling	Planning Commission	

Additional Participants in the Process:

- Lisa Bragg, Strafford Town Clerk
- Micki Colbeck, Conservation Commission
- Dorian Yates, Energy and Climate Committee

B. Plan Development Process

Strafford developed its first hazard mitigation plan as the Hazard Annex in 2009. This plan was part of a broader, multi-jurisdictional Regional Hazard Mitigation Plan developed by the Two Rivers-Ottawaquechee Regional Commission. Strafford developed its first Local Hazard Mitigation Plan in 2016 as a stand-alone plan, which was approved by FEMA on February 3, 2017.

This Plan is an update to the 2016 Local Hazard Mitigation Plan for Strafford that will be submitted for individual approval to FEMA. As such, several sections have been added or updated to keep the plan current.

This section of the Plan satisfies the Element A: Planning Process requirements set out in 44 CFR 201.6.

The changes to this Plan include:

- **General**
 - New sections: Plan Development Process, 2016 Mitigation Strategies Status Update chart, Existing Hazard Mitigation Programs, Projects & Activities, Plan Maintenance;
 - Data updates: New hazard incidents, emergency declarations, census data;
 - Hazards have been reevaluated to reflect changes in the hazard ranking system used by the Vermont Division of Emergency Management and Homeland Security.
- **Hazards Analysis**
 - Flash Flood/Flood/Fluvial Erosion, snow/ice storms, tropical storms/hurricanes, and severe summer weather remain on the list of “top hazards,” which reflect the local officials’ belief that the Town is still vulnerable to these hazards;

- Extreme heat, has been added to the list of “top hazards,” which reflects the intention/priorities of local officials to expand their analysis of hazards that the Town is or may be vulnerable to in the next five years;
- Invasive species has been removed from the list of “top hazards;”
- For each hazard, a location/vulnerability/extent/impact/likelihood table has been added to summarize the hazard description.
- **Maps**
 - A map of the Town of Strafford depicting critical facilities, town infrastructure, and the NFIP designated floodway and 100-year floodplain has been added.

The following represent the avenues taken to draft the Strafford Local Hazard Mitigation Plan:

- **Activities**
 - 08/02/2022: TRORC staff met with Strafford LHMP committee members to introduce the update/plan development process, to review Strafford’s existing Hazard Mitigation Plan (adopted in January 2017) and to consider the status of various mitigation actions. During this meeting, the Strafford committee also discussed and ranked hazards to determine the “Top Hazards” in the Town. TRORC staff then explained to the committee the next steps in the process and scheduled a meeting to continue reviewing the status of mitigation actions, discuss plan maintenance, and review town programs and capabilities. The following stakeholders were represented by core planning team members at the meeting: the Strafford Planning Commission, the Emergency Management Director, Strafford Fire and Rescue, and the Town Zoning Administrator. This meeting was open to the public. No public comments were received.
 - 08/29/2022: TRORC staff and the Strafford LHMP committee held a meeting to discuss Town Capabilities for Mitigation actions, Plan Maintenance, and to review and finalize top hazards. The committee also finished reviewing the status of 2016 actions. The following stakeholders were represented at the meeting: the Strafford Planning Commission, the Emergency Management Director, Strafford Fire and Rescue, the Conservation Commission, and the Town Zoning Administrator. The meeting notice was posted on the town website, listserv, the Valley News, the Town Hall, the General Store and the Post Office on 8/22/22 (See Appendix E for meeting notice examples). This meeting was open to the public. No public comments were received.
 - 10/05/2022: TRORC staff and the Strafford LHMP committee held a meeting to discuss top hazards and to develop hazard mitigation strategies. In the meeting, there was discussion of town vulnerabilities to specific hazards and which areas and groups in town might be most affected. The following stakeholders were represented at the meeting: the Strafford Planning Commission, the Emergency Management Director, Emergency Rescue, and the Town Zoning Administrator. The meeting notice was posted on the town website, listserv, the Town Hall, the General Store and the Post Office on 9/26/22. This meeting was open to the public and one member of the public attended and contributed to the discussion throughout the meeting.
 - 11/02/2022: TRORC staff and the Strafford LHMP committee held a meeting to finish developing hazard mitigation strategies and to review and comment on the draft of the

plan. The meeting notice was posted on the town website, listserv, the Town Hall, the General Store and the Post Office on 10/24/22. A draft of the plan was also made available for review on the Town Website and was available for review at the meeting as well. The following stakeholders were represented at the meeting: the Strafford Planning Commission, the Emergency Management Director, the Town Zoning Administrator, Emergency Rescue, and the Strafford Energy and Climate Committee. The Chair of the Energy and Climate Committee attended the meeting and contributed to the discussion of the draft as well as to the formation of hazard mitigation strategies. This meeting was open to the public. No public comments were received.

- 11/15/2022: A draft of the 2022 Hazard Mitigation Plan was sent to the Strafford Selectboard Chair for comment. A draft was also sent to either the Selectboard Chair or the Town Administrator of the following municipalities for comment: Thetford, West Fairlee, Vershire, Chelsea, Tunbridge, Royalton, Sharon, Norwich. No comments were received.

- **Review of existing plans, studies, reports, and technical information (44 CFR 201.6(b)(3))**

- State of Vermont Hazard Mitigation Plan, 2018
 - This Plan was referenced for knowledge of the state's hazard mitigation planning processes and description of top hazards for the State of Vermont.
- Strafford Hazard Mitigation Plan (Adopted 01/11/2017)
 - This Plan was referenced extensively during the plan development process, especially in regards to the worst threats and mitigation action strategies identified in 2016.
- Strafford Town Plan (Adopted 10/13/2021)
 - The Town Plan provided TRORC's staff with background information on the community, as well as more detail on their emergency services.
- Strafford Unified Bylaw (As of 04/15/2013)
 - The Unified Bylaw was referenced for general knowledge of Strafford's zoning regulations.
- Flood Insurance Study: Town of Strafford, Vermont, Orange County (February 3, 1993)
 - The Flood Insurance Study was referenced for general knowledge of the West Branch of the Ompompanoosuc River and Tunbridge Branch, and for peak discharge information.
 - Relevant peak discharge information for the West Branch of the Ompompanoosuc River and Tunbridge Branch can be found on page 5.
- 2021 Strafford Culvert Inventory
 - This inventory was used to identify critical culverts in need of upsizing.
- 2020 Census
 - Census data was gathered to keep statistical data within the plan current.

This section of the Plan satisfies 44 CFR 201.6(b)(3) (or, A4.a and A4.b of FEMA's Local Mitigation Plan Review Guide, 2011).

C. Status Update on Mitigation Actions Identified in 2016

This section of the Plan satisfies the requirements of 44 CFR 201.6(d)(3).

The following table outlines the mitigation actions that were proposed in the 2016 All-Hazard Pre-Disaster Mitigation Plan for the Town of Strafford (adopted on January 11, 2017 as an appendix to the Two Rivers-Ottawaquechee Regional Commission's multi-jurisdictional Pre-Disaster Mitigation Plan).

Participants in the new Plan update process reviewed these actions and reported on the status of each: Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding/ Support)	2022 – Status of Mitigation Actions
ALL HAZARDS				
<i>Install dry hydrants on Mine Road and Turnpike Road to protect town infrastructure from structural fires and to protect the health of residents. (Mitigation)</i>	Fire Department	Fall 2021- Fall 2022	Local resources. VT Dry Hydrant Grant Program	Not completed. The committee will revise this strategy to include dry hydrants in rural areas for the 2022 Plan.
<i>Ensure that Strafford's Local Emergency Operations Plan (LEOP) is kept up-to-date, identifies vulnerable areas, and references this plan. (Preparedness)</i>	Emergency Management Director.	Yearly	Local resources; TRORC.	Completed.
<i>Keep gasoline powered generator located at town garage operational to be used in an emergency, as needed, at the United Church. (Preparedness)</i>	Road Foreman	Check generator every six months	Local Resources	Not completed. This action will carry over into the 2022 plan.
<i>Keep four Red Cross shelters, Newton School, Barrett Hall, Tyson Gym, and United Church, stocked with cots, blankets, and MRE (Meals Ready to Eat). (Preparedness).</i>	Emergency Management Director.	Ongoing	Local resources.	Ongoing. Some materials are present at the four Red Cross shelters. This strategy will carry over into the 2022 Plan.
Flash Flood/ Flood/Fluvial Erosion// Severe Summer Weather// Hurricanes/ Tropical Storms				

<p><i>Develop a schedule and program to replace undersized culverts. Appropriately sized culverts effectively handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding damage. (Mitigation)</i></p>	Road Foreman	Summer 2018-Fall 2019	Local resources, TRORC.	Completed. A schedule of culverts was created several years ago.
<p><i>Inventory bridges to document future damage from flooding. A constantly updated inventory will allow Strafford to keep track of frequently damaged infrastructure and will guide planning to avoid future infrastructure damage. (Mitigation)</i></p>	Road Foreman	Summer 2019- Fall 2020	Local resources.	Not completed. This strategy will not carry over in the 2022 Plan.
<p><i>Identify streambanks that have high risk of fluvial erosion that could benefit from riparian plantings or Better Roads grant. Riparian buffers prevent erosion, restore river floodplain, and help reduce the intensity of flood events; therefore protecting town infrastructure and human health. (Mitigation)</i></p>	Road Foreman	Summer 2020-Fall 2021	Local resources, TRORC, State resources.	Ongoing. There has been some activity for this strategy. The Town received a grant this year through the Flood Resilience program for the planting of 400 trees to prevent fluvial erosion.
<p><i>Upgrade two culverts, #3 and #6, in critical condition on Sawnee Bean Road. These 12 inch culverts should be upgraded to at least 18 inches in conformance with Town Road and Bridge standards. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation)</i></p>	Road Foreman.	Summer 2018-Fall 2019	Local resources, TRORC, state resources.	The committee could not determine whether these culverts were still a priority. The road foreman also did not specify these culverts as high priority. This action will not carry over into the 2022 plan.

<p><i>Upgrade culvert #22 in critical condition on Old City Falls Road to effectively handle current level of water that it experiences. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation).</i></p>	Road Foreman.	Summer 2019-Fall 2020	Local resources, TRORC, state resources.	Ongoing. There is a project currently underway to replace this culvert.
<p><i>Upgrade two culverts on Wetmore Road, culverts #5 and #8 in critical condition. These culverts should be upgraded to at least 18 inches in conformance with Town Road and Bridge standards. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation).</i></p>	Road Foreman.	Fall 2019-Fall 2020	Local resources, TRORC, state resources.	The committee could not determine whether these culverts were still a priority. The road foreman also did not specify these culverts as high priority. This action will not carry over into the 2022 plan.
<p><i>Upgrade culvert #6 on Turnpike Road in critical condition. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation)</i></p>	Road Foreman.	Fall 2018-Summer 2019	Local resources, TRORC, state resources.	Completed.
<p><i>Replace bridge on Cook Road with an upsized structure that will be more durable to extreme weather events and will protect other Strafford roads from damage. (Mitigation)</i></p>	Road Foreman.	Fall 2023-Fall 2024	Local resources, TRORC, state resources.	Completed.

<i>Revise Flood Hazard Area Zoning Ordinance to prevent the construction of infrastructure in areas that are vulnerable to flooding and severe weather. (Mitigation)</i>	Planning Commission	Fall 2016 during Town Plan update-Fall 2017.	Local resources, TRORC.	In progress. The Planning Commission is in the process of amending the bylaws.
<i>Anchor fuel tank behind Coburn's General Store on Route 132 in order to secure it in the event of flooding. (Mitigation)</i>	Fire Chief	Spring 2017-Fall 2017	Local Resources	Not completed. This action will carry over.
<i>Consider adopting River Corridor regulations, which will incorporate VT ANR's River Corridor Map. These regulations will help residents and planners know what land is necessary for riparian functions and to will prevent the threat to current and future infrastructure. (Mitigation)</i>	Planning Commission	Fall 2021-Fall 2022	Local Resources	Completed. The town discussed inclusion of River Corridor bylaws and will look to incorporate bylaws as an action of this plan.
<i>Adopt Flood Resiliency Element to Town Plan, which will identify flood hazards to Strafford and will identify goals, policies, and recommendations to mitigate risks to public health and infrastructure. (Mitigation)</i>	Planning Commission	Fall 2016 during Town Plan update-Fall 2017.	Local Resources	Completed.
<i>Continue to use existing methodology for documenting infrastructure damage from hazards. This process began after Tropical Storm Irene and is ongoing. Ongoing knowledge and record of infrastructure damage helps Strafford to determine vulnerable structures, and will guide planning to prevent future infrastructure damage.</i>	Road Foreman	Ongoing	Local Resources.	This action is ongoing.
Extreme Cold/Snow/Ice Storms//Severe Summer Weather (High Wind)				

<i>Once specific at-risk residents are identified, develop a plan to reach out to those (and all) residents to educate them about accessible heating centers and Red Cross facilities in Strafford. Knowledge and ability to access these areas by residents will reduce the risk to human health in the event of a hazard.</i>	Emergency Management Director	Yearly.	Local Resources	This action is ongoing.
<i>Identify power critical customers that are vulnerable to power outages. (Preparedness).</i>	Emergency Management Director	Every four months.	Local Resources	This action is ongoing.
<i>Budget to ensure the Town has sufficient funds to provide safe winter travel conditions, which will reduce the threat to the health of residents.</i>	Selectboard	Yearly	Local Resources	Ongoing. The Town updates the budget yearly.
<i>Encourage Green Mountain Power to continue regular tree trimming along power lines through their Phase 3 power project to ensure clear and maintained utility corridors and to protect utility and town infrastructure.</i>	Emergency Management Director	Yearly	Local Resources	It is not clear to the Committee how this action will be effective, as GMP sets its own schedule. This action will not carry over into the 2022 Plan.
Invasive Species				
<i>Formalize road crew best practices for seasonal mowing. Mechanical control methods will reduce the spread of invasive species. (Mitigation)</i>	Road Foreman, Conservation Commission	Summer 2019- Summer 2020	Local Resources.	Completed and ongoing.
<i>Road crew and volunteer efforts will coordinate to schedule mechanical control events to eradicate invasive species. (Mitigation)</i>	Road Foreman, Conservation Commission	Summer 2019- 2020.	Local Resources	Completed and ongoing.

Create a community education program for municipal staff and residents. (Preparedness)	Conservation Commission	Summer 2018	Local Resources.	Ongoing. The conservation commission is engaged in educational efforts on invasive species. This action will continue in the 2022 plan.
Develop a Forest Preparedness Plan (Preparedness)	Conservation Commission	Summer 2018	Local Resources.	Completed.

Changes in Town Priorities and Vulnerabilities Since the 2016 Plan

The 2022 Strafford Local Hazard Mitigation Plan reflects several changes to the Town of Strafford's vulnerabilities to hazards and addresses the Town's changes in priorities to different hazards. These priorities and vulnerabilities have changed in large part due to the implementation of mitigation actions that were listed in the 2009 Plan. The implementation of several of these mitigation actions has reduced the Town's vulnerability to specific hazards. However, several new hazards that currently pose a risk to the Town were addressed in detail in this 2022 Plan that were not addressed in the previous 2016 Plan. One hazard from the 2016 Plan, Invasive Species, is not considered in the 2022 Plan. Invasive species is still an important hazard for the town and strategies to address this hazard are being carried over into the current plan. The 2016 Plan addressed Flash Flood, Flood, Fluvial Erosion; Severe Summer Weather & Hurricanes, and Tropical Storms; Extreme Cold, Snow and Ice. These hazards have carried over into the 2022 Plan, given the likelihood of occurrence and impact on the town. Added to the 2022 Plan is Extreme Heat and Drought. The Committee considers Extreme Heat to be of moderate concern, but that occurrences of extreme heat events will likely only increase and become more severe. Strafford, like much of Vermont, experienced drought during the Summer of 2022, prompting the committee to review options for addressing this hazard.

Overall, there is very little development activity in the Town of Strafford, and no major development that would affect the town's vulnerability to hazards. The Town's Flood Hazard Area Zoning Ordinance prohibits new development and construction of new buildings in the Town's mapped floodways and Special Flood Hazard Areas, which are the areas in the Town that are most vulnerable to severe weather/hurricanes/tropical storms, flooding, and fluvial erosion. No new building permits were issued for locations within the Town's Special Flood Hazard Areas. No new development is or will be permitted in mapped flood hazard areas, which are specifically vulnerable to flooding. Structures located outside the SFHA are also vulnerable to flood hazards if they are located near a steep, upland stream. Structures in these areas are vulnerable to fluvial erosion as opposed to inundation hazard. Due to the terrain and steep valleys in the Town of Strafford, future new development may be vulnerable to either flood hazards or fluvial erosion hazards. The vulnerability of any new growth would be dependent on its location near a Special Flood Hazard Area (SFHA), near a small stream, or on a steep hill. Overall, new development in Strafford since the 2016 Plan has caused no change in the Town's vulnerabilities.

D. Town Capabilities for Implementing Mitigation Strategy

The Town of Strafford is currently engaged in the following hazard mitigation programs, projects and activities:

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3).

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On
Community Preparedness Activities	Program—Annual update of Strafford’s Local Emergency Management Plan (LEMP). Last updated and approved on 05/25/2022.	Volunteer time from the Selectboard//Emergency Management Director; assistance from TRORC. Funding from Vermont DEMHS.	This document is reviewed and updated each year to ensure that the contact information of emergency response personnel is up-to-date. This information is then sent to Vermont Emergency Management for their records. There is no need to expand on this program at this time.
	Completed Action—Red Cross Shelter Designation Shelters designated at Barrett Hall, the Newton School, the Rosa Tyson Gym, and the United Church of Strafford.	Staff time from the Town Clerk, volunteer time from Selectboard, Emergency Management Director. Funding from American Red Cross.	This is a one-time action This action can be expanded to include an inventory maintenance plan to ensure shelters have adequate supplies.
	Program—attendance/participation at Local Emergency Planning Commission (LEPC) #12 meetings	Volunteer time from the Strafford Emergency Management Director. Funding from Vermont DEMHS.	No need to expand or improve on attendance, as attendance is satisfactory.
Insurance Programs	Authority/ Program— participation in National Flood Insurance Program (NFIP) The Town of Strafford participates in and is compliant with the NFIP by enforcing its most currently adopted Flood Hazard Area Zoning Bylaw (Last amended March 2, 1993). The Town enforces the Flood Hazard Area Regulations based on the 02/03/1993 FIRMs. [Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]	The Town’s Zoning Administrator serves as the NFIP administrator. Assistance from TRORC and Vermont ANR. Funding from local resources—annual budget.	The Town’s initial Flood Hazard Boundary Map (FHBM) was dated 03/28/1975. The Town’s initial Flood Insurance Rate Map (FIRM) was dated 09/27/1985. The Town of Strafford, Vermont Flood Insurance Study (FIS) is dated 02/03/1993. The Town’s current Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) have not been updated since 1993, and the current effective date for the Town’s FIRMs is 02/03/1993.
	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On

Land Use Planning	Policy/Program— Strafford Town Plan (Adopted 10/13/2021).	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	The Town Plan is updated every eight years, as required by statute. The Planning Commission may expand or improve on any section it deems necessary, or that is required by changes in state statute. The Town Plan was recently readopted in 2021.
	Authority—Strafford, Vermont Zoning Ordinance (As of 01/10/2007). Includes the Town’s Subdivision Regulations which were last updated 6/15/1996.	Volunteer time from Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Strafford Zoning Ordinance is also reviewed and updated if needed, and also to reflect any changes made in the Town Plan.
	Authority—Strafford Flood Hazard Area Zoning Ordinance. Last amended March 2, 1993. Part of the Town’s Unified Bylaw.	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont ANR. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Flood Hazard Area Bylaws are also reviewed and updated if needed. The Town’s Flood Hazard Area Zoning Ordinance has not been updated since it was adopted, but the Planning Commission is working on revising it.
Hazard Control & Protection of Critical Infrastructure & Facilities	Completed Action— Culvert inventory with TRORC assistance in 2021.	Staff time from the Road Foreman; with assistance from TRORC. Funding from VTrans.	The Town recently completed a culvert inventory with assistance from TRORC. Strafford is currently using the culvert inventory to further its culvert improvement program. Currently, 87% of culverts are considered to be in “Good” condition, 8% are in “Fair” condition, 4% poor, and 1% critical.
	Authority— Town Road and Bridge Standards (Adopted 04/24/2013) Certificate of Compliance issued 02/38/2018	Adopted by the Selectboard, implemented by the Road Foreman, assistance from TRORC. Funding from VTrans and the local budget to implement.	Specifies minimum construction standards for roadway, ditches, culverts and bridges and guardrails. VTrans updates the Town Road and Bridge Standards on a fairly regular basis. The Town has the authority to require above-and-beyond what is written in the policy.
	Authority—Strafford Flood Hazard Area Zoning Ordinance Last amended January 10, 2007	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont ANR. Funding from	During the Town Plan review/update period, the Flood Hazard Area Bylaws are also reviewed and updated if needed. The Town’s Flood Hazard Area Zoning Ordinance was last amended in 2007.
		Municipal Planning Grants.	
	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability To Expand/Improve On

	Policy/Program—Strafford Winter Road Maintenance Policy (Adopted 02/09/2011)	Staff time from the Town Road Foreman, volunteer time from the Town Selectboard. Funding from local budgets to implement.	This policy outlines how the town's road network will be maintained during the winter months, and ultimately places the safety of winter travel on the "traveling public." This policy may be revised and/or updated at the discretion of the town's Selectboard.
	Policy/Program—Strafford Hazard Mitigation Plan (Adopted on 01/11/2017)	Volunteer time from Town officials; assistance from TRORC and Vermont DEMHS. Funding from FEMA; Vermont DEMHS; TRORC.	The 2022 Strafford Local Hazard Mitigation Plan will replace the 2016 Plan. The 2022 LHMP has evolved from the 2016 Plan and has greatly expanded and improved upon it. Future iterations of the Town's LHMP will be updated by the Town at least every five years.
Education/ Public Outreach	Ongoing Action—Education/Communication to community regarding structure fire prevention or important information.	Time from the Volunteer Fire Department and funding from Fire Department budget.	This is an ongoing action, and there is no need to expand or improve on this action.
	Ongoing Action—The Town of Strafford has a website, town facebook page, and listserv, where important information is posted.	Time from the Town Office. Funding from local budgets.	There is no need to expand or improve on this action.

E. Plan Maintenance

This Plan (the Strafford Local Hazard Mitigation Plan) will be updated and evaluated by discussing its effectiveness and making note to incorporate any necessary revisions in the update process. This update and evaluation will occur annually at an April Selectboard meeting along with the annual review of the Local Emergency Management Plan (LEMP). At this meeting, the Selectboard will monitor the implementation of the hazard mitigation and preparedness strategies outlined in this Plan by noting those that have been completed, and identifying the next steps required to implement the Plan's remaining strategies. Comments from local officials and the public will be incorporated when relevant. This meeting will constitute an opportunity for the public and other town officials to hear about the town's progress in implementing mitigation strategies and to give input on future activities and Plan revisions. The public will be given the opportunity to comment at this meeting. Evaluation of the Local Hazard Mitigation Plan will consist of a thorough analysis of the status of mitigation and preparedness strategies and whether they are being implemented according to the time frames included in tables in this Plan. The Town of Strafford will evaluate the status of mitigation strategies to assess that goals of the Local Hazard Mitigation Plan are being met. Adherence to the mitigation, preparedness, and ongoing strategy implementation tables included in this Plan will constitute the degree of effectiveness of the Plan. The Town will also evaluate the status of vulnerabilities detailed in this Plan to evaluate their validity. The update of the Plan will bring up to date materials that have become outdated due to the passage of time. Strafford's Emergency Management Director will be the principal point of contact and will take primary responsibility for the monitoring, evaluation, and update process described here. He or she will bring the Plan's maintenance activities to the Selectboard's agenda and discussions.

Updates and evaluation of this Plan by the Selectboard and the local Emergency Director will also occur within three months after every federal disaster declaration directly impacting the Town of Strafford. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at every April Selectboard meeting and after every federally declared disaster according to the graphic in Appendix C. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws.

This section of the Plan satisfies 44 CFR and 201.6(c)(4)(i), 201.6(c)(4)(ii), and 201.6(c)(4)(iii).

At least one year before the Plan expires, the update process will begin (though annual updates, monitoring of progress and evaluation will occur at the April Selectboard meeting). For this next Plan update, the Two Rivers-Ottawaquechee Regional Commission (TRORC) will help with Plan updates if assistance is requested by the Town of Strafford and if funding is available. If TRORC is unable to assist the Town, then Strafford's Town Clerk, Administrative Assistant, or Selectboard will update the Plan, or the Selectboard may appoint a committee of interested citizens (including the current local Emergency Director) to draft changes. Ultimately, it will be the Town's responsibility to update their Local Hazard Mitigation Plan.

The process of evaluating and updating the Plan will include continued public participation through public notices posted on the municipal website, notice within the municipal building, notice in The Valley News and other local newspapers, inviting the public to the scheduled Selectboard (or specially scheduled) meeting. The public will be given the opportunity to comment during these public meetings. Additional stakeholders should be invited to the meeting, including: local business and civic/non-profit organizations, Upper Valley Ambulance, Inc., and the Vermont Agency of Natural Resources (VT ANR). VT ANR should be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning regulations, delineation of river corridor areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk.

Updates will address changes in community mitigation strategies; new town bylaws, zoning and planning strategies if appropriate; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities effectiveness in reducing town's vulnerabilities and meeting plan goal. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

The Town of Strafford shall also incorporate mitigation planning into their long-term land use and development planning documents. The 2013 Vermont Legislature passed a law requiring all towns to incorporate flood resiliency elements into their town plans as of July 2014. To do so, flood hazard and fluvial erosion hazards will be identified, and strategies and recommendations will be provided to mitigate risks to public safety, critical infrastructure, historic structures and public investments. This Local Hazard Mitigation Plan will help the town to comply with the new community flood resiliency requirement for town plans adopted after July 2014.

It is also recommended that the process work both ways and the Town review and incorporate elements

of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ river corridor bylaws. The current Strafford Town Plan has incorporated goals, policies, and objectives to protect citizens, property, and the town economy from heavy flooding incidents. In addition, the 2021 Town Plan presents some strategies based on the 2016 Hazard Mitigation Plan. In the Natural Resources chapter of the Town Plan, one of the implementation tasks is for the Conservation Commission to “inform citizens to identify and practice the safe elimination of invasive plants, which can be found in the Strafford Local Hazard Mitigation Plan.” Furthermore, both the 2016 LHMP and the 2021 Town Plan have action items for exploring revisions to the Flood Hazard Area Zoning Ordinance and the incorporation of River Corridors into the flood hazard bylaw.

The Strafford Planning Commission will continue to incorporate mitigation strategies directly into goals, policies, and recommendations in future updates to the Strafford Town Plan. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations, and flood hazard/river corridor bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

V. Community Vulnerability by Hazard

A. Hazard Identification

Mitigation efforts must be grounded in the rational evaluation of hazards to the area and the risks these hazards pose. This is done through a process, which in essence asks and answers three basic questions:

- What bad things can happen, given the Town’s vulnerabilities?
- How likely are they to occur?
- How bad could they be?

This process, which is laid out in the table below, is an attempt to inventory the known hazards, establish the likelihood of them occurring in the future, and then assess the community’s potential vulnerability to each. In performing this analysis, we are then able to prioritize actions that are designed to mitigate the effects of each of these disaster types and ultimately make Strafford a safer place.

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Strafford, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While the Town of Strafford might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not remain consistent. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially high intensity rainfall events. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

A significant change between this Plan and the 2016 plan is the way in which hazards are assessed. This Plan follows closely the hazard assessment approach taken in the 2018 State Hazard Mitigation Plan. The table below displays the ranking criteria used to score both the potential impact and the frequency of occurrence. The Hazard Mitigation Planning Team performed an analysis to determine the probability of hazard events occurring in the future.

Score	Frequency of Occurrence: Probability of a plausibly significant event.	Potential Impact: Severity and extent of damage and disruption to population, property, environment and the economy.
1	Unlikely: Less than 1% probability of occurrence per year.	Negligible: Isolated occurrences of minor property and environmental damage, potential for minor injuries, minor economic disruption.
2	Occasionally: 1% through 10% probability of occurrence per year, or at least one chance in next 100 years	Minor: isolated occurrences of moderate to severe property and environmental damage, potential for injuries, minor economic disruption.
3	Likely: between 10% to 75% probability per year, at least 1 chance in next 10 years.	Moderate: severe property and environmental damage on a community scale, injuries or fatalities, short-term economic impact
4	Highly Likely: 75% or greater probability in a year	Major: severe property and environmental damage on a community or regional scale, multiple injuries or fatalities, significant economic impact

Using this ranking criteria, the following table reflects the hazards that we believe can be expected, or are at least possible, in the central Vermont area. We have considered factors such as frequency of occurrence and potential community impact to rank each and determine which hazards pose the greatest threats to life and property in Strafford. The most significant threats (bolded in the table, below) are then followed-up with discussion and mitigation strategies throughout the rest of this Plan.

Table: 2022 Hazard Assessment							
	Probability	Potential Impact					
Hazard Impacts		Infrastructure	Life	Economy	Environment	Average:	Score*:
Snow Storm & Ice*	4	3	3	3	2	2.75	11
Inundation, Flooding, and Fluvial Erosion*	3	4	4	3	2	3.25	9.75
Extreme Heat*	4	3	2	2	2	2.25	9
Tropical Storm/Hurricane*	3	4	3	3	2	3	9
Severe Summer Weather**	3	4	3	2	2	2.75	8.25
Drought	3	1	3	2	4	2.5	7.5
Generalized Power outages	4	2	3	2	1	2	8
Invasive Species	4	1	1	2	3	1.75	7
Extreme Cold	3	3	3	2	1	2.25	6.75
Wastewater Contamination	3	1	3	2	3	2.25	6.75
Infectious Disease	3	1	4	3	1	2.25	6.75
Freeze/Thaw cycles	3	4	1	3	1	2.25	6.75
Wildfire	3	2	2	2	2	2	6
Tornado	2	3	3	3	2	2.75	5.5
Thunderstorms	4	1	2	1	1	1.25	5
Strong Winds	3	3	2	3	1	2.25	6.75
Landslides, rockslides, and mudslides	2	3	2	2	2	2.25	4.5
Hazardous Materials Spills	2	1	2	2	4	2.25	4.5
Earthquakes	2	3	2	3	1	2.25	4.5
Structural Fire	2	3	3	2	1	2.25	4.5
Dam Failure	1	4	4	4	4	4	4
Tsunami (Vermont is landlocked)	1	4	4	4	4	4	4
Hail	2	2	1	1	1	1.25	2.5
Civil Unrest	1	3	3	3	1	2.5	2.5

The Strafford LHMP committee discussed the results of the hazard ranking activity and decided to focus on hazards that scored highest in probability of occurrence as well as potential impact. While hail storms ranked extremely low, they were included in the Severe Summer Weather hazard, given the likelihood of it occurring in combination with a severe thunderstorm event. The committee also chose to include drought as a top hazard, given the impact drought can have on water supply, livestock, agriculture, and the environment. Extreme cold was also included in the Snow Storm & Ice hazard, due to the overlap of these events. The Committee discussed generalized power outages as a hazard, and concluded that these were the result of other events – such as flooding, severe weather, and winter storms – and that power outages could be incorporated into those top hazards. For the purposes of this Plan, Severe Weather and Hurricanes/Tropical Storms will be combined into one hazard profile area for analysis due to their overlapping events and potential impacts to the Town.

Due to a lack of resources and capacity at the town, the following hazards will not be discussed in detail in this plan: Generalized Power Outages; Invasive Species; Extreme Cold; Wastewater Contamination; Infectious Disease; Freeze/Thaw Cycles; Wildfire; Tornado; Thunderstorms; Strong Winds; Landslides, Rockslides, and Mudslides; Hazardous Materials Spills; Earthquakes; Structural Fire; Dam Failure; Tsunami; Hail; Civil Unrest. Hail is included but not discussed in detail in the Severe Summer Weather hazard, since hail may occur during severe thunderstorm events but did not rank highly in the hazard assessment. Likewise, extreme cold is discussed in the Extreme Cold/Snow/Ice Storm section, but is not fully profiled since the primary focus was snow and ice storms. For a detailed description of many of these hazards, the reader should review the Vermont State Hazard Mitigation Plan. It should be noted that hazards assigned with the same “Hazard Score” are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

After engaging in discussions using their best available knowledge, the Town of Strafford identified the following “top hazards” (based on frequency of occurrence and potential impact) that they believe their community is most vulnerable to:

- Flash Flood/Flood/Fluvial Erosion
- Severe Summer Weather & Hurricanes/Tropical Storms
- Extreme Cold/Snow/Ice Storms
- Extreme Heat
- Drought

Each of these “top hazards” will be discussed in the following sections. Within each section, previous occurrences of each hazard will be listed, including the County-wide FEMA Disaster Declarations (DR-#), where applicable. Hazards information was gathered from local sources (ex., town history book), the National Climatic Data Center’s (NCDC’s) Storm Events Database (1950-2015), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2015, and Special Reports produced by the National Weather Service in Burlington, Vermont. As of 2020, SHELDUS is no longer a free national database, but data collected from the database prior to 2015 has been included in this Plan as it is still extremely relevant. Often data was only available at the county level, but when available, town-specific data was used. This section also includes a description of each “top hazard” and a hazard matrix that will also include the following information (please see each hazard profile for a hazard-specific matrix):

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Type of hazard.	General areas in community that may be vulnerable to the hazard.	Community structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard events.	The strength or magnitude and details of the most notable event(s).	Financial impact from an event and/or the number of structures that are impacted.	<u>Occasionally</u> : 1–10% probability of occurrence per year, or at least one chance in next 100 years <u>Likely</u> : >10% but <100% probability per year, at least 1 chance in next 10 years <u>Highly Likely</u> : 100% probable in a year

B. Hazard Profiles for “Hazards Posing Highest Vulnerabilities”

1. Flash Flood/Flood/Fluvial Erosion

The most frequent form of flooding in the State of Vermont and the Town of Strafford is riverine flooding, or overbank flooding, which occurs to rivers when they receive more rain or snowmelt from their watershed than they typically experience. Flooding causes the inundation of land that is normally dry. Overbank flooding is experienced more frequently in mountainous and hilly areas where water moves with higher velocities. Flash floods occur when severe storms drop high amounts of rainfall in short periods of time. Flash floods occur more frequently in areas with steep slopes and narrow stream valleys. Riverine erosion is the gradual wearing away of land masses by rivers and streams. River channels are constantly changing. As rivers flow and water moves downstream, water exerts energy upon riverbanks and causes erosion.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Flash Flood/Flood/Fluvial Erosion**.

Flooding is one of the worst threats to Strafford’s residents and infrastructure. Past instances of flooding in Strafford have included rain and/or snowmelt events that cause flooding in the major rivers’ floodplains and intense rainstorms over a small area that cause localized flash- flooding. Both kinds of events can be worsened by the build-up of ice or debris, which can contribute to the failure of important infrastructure (such as culverts, bridges, and dams).

The worst flood disaster to hit the Town of Strafford, as well as the overarching region and the State of Vermont, occurred on November 3, 1927. This event was caused by up to 10 inches of heavy rain from the remnants of a tropical storm that fell on frozen ground. Eighty-four Vermonters, including the Lieutenant Governor, were killed. The flooding in the White River valley was particularly violent, with an estimated 120,000 to 140,000 cubic feet/second (cfs) flowing out of the White River at West Hartford, Vermont. Like many towns in the region, the Town of Strafford received heavy precipitation, seeing roughly 6-7 inches of rainfall over the storm period.



Alger Brook Road after Irene

A more recent flooding event that devastated the region and the state was the result of Tropical Storm Irene, which occurred on August 28, 2011. Record flooding was reported across the state and was responsible for several deaths, as well as hundreds of millions of dollars of home, road and infrastructure damage. Due to strong winds, 50,000 Vermont residents were initially without power, and many did not have electricity restored to their homes and businesses for over a week. Despite the damage wrought, the flooding caused by Tropical Storm Irene is considered to be the second greatest natural disaster in 20th and 21st century Vermont, second only to the Flood of 1927.

The Town of Strafford suffered some damage to property and infrastructure during Tropical Storm Irene, although no lives were lost. It is estimated that Tropical Storm Irene dropped 6-7 inches of rain over the Town of Strafford in a very short span of time, some of the highest precipitation totals in Orange County (which averaged 5-7+ inches over its land area). A few of Strafford's roads were damaged by the storm, including parts of Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road. The county-wide damage for Orange County totaled \$5 million. According to FEMA's PA database, the storm damage for Strafford alone totaled \$2,432,610.17, which is a figure that captures at least 70% of total damage for the Town. No other homes or other structures in the Town were a part of the ensuing TS Irene property buyout process.

According to Strafford LHMP committee members, two of the biggest problems associated with flood events in the town are debris and the erosive washouts of roadways and bank slopes. With respect to debris during flood events, there was a great deal of concern around propane storage tanks floating downstream.

Barrett Hall, which was in the evacuation zone and serves as a community shelter, was compromised during TS Irene when an unanchored 1,000 gallon above ground storage tank AST threatened to hit a nearby bridge. Other emergency shelters may be at risk as well during large future flood events.



Fay Brook Road during Hurricane Irene

Roads of particular concern for flooding and washouts include Alger Brook Road, Wetmore Road, and Brook Road. An area along Route 132 close to Jackson Brook Road is also of concern for emergency responders. Flooding and erosion along this area could make it difficult for ambulances and emergency response vehicles to access

The land between the two villages was, and continues to be, especially prone to flood damage, in part due to the topography of where they are situated at lower elevations from steeper terrain and along river and streambanks. The expectation is that damage will continue to be concentrated in lower elevation areas with more inundation flooding, particularly in the lower village (where the stream is

very close to the buildings) and areas generally where the waterways and roadways are nearly level.

To address this ongoing concern, the Conservation Commission has recently undertaken a riverine tree planting project along unvegetated bends in the river that were prone to flooding. In all, around 400 trees were planted along the river in South Strafford and Strafford Village. More projects such as this can be undertaken to strengthen the riparian buffer along the Ompompanoosuc and reduce the impact of future flood events in Strafford.

Unfortunately, flooding is very common across the region, with many events impacting the Town of Strafford. Strafford has been severely affected by other flooding events that pre-date Tropical Storm Irene. As such, flooding is one of the worst threats to Strafford's residents and infrastructure. The following list indicates the history of occurrence with regard to this hazard in Orange County (given the small population of Strafford, town-specific data is limited); an asterisk "*" denotes the instances in which town-specific data is available, and federal disaster numbers are listed where appropriate. No detailed data was available for fluvial erosion damage in Strafford in terms of acres lost during each event.

History of Occurrences:

Date	Event	Location	Extent and Impacts
4/15/2019 (DR-4445 VT)	Flood	County-wide	No town-level data on the size of land impacted is available. Total FEMA funding obligations for Orange County are estimated over \$600,000. Over 1.5 inches of rain fell in Corinth Vermont.
10/29/2017- 10/30/2017 (DR-4356 VT)	Flood	County-wide	No data on the size of the land area that was impacted. Total FEMA funding obligations totaled over \$5 million. Rain accumulations of over 1.75 inches for October 30 th .
6/29/2017- 7/1/2017 (DR- 4330)*	Flash Flood	Strafford, county-wide.	Flash flooding and road damage throughout the County. Between June 30 th and July 2 nd , over 5 inches of rain fell throughout the region. No available data on the size of the land area that was impacted.
2/25/2017	Flood	Strafford, County-Wide	Minor river flooding. No available data on the size of the land area that was impacted. Approximately \$10,000 in property damage County-wide.
Period from 04/15/2014- 04/18/2014 (DR-4178 VT)	Severe Storms and Flooding	County-wide	Heavy rains and melting of late season snowpack caused widespread flooding across central Vermont, with 4-6 inches of water released and many waterways reaching near bankfull conditions. Many state highways in Orange County were closed, and unpaved secondary roads were damaged.
Period from 06/25/2013— 07/11/2013 (DR-4140)*	Severe Storms and Flooding	County-wide	Severe storms caused flooding throughout the region, and damaged some infrastructure and facilities. No specific damage was claimed in the Town of Strafford. Strafford received about 9.22 inches of rain over the disaster period. Two power outages occurred during the disaster period in Strafford, but affected only 20 Green Mountain Power customers for less than 2 hours.

Date	Event	Location	Extent and Impacts
08/28/2011 (DR-4022, TS Irene)*	Tropical Storm	Strafford, County-wide	<p>Widespread rainfall amounts of 3-5 inches occurred across Vermont with 5 to 7+ inches across much of southern, central Vermont. Devastating flash flooding occurred across much of central and southern Vermont mountain valleys with substantial and some record breaking flood stages on larger rivers. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage [26ccurri. \$500 million statewide vs \$350 million (1927 in 2010 dollars)]. There were nearly 2,400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. According to spotter's reports, Strafford received nearly 7" of rain. Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road were damaged in Strafford during Irene. \$2,432,610.17 in damage occurred for Strafford according to FEMA's Public Assistance database (captures at least 70% of total damage).</p> <p>Widespread power outages occurred in Strafford affecting more than 500 Green Mountain Power customers, and most outages lasted longer than 48 hours.</p>
05/25/2011-05/27/2011 (DR-4001)	Severe Storms and Flooding	County-wide	Severe storms and flooding struck the region and the state. Orange County was eligible for federal public assistance funding in the wake of the storms. Strafford received about .63 inches of rain in 24 hours. No significant power outages occurred in Strafford.
07/21/2010	Flash Flooding	Strafford; County-wide	Several storms strengthened into super cells that produced widespread wind damage to trees, power poles and structures as well as large hail in excess of golf ball size in diameter. Very heavy localized rains caused some temporary problems in many communities. Strafford received about 4.18 inches of precipitation in 72 hours. Power outages in Strafford affected 256 customers and lasted from 5.4 to 10.8 hours.
08/21/2009	Flash Flooding	Strafford; County-wide	Thunderstorms produced torrential downpours in Strafford and surrounding areas. An official NWS Cooperative Observer reported a rainfall total of 2.79 inches, and other unofficial reports of 4 inches of rain within 2 hours were common. Flash Flooding resulted throughout the region. No significant power outages occurred in Strafford.
08/07/2008* (Part of DR-1790 VT)	Flash Flooding	Strafford; County-wide	Thunderstorms with heavy rainfall in a moist atmosphere moved through central and southern Vermont during the afternoon and evening hours. Flash flooding resulted in portions of Aimes, Carpenter Hill, Clover Hill, and Brook Roads being washed out. Approximately \$25,000 in damage occurred to Town roads and embankment slides. Strafford received 2.83 inches of rain in 48 hours. No significant power outages occurred in Strafford.
07/11/2007 (DR-1715 VT)	Flash Flood	County-wide	Tropical-like showers and thunderstorms struck east-central Vermont, with localized rainfall amounts exceeding 3 inches in a 2 hour period. No significant power outages occurred in Strafford.
06/27/1998 (Part of DR-1228 VT)	Flash Flood	County-wide	Heavy rains brought 4-8 inches of rainfall to the county, with many homes and businesses flooded and/or losing power. National Guard members were sent in to aid with relief. Power outage time data for this event are not known.
01/1998 (DR-1201 VT)	Flooding	County-wide	An average of 3.5 inches of rainfall throughout the region early in the month was exacerbated by ensuing bad weather, causing flood damage throughout the region. Power outage time data for this event are not known.
01/19/1996-01/20/1996	Flood	County-wide	A deadly storm caused strong winds and flooding throughout the state. Many roads washed out, numerous power outages were reported, and \$250K in damage were reported for Orange County. More detailed rainfall data was unavailable for Strafford. Power outage time data for this event are not known.

Date	Event	Location	Extent and Impacts
03/1992 (DR-938 VT)	Flooding	County-wide	Heavy rain and ice jams during the winter season prompted flooding throughout the state, including Orange County. More detailed rainfall data was unavailable for Strafford. Power outage time data for this event are not known.
06/28/1973—06/30/1973 (DR-397)	Flooding	County-wide	Rainfall as much as 6 inches in 24 hours in some locations. State declared disaster area. 3 deaths occurred and resulted in \$64 million in damage. Power outage time data for this event are not known.

The Town of Strafford has standalone flood hazard regulations that were last amended in 1993, which are referenced within the Town’s zoning regulations. Development in the floodway is prohibited unless a proposed development has been certified by a qualified engineer that can demonstrate that a project will not result in any increase in flood levels within the floodway during an event. The flood hazard regulations also place restriction on development in “fringe areas,” although these areas are not fully defined in the regulations. However, structures in the fringe areas of the Town shall be designed to minimize flood damage and maintain the integrity of waterways.

There are 30 structures within the 500-year floodplain, the majority of which are residential in character. There are 5 properties within the SFHA that have Flood Insurance Policies, and 1 municipal building is located within the SFHA. There are no public water supply wells or waste treatment facilities located in Strafford that could be adversely impacted by a flood event; however, private wells and septic could be impacted by flood waters. Disruption of the critical services in the 500-year floodplain could drastically hamper future response and relief efforts in the Town, and could cause major disruption to business continuity. Of operations. Putting such an event into context, the flooding that occurred as a result of Tropical Storm Irene is considered to be greater than a 100-year flood event, and likely closer to a 500-year flood.

Across Vermont, most child and elder care facilities are not registered with the State. Most child day care is private in-home care in Strafford, but there is also one licensed childcare facility in the Town. There are no elder care facilities in the Town of Strafford. Finally, low income housing is not registered with the State, and there are currently no mobile home parks located in Strafford that are registered with the State.

Recent studies have shown that the majority of flooding in Vermont occurs along upland streams, as well as along road drainage systems that fail to convey the amount of water they are receiving. These areas are often not recognized as being flood prone, and property owners in these areas are not typically required to have flood insurance. It should be noted that, while small, mountainous streams may not be mapped by FEMA in NFIP FIRMs (Flood Insurance Rate Maps), flooding along these streams is possible, and should be expected and planned for. Flash flooding in these reaches can be extremely erosive, causing damage to road infrastructure and to topographic features including stream beds and the sides of hills and mountains. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountainside undercutting. Furthermore, precipitation trend analysis suggests that intense, local storms are occurring more frequently, which indicates that Strafford will experience high intensity rainfall and flooding events in the future. Due to Strafford’s topography of steep slopes and narrow river valleys, fluvial erosion also has a high probability of future occurrence.

Strafford maintains an up-to-date list of culverts and culvert conditions, and has engaged in culvert upgrading since the 2009 Strafford Annex was drafted. The Town’s most recent comprehensive, town-wide culvert inventory was completed with Two Rivers-Ottawaquechee Regional Commission assistance in 2021, and the process of upgrading culverts is ongoing (and funding permitting). No development projects are planned in Strafford in areas that would be vulnerable to flooding. There are no repetitive loss properties in the Town of Strafford. According to the most recent inventory, 32 of 608 culverts are considered to be in poor or critical condition. A list of these culverts is provided in Appendix D.

Finally, in an effort to help reduce the Town’s vulnerabilities to flooding and protect structures and road infrastructure, it is important to restore floodplain and increase the number of areas for retention wherever possible. Equally important to reducing flood vulnerabilities is the process of stabilizing river banks in areas that are vulnerable to slides and/or have the potential to damage critical or important infrastructure.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Flood/Flash Flood/Fluvial Erosion	All roadways and properties adjacent to waterways.	Culverts, bridges, road infrastructure. There are 26 residential and 3 commercial structures in the 500-year floodplain. Vulnerable commercial and public structures include Coburn’s General Store, the South Strafford Post Office, The Our Lady of the Light Church, the Rosa Tyson Gym, and the Strafford and South Strafford Volunteer Fire Departments, which are within the mapped Vermont River Corridor.	Tropical Storm Irene. 5-7” of rain across the county (6-7” in Strafford). No detailed data was available for Fluvial erosion damage in Strafford in terms of numbers of acres lost during each event.	Tropical Storm Irene: \$2,432,610 for Strafford, per FEMA’s Public Assistance database (captures at least 70% of total damage).	<u>Likely</u>

2. Severe Summer Weather & Hurricanes/Tropical Storms

Severe weather consists of thunderstorms, lightning, hail, and intense winds. Often it consists of multiple events that combine to create hazardous conditions that pose a threat to communities in the State of Vermont and the Town of Strafford. Severe weather can be incredibly unpredictable. More common than hurricanes or tropical storms are severe thunderstorms (usually in the summer), which can cause flooding, as noted above, and are associated with

lightning, high winds, hail and tornadoes. Hailstorms have occurred in Vermont, usually during the summer months. While local in nature, these storms are especially significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage. Between 1950 and 2022, there were 787 hail events recorded in the state of Vermont, making hail an annual occurrence in some parts of the state. Most of these events had hail measuring .75 inches, but many had hail at least 1.5 inches in size. The largest hail during the period was 3-inch hail that fell in

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Severe Summer Weather**.

Chittenden County in 1968 (NCDC). Tennis ball-sized hail was reported in the town of Chittenden during a storm in the summer of 2001. Thunderstorms can generate high winds, such as the event that hit Bethel in the summer of 2014 that produced straight-line winds which leveled trees in large swathes.

In Strafford, severe weather is quite common, typically in the late spring and summer months when the region experiences high temperatures. Severe thunderstorms tend to bring other hazards such as high winds, hail, lightning, and flooding, and these hazards are often experienced in combinations which create many unique weather and emergency management situations. Over the years, Strafford has been hit with high winds that have downed and uprooted numerous trees, and knocked out electricity to residents in the Town. Town-specific wind data is sometimes difficult to find, nevertheless, the “Remarks” section of NCDC Database helps to illuminate the impact strong winds can have on Strafford. Sizeable hail has also accompanied storms moving through the Town and region.

While hurricanes (storms with sustained winds greater than 74 mph) and tropical storms rarely reach as far inland as Vermont, they can be as or more destructive than a more commonly occurring severe weather event. Typically, they will manifest themselves in Vermont as tropical storms. In either case, the high winds, heavy rains, and large affected areas from hurricane or tropical storms can make these rare events major disasters. The most infamous example of this was the disastrous hurricane of 1938. On September 21, 1938 a very fast moving hurricane hit Vermont in the early evening, but was moving so fast that wind damage was more severe than damage from rain in places. However, there was severe flooding, as over 4 inches of rain accompanied the storm and followed upon the heels of preceding storms that had saturated the ground and raised river levels. Buildings were lost, power lines were downed, and many trees were felled. Tropical Storm Floyd in September 1999 caused flooding and wind damage in parts of Vermont, as well as one fatality, and resulted in a federal disaster declaration.

The most recent flood that devastated Vermont, Orange County, and Strafford was the result of Tropical Storm Irene, which occurred on August 28, 2011. Record flooding was reported across the state and was responsible for several deaths, and millions of dollars of home, road, and infrastructure damage. Due to the strong winds, 50,000 Vermont residents were



Damage from a microburst on Route 132, July 2022



Utility lines at risk following a microburst in Strafford, July 2022

without power initially, and many did not have power restored for over a week. Despite the damage wrought, the flooding caused by Tropical Storm Irene is considered to be the second greatest natural disaster in 20th and 21st century Vermont, second only to the Flood of 1927.

More recently, the town has experienced microbursts, columns of sinking air that can cause significant localized damage during thunderstorm events to infrastructure and property. The most recent microburst occurred July, 2022, and caused downed trees, power outages and downed power lines throughout Strafford. Route 132 was closed for an extended period and other roads, including Turnpike Road and Stage Road, were not accessible.

Blowdowns also occur occasionally in Strafford. Blowdowns are wind events that flatten trees in a straight line. While blowdowns can damage power lines and local infrastructure, they can also make the environment more vulnerable to wildfire, erosion and other hazards.

The following list indicates the history of occurrence with regard to this hazard in Orange County (given that small population of Strafford, town-specific data is limited); an asterisk “*” denotes the instances in which town-specific data is available, and federal disaster numbers are listed when appropriate. In an attempt to capture the individual hazards that may arise, and the different circumstances caused by the hazards in concert, the separate hazards are documented in the table below.

History of Occurrences:

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
07/20/2021	✓			✓		County-wide	Thunderstorms and damaging winds across Orange County, causing downed trees. Wind speeds reported above 50 MPH. 1.66 inches of rain reported in Union Village, just east of Strafford. No specific impact data available.
08/04/2020- 08/05/2020	✓			✓		State-wide	Tropical Storm Isaias moved through Vermont the evening of August 4 th . Wind speeds were reported at 40-45 MPH in Orange County, though localized 50 MPH gusts were reported in Vermont. 20-25,000 power outages reported across the State. Over half an inch of rain was reported in Union Village, just East of Strafford. Impact of rain was reported to be minimal. \$50,000 in estimated property damage for the County.
11/01/2019 (DR-4474)	✓			✓			Strong storms and wind gusts developed across Vermont. Total precipitation ranged from 1.5-4 inches across the State.

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
							.64 inches of rain reported in Union Village, just east of Strafford. Wind gusts ranged from 40-50 MPH. Property damages estimated at \$15,000.
08/17/2019	✓			✓		County-wide	An upper level disturbance lead to the development of strong thunderstorms throughout southern Vermont. Wind speeds reached up to 63 MPH in some places, and lead to downed trees and power lines.
10/16/2018				✓		County-wide	Eastern Vermont experienced strong winds of up to 50 MPH, leading to tree damage and 10,000 power outages. \$50,000 in estimated damages for Windsor County.
10/30/2017 (DR-4356)				✓		County-wide	Strong winds reported across Vermont, with Orange County reporting tree damage, power outages, and wind gusts of up to 40-50 MPH. Estimated \$150,000 in damages.
6/29/2017-7/1/2017 (DR-4330)*	✓	✓		✓			Flash flooding and road damage throughout the County. Between June 30 th and July 2 nd , over 5 inches of rain fell throughout the region over a four day period. No available data on the size of the land area that was impacted.
05/18/2017	✓		✓	✓		County-wide	High temperatures lead to an unstable weather system across Vermont, producing dime-sized hail and wind speeds of 50 kts (57 MPH). The storm downed large trees and left 15,000 customers without power throughout Vermont. Total damages across the State were estimated at \$395,000.
02/25/2017	✓	✓		✓		County-wide	Unusually warm weather resulted in early snow melt and heavy rainfall, resulting in flooding throughout the region. Thunderstorms lead to extremely high wind speeds of 55 kts (63 MPH), \$50,000 in estimated damages across Orange County.
07/23/2016	✓			✓		County-wide	Thunderstorms with winds of up to 60 kts (69 MPH) downed trees, damaging power lines and leaving 20,000 outages. Estimated \$385,000 in damage across Vermont.
05/27/2015	✓			✓	✓	County-wide	A line of showers and thunderstorms moved across Vermont from New York. Reports of downed trees and

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
							power lines in the region. Wind speed was measured at 50kts. Specific data for Strafford was not available.
07/23/2014	✓			✓		County-wide	Severe summer storms rocked the Central Vermont region, including Strafford. More detailed rainfall data was unavailable for Strafford. 2 customers lost power in Strafford for 6.7 hours.
10/07/2013	✓			✓		County-wide	Scattered wind gusts of 50 mph or greater, registering a 9 on the Beaufort Wind Scale, across portions of Vermont produced numerous downed trees or tree limbs on utility lines resulting in more than 25,000 customers without power at the peak. Specific power outage time data in Strafford for this event were unavailable. Strafford experienced about 1 inch of rain in 48 hours.
09/11/2013	✓			✓		County-wide	A series of thunderstorms moved across Vermont during the late afternoon and evening. Some of these thunderstorms produced damaging winds that downed trees and utility lines. Strafford received 1.85 inches of rain in 72 hours. 3 customers lost power in Strafford for 26-30 hours.
Period from 6/25/2013—07/11/2013 (DR-4140 VT)	✓	✓	✓	✓	✓	County-wide	Showers and thunderstorms developed on a near daily basis in the summertime heat, and rainfall rates as high as two to three inches in an hour were observed at times. Flash flooding occurred in several areas where storms remained stationary or repeatedly moved across the same area. High water from flash flooding closed some of the region's roads or washed them out completely. Two power outages occurred during the disaster period in Strafford, but affected only 20 Green Mountain Power customers for less than 2 hours.

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
05/29/2012	✓		✓	✓		County- wide	A warm front moved across Vermont during the morning hours of May 29 th , which lead to numerous thunderstorms with heavy rain, damaging lightning and some isolated large hail and strong winds. Some of these thunderstorms deposited up to 2 inches of rainfall in portions of north-central and northeast Vermont. Strafford did not experience significant power outages.
08/28/2011 (DR-4022, TS Irene)*	✓	✓		✓		Strafford/ County- wide	Widespread rainfall amounts of 3-5 inches occurred across Vermont with 5 to 7+ inches across much of southern, central Vermont. Devastating flash flooding occurred across much of central and southern Vermont mountain valleys with substantial and some record breaking flood stages on larger rivers. There were nearly 2,400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. According to spotter's reports, Strafford received nearly 7" of rain. Alger Brook Road, Old City Falls Road, Sawyer Mountain Road, Route 132, Tyson Road, and Taylor Valley Road were damaged in Strafford during Irene. \$2,432,610.17 in damage total for Strafford according to FEMA's Public Assistance database (captures at least 70% of total damage). Widespread power outages affected more than 500 customers in Strafford and lasted between 48-53 hours.
08/21/2011	✓		✓	✓		County- wide	Numerous showers and thunderstorms developed during the afternoon with some containing large hail and damaging winds. This storm also produced a microburst with straight line winds estimated, by a NWS Storm Damage team, between 70 and 90 mph. This event registered hurricane level winds according to the Beaufort Wind Scale.

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
							Strafford received 1.12 inches of rain in 24 hours. No significant power outages occurred in Strafford.
07/06/2011*	✓			✓	✓	Strafford/ County- wide	Wind damage as well as lightning strikes resulted in more than 15,000 customers in Vermont losing power. Strafford had 8 residents lose power for 7.6 hours. There were numerous reports of trees down in Strafford. Approximately \$10,000 in damages occurred.
10/01/2010	✓	✓		✓		County- wide	Heavy rain, including moisture associated with the dissipated remnants of Tropical Storm Nicole, spread into Vermont and produced four to five inches of rain. Severe storms and flooding in Addison, Caledonia, Essex, Lamoille, Orange, Washington, and Windsor Counties. FEMA disaster declaration with 1.9 million dollars of public assistance. No significant power outages occurred in Strafford.
07/21/2010*	✓		✓	✓		Strafford/ County- wide	Supercell thunderstorms spread across the region, causing widespread damage to trees, power poles, structures, and infrastructure. Numerous trees were down between Strafford and Vershire along Route 113 and numerous backroads, totaling \$25,000 in damage. 2 inches of rain fell in Strafford on 7/20 and another 1.9 inches fell on 7/22. 276 total customers in Strafford lost power, and power outages lasted between 5.4 and 10.8 hours.
5/31/2009	✓		✓	✓		County- wide	40-55mph wind gusts and hail caused fallen trees and power outages in the region. This event registered as an 8-9 on the Beaufort Wind Scale. 89 power customers were affected in Strafford, and power outages lasted 7.8 hours.
7/21/2008— 8/12/2008 (DR	✓			✓		County- wide	Severe storms and flooding impacted Orange and surrounding counties. 10.29 inches of rain fell in Strafford during the

Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
1790 VT)							disaster period. On 7/24, 55 people in Strafford lost power for 3.2 hours.
06/10/2008	✓			✓		County- wide	Severe storms caused damage to hundreds to thousands of trees, downing power lines and causing structural damage to numerous buildings and vehicles. Tens of thousands of Vermonters lost power due to the storms, with some outages that lasted several days. Power outages in Strafford affected 101 people and lasted 8 hours. .57 inches of rain fell in Strafford in 24 hours.
08/25/2007*	✓			✓		Strafford, County- wide	Numerous reports of tree and power line damage across the region. In Strafford, there was extensive tree damage, and winds were reported at approximately 60mph. Damage was estimated at \$10,000. Over two days, 435 people in Strafford lost power, and power outages lasted from 4 hours for some people to 24 hours for others. Strafford experienced .42 inches of rain in 24 hours.
07/11/2007 (DR 1715 VT)	✓	✓				County- wide	Localized heavy rainfall exceeded 3 inches within a two hour time frame with some localized storm totals approaching 6 inches across a very hilly or mountainous terrain, which resulted in flash flooding of several communities. Storm damage overall totaled over \$3 million in affected counties.
06/10/2005*	✓				✓	Strafford, County- wide	Severe thunderstorms settled over the region. Lightning strikes killed 17 cows in Strafford, and caused a total of \$50,000 in damage. More detailed rainfall data was unavailable for Strafford. Only 5 customers were affected by power outages that lasted from 1.4-4.8 hours.

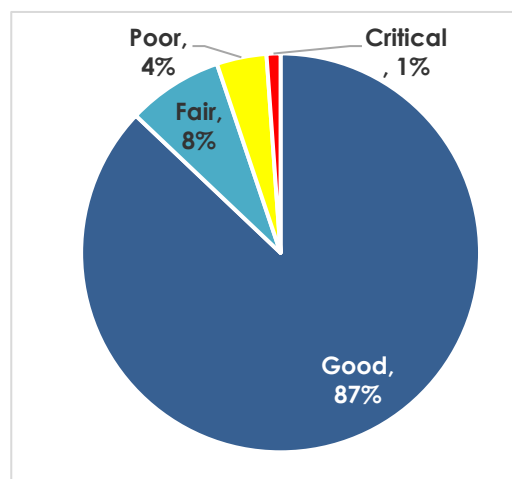
Severe Weather/ Hurricane/ Tropical Storm Date	Event					Location	Extent and Impact
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
9/16/1999— 9/21/1999 (DR 1306 VT)	✓	✓		✓		County- wide	Tropical Storm Floyd brought high winds and heavy rainfall of 3-6 inches to Southern Vermont. The rain produced significant flooding across the region, which proved destructive. The combination of the wind and very saturated ground produced widespread downing of trees and power lines across much of Southern Vermont, and as many as 2,000 people lost power. Detailed power outage information for Strafford is unknown.
06/22/1997*	✓			✓		Strafford, County- wide	Severe thunderstorms and high winds were reported, causing \$5,000 in damage to Strafford. Detailed rainfall and power outage data for this event are unknown.
08/09/1976	✓	✓		✓		County- wide	Hurricane Belle brought intense rains to much of State. Detailed rainfall and power outage data for this event are unknown.
7/6/1973 (DR 397 VT)*		✓		✓		County- wide	One of the largest flood events of the 20 th century in VT. Landslides reported in the region. The South Strafford (Tyson) Dam overtopped, washing out at its right abutment. No damage was reported.
09/21/1938 ("The Great New England Hurricane")	✓			✓		County- wide	Hit Vermont as a Category 1 storm. High winds severely damaged trees, buildings, power lines. Detailed rainfall and power outage data for this event are unknown.
11/3/1927	✓	✓				County- wide	"Great Flood of 1927." Worst recorded flood in VT. White River crested at a record of 29.30 feet.

As demonstrated in the table of previous occurrences above, high winds have caused damage in Orange County and in the Town of Strafford specifically. Damage caused by high winds has included downed trees and power lines, and, as a result, power outages during or after severe weather, hurricane or tropical storm events. Power outages can be particularly serious for "power critical customers" that do not have the luxury of having a generator, particularly vulnerable population segments (i.e., the elderly

or disabled). However, in general, high winds cause relatively minor damage on a town-wide scale.

One of the main hazards caused by severe weather, hurricanes, and tropical storms throughout the Town is flooding. A recent flooding event occurred over three weeks in late June and early to mid-July in 2013. The flooding was widespread and severe enough for a Federal Disaster Declaration, DR-4140, to be issued for Orange and other counties in Vermont. As part of the Town's LHMP writing process, Committee members identified the following areas as especially prone to severe storm and flooding impacts and create choke points along waterways: Bird Hill Road, Justin Morrill Memorial Highway, Old City Falls, Alger Brook Road, Brook Road, Route 132 (especially at Tyson Road), and Tognacci Road.

By the end of the fall of 2013, the Town of Strafford had completed a geo-referenced culvert inventory with assistance from Two Rivers-Ottauquechee Regional Commission. In 2021, and in collaboration with TRORC, Strafford updated its culvert inventory. The Town plans to maintain the culvert inventory in-house, and use it as a way to plan and prioritize culvert and road upgrade projects. The Town of Strafford's work to upgrade culverts remains in process. A considerable number of culverts have been upgraded in the Town of Strafford as part of the Town's recovery from Tropical Storm Irene.



Condition of Strafford Culverts, 2021 Inventory

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Severe Summer Weather/ Hurricanes/ Tropical Storms	Town-wide for wind, hail, high winds, lighting, and thunderstorm impacts. Generally speaking, the entire Town is vulnerable to flooding, but "hot spots" include the following roads/areas: Bird Hill Road, Justin Morrill Memorial Highway, Old City Falls, Brook Road, Route 132 (especially at Tyson Road), and Tognacci Road.	Town and private buildings and utilities; culverts, bridges, road infrastructure. Vulnerable commercial and public structures include Coburn's General Store, the South Strafford Post Office, the Our Lady of the Light Church, The Strafford and South Strafford Volunteer Fire Departments, and the Town Office, which are within the mapped Vermont River Corridor.	Tropical Storm Irene. 5-7" of rain across the county (6-7" in Strafford). No detailed data was available for Fluvial erosion damage in Strafford in terms of numbers of acres lost during each event.	Tropical Storm Irene: \$2,432,610 for Strafford, per FEMA's Public Assistance database (captures at least 70% of total damage).	Highly likely/ Likely

****Note:** The main hazard caused by severe weather is typically flooding (though not always). In addition, flooding is often the most expensive hazard caused by severe weather. Therefore, the Extent and Impact categories for Severe Summer Weather will reflect the data reported in the Flash

Flood/Flood/Fluvial Erosion, as it represents the higher limits of damage caused by severe weather.

3. Extreme Cold/Snow/Ice Storm

Winter storms are a regular occurrence in Vermont. However, severe winter storms can cause serious damage, including collapse of buildings due to overloading with snow or ice, brutal wind chills, downed trees and power lines, and stranded vehicles. People can be at risk of freezing in extended power outages if they lack wood heat or backup power, and individuals shoveling large accumulations of snow can also be at risk from frostbite, hypothermia, and heart attacks caused by cold and overexertion. While snow removal from the transportation system is standard fare in Vermont winters, extreme snow or ice can close rail and road systems, further jeopardizing any stranded persons that are in danger of freezing or needing medical assistance.

Severe winter storms include a blizzard on February 15-17 in 1958, which dumped over 30 inches and resulted in 26 deaths in New England. On December 26-27 in 1969, another blizzard left 18-36 inches of snow in northwestern Vermont, and a whopping 45 inches in nearby Waitsfield. A string of storms in March 2001 hit the state, beginning with 15-30 inches on March 5-6th (later declared a federal disaster), 10-30 inches on the 22nd, and 10-20 inches on the 30th. Recent years have seen wet snow storms that have toppled trees and caused widespread power outages.

The worst winter storm in terms of damage to hit the state recently was not a snow storm, but an ice storm. In January of 1998, just the right combination of precipitation and temperature led to more than three inches of ice in spots, closing roads, downing power lines, and snapping thousands of trees. This storm was estimated as a 200-500 year event, meaning there is a .5%-.2% chance of occurring annually. Power was out up to 10 days in some areas, and 700,000 acres in of forest were damaged in Vermont. Amazingly, there were no fatalities in Vermont, unlike Quebec where 3 million people lost power and 28 were killed. The Town of Strafford was impacted by this ice storm.

Recently, freeze-thaw cycles have been causing significant damage to roads. This past Spring, Strafford was heavily impacted, with many roads affected including Cross Road, Old City Falls Road, Brook Road, Robinson Road and Miller Pond Road. Most if not all dirt roads were affected by this event at varying degrees.

Over the past few winters, Strafford has received numerous snow storms that have dropped significant amounts of snow over a day or two day period. However, the details of these events and the damage they caused are overshadowed by winter weather events of the past. This is not to say such extreme events will not repeat themselves. It should be assumed that extreme winter weather events will occur at some point in the future. The following table documents the occurrence of extreme cold/snow/ice storms in the Town of Strafford and in Orange County:

History of Occurrences:

Date	Event	Location	Extent and Impacts
02/03/2022-02/04/2022	Winter storm	County-; region-wide	An arctic front moved across Vermont on the morning of February 3 rd , bringing light rain that changed to snow. The front continued in the region through February 4 th , with heavy snow, freezing rain, and sleet falling throughout the region. Total

Date	Event	Location	Extent and Impacts
			snowfalls ranged from 10-14 inches, with some areas seeing ice and power outages.
12/18/2021-12/19/2021	Winter storm	County-; region-wide	A weak low pressure system brought 5-8 inches of snowfall across the state. Property damages for Orange County were estimated at \$10,000.
1/16/2021	Winter storm	County-; region-wide	A winter storm brought rain and wet snow to many areas of Vermont. Snow accumulation ranged from 3-18 inches. The wet snow caused power outages and left 30,000 customers without electricity.
03/23/2020-03/24/2020	Winter storm	County-; region-wide	A winter storm system moved into Vermont from the Midwest, bringing 7-10 inches of snow and isolated power outages. \$5,000 estimated in damages for Orange County.
12/16/2020-12/17/2020	Winter Storm	County-; region-wide	A Nor'easter moved up the Atlantic Coast and through Southern Vermont. Snowfall rates ranged from 2-4+ inches per hour. Snowfall ranged from 6-17 inches in much of Orange County, with 17 inches reported in Union Village. There were \$70,000 in estimated damages throughout the region.
03/22/2019	Winter storm	County-; region-wide	A wet snowstorm brought 7-14 inches of heavy snow to Orange County. Thousands of power outages were reported throughout the State. Wind gusts of 15-25 MPH were also reported.
01/20/2019	Winter Storm/Extreme Cold	County-; region-wide	A long-lived winter storm brought heavy snow in accumulations of 10"-18", with 15" falling in nearby Chelsea. The region also experienced extremely cold temperatures Saturday through Monday, with overnight lows at 10-20 below zero. Estimated damages for Orange County were \$15,000.
03/13/2018-03/15/2018	Winter Storm	County-; region-wide	A nor'easter swept through New England. Snow fall in Orange County ranged from 10-27 inches, with 18 inches falling in nearby Chelsea.
02/07/2018	Winter storm	County-; region-wide	Low pressure systems moved across central and southern Vermont, bringing light snowfall. Accumulations for Orange County ranged from 6-11 inches. Snowfall rates reached 1 to 2 inches per hour in some places. No known damages.
03/14/2017-03/15/2017	Winter storm	County-; region-wide	A nor'easter moved up the Atlantic coast, bringing heavy snowfalls, 45 inches per hour in some places, as well as blizzard conditions. Snowfall across Vermont ranged from 12"-36". Windsor County snowfall ranged from 12"-24". Many schools, businesses, and offices were closed as a result of this storm. 19" of snow was reported in nearby Vershire.
12/29/2016	Winter storm	County-; region-wide	A weak low pressure system brought heavy snowfall across eastern Vermont throughout the day and intensified into the night. Snow accumulations ranged from 8-12 inches.
02/01/2015-02/28/2015	Cold/wind chill	County-; region-wide	Vermont communities experienced the coldest month on record for over 20 years. Many communities recorded 15 to 20+ days below zero and on several days, dangerously cold wind chills of 30 below zero or colder occurred.
Period from 12/09/2014—12/12/2014 (DR-4207 VT)	Snow/Winter Storm	County-; region-wide	A powerful prolonged heavy, wet snow event from December 9 th through December 11 th . Snowfall totals ranged from a few inches to almost 2' near Warren, VT. The snow to liquid ratios ranged from 5-7" of snow to 1" of rain, which lead to the snow sticking to trees and power lines. A widespread 10 to 15 inches of snow fell across Orange County.
Period from 03/12/2014—03/13/2014	Snow Storm	County-; region-wide	A major snowstorm with near blizzard conditions at times impacted Vermont towns. Numerous motor vehicle accidents, school and business closures resulted due to the storm on both March 12 th and 13 th . Snowfall totals across Orange county were generally 15 to 20+ inches.
Period from 02/13/2014—02/14/2014	Winter Storm	County-; region-wide	A winter storm, responsible for record ice and snow across the southeast United States on February 12 th , moved and redeveloped off the southeast United states coastline on February 13 th . Snowfall across Orange county was 12 to 18 inches.
02/05/2014	Snow Storm	County-; region-wide	Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel. Eight to twelve inches of snow fell across Orange county.
11/23/2011*	Winter Storm	Strafford, County-wide	Heavy snowfall accounted for numerous vehicle accidents and scattered power outages from tree limbs falling on power lines. Strafford recorded 7 inches of snow

Date	Event	Location	Extent and Impacts
			accumulation.
02/02/2012	Winter Storm	County-; region-wide	An intense winter storm brought snowfall at rates of up to 2 inches per hour, and dropped 10-15 inches across Orange County.
Period from 12/26/2010-12/27/2010*	Winter Storm	Strafford, County-wide	Heavy snowfall combined with strong winds (15-25mph with gusts up to 40mph) caused blowing and drifting snow that led to accidents and power outages. Strafford recorded 9 inches of snow accumulation.
Period from 02/23/2010-02/25/2010	Winter Storm	County-; region-wide	Heavy wet snow led to accumulations of 6-30 inches across central and southern Vermont, leading to power outages of 50,000 or more residents.
Period from 02/22/2009-02/23/2009	Winter Storm	County-; region-wide	Heavy snow and high winds with gusts as high as 30mph in the region, impacting travel. Around a foot of snow or more fell in towns neighboring Strafford.
Period from 12/19/2008-12/21/2008	Winter Storms	County-; region-wide	Two heavy storms moved through the region over a 2-3 day period, leading to combined snowfall totals in excess of 2 feet. High snowfall totals led to blocked ventilation pipes and some carbon monoxide injuries as well as a few collapsed small farm structures due to the weight of the snow in Orange County.
Period from 02/06/2008—02/07/2008	Winter Storm	County-wide; statewide	Heavy snowfall of 10 to 16 inches fell across Orange County, prompting many school closures and vehicle accidents.
02/01/2008	“Mixed” Winter Storm	County- wide; statewide	Snowfall reports were generally 2 to 5 inches with localized amounts up to 7 inches. In addition, one quarter to one half of ice accumulation (accretion) occurred as well. Finally, strong south to southeast winds around 3000 feet and above transferred to a few hilltops along the western slopes and produced wind gusts in excess of 50 mph.
02/14/2007*	Snow Storm	Strafford; County-wide; statewide	Snow fell at 2-4 inches per hour at times amidst brisk 15-25mph winds and wind chills of -10F, making many roads virtually impassible. A total of 19 inches was reported in Strafford
Period from 12/06/2003-12/07/2003	Winter Storm	County-; region-wide	Steady snow fell throughout a two day period, producing snow totals around 12-20 inches in Orange County.
Period from 01/06/1998-01/16/1998 (DR-1201 VT)	Ice Storm	County-; state-wide	Ice accumulations of around ¾ of an inch or less hit the region, causing damage to tens of thousands of trees, downed power lines, road closures due to ice coatings, vehicle accidents, and temporary cessation of milking operations at farms. Indirect injury impacts included carbon monoxide poisoning from improper generator use and hazards from tree limb/other debris.

The Town of Strafford is no stranger to winter weather and the hazards that it brings. Depending on the event, though especially with heavy, wet snow or ice, and sometimes in combination with high winds, electricity may be knocked out from a few hours to several days. The utility company currently serving the Town of Strafford, Green Mountain Power, has followed a regular tree-trimming schedule. Strafford town officials believe this is satisfactory to mitigate damage and the power outages caused by downed trees and tree limbs during a heavy, wet snow or ice event. In the event of an extended power outage, the Town would open its emergency shelter. More often, those without power would seek accommodations with friends or relatives.

Another complication of falling utility poles is the potential loss of the telephone line. If the landlines are impacted, the possibility presents itself that there is no reliable means of communication in the affected parts of Town, as cellular reception can be spotty. If the power is out, an internet connection is unlikely to be available.

One possible vulnerability is that Strafford has no state highways within town, and therefore depends on the local road crew to keep the roads clear during winter storm events. This means that under most circumstances, there will be no clearing and plowing assistance from the state during heavy snow or ice events.

Heavy, wet snow or large quantities of snow may also leave structures vulnerable to roof collapse. Roof collapse occurs when the structural components of a roof can no longer hold the weight of snow. Flat roofs are most vulnerable to collapse because they do not drain well, and the snow on the roof soaks up water like a sponge, increasing the weight that the roof must bear. More common, it seems, is the collapse of barns commonly used for livestock sheltering and other agricultural purposes.

Unfortunately, livestock in the barn are often killed, and equipment stored in the barn may be damaged or ruined. It is difficult to determine whether a residential structure or a barn would be rebuilt after a roof collapse because the decision to rebuild would likely depend on the extent of damage. The collapse of a barn roof is likely to be a total loss, and the collapse of a house roof may be a 50% loss.

In general, winter weather is most hazardous to travelers. Icy and snow-covered roads present multiple examples of dangerous driving conditions and situations. In Strafford, the mountainous terrain, steep slopes, and remoteness of some roads further complicate travel. The Town relies on Travel Advisories issued by the State of Vermont Department of Emergency Management Homeland Security and the National Weather Service to alert residents of dangerous travel weather. Despite this, it is difficult to prohibit people from driving during winter weather events. As a result, emergency services personnel must always be prepared to provide assistance to stranded drivers or to those who have been in an accident.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Extreme Cold/ Snow/ Ice Storm	Town-wide	The entire Town is vulnerable, including road infrastructure, town and privately owned buildings, utility infrastructure.	Snowfall has varied from a few inches to over a foot or more. Heavy snow and wind may down trees and power lines. Snow/ice contributes to hazardous driving conditions.	Ice storm of January 1998. ¾ inch of ice and road closures. Downed power lines led to power outages of up to 10 days in some areas. 700,000 acres of forest damaged. Estimated \$80,000 in damages for Orange County. Loss of energy or communication capabilities may occur and impede recovery.	Highly likely

4. Extreme Heat

The definition of a heat event varies depending upon the typical weather patterns of the local environment and the vulnerabilities of the population. The Burlington Weather Forecast Office of the National Weather Services, which covers the Town of Strafford, has established the following thresholds:

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Extreme Heat**.

- **Excessive Heat Warning:** Daytime heat indices² equal to or greater than 105°F for two or more hours
- **Heat Advisory:** Daytime heat indices between 95°F and 104°F for two or more hours.
- **Heat Wave:** Three or more days of temperatures equal to or higher than 90°F

The Vermont Department of Health defines a “hot day” as one during which the maximum temperature is 87°F or hotter. Climate change is increasing both the average annual temperature in Vermont and the number of hot days per year. The state’s climate models predict that the number of days per year with a statewide average temperature at or above 87°F, which averaged about 7 between 2000 and 2016, will increase to 15 to 20 by mid-century and 20 to 34 by the end of the century.

Heat events have serious impacts. Health data have shown that when the statewide average temperature reaches at least 87°F, Vermonters are 8 times more likely to suffer heat-related illnesses (e.g. heat exhaustion, heat stroke, etc.). People aged 15 to 34 or over 74 years old experience the highest rates of heat-related illnesses. Moreover, senior citizen (ages 65 or older) morbidity increases by 1 person per hot day. Chronic medical conditions, a job that requires outdoor work, and a lack of air conditioning are compounding risk factors.

Other potential impacts of higher temperatures include: increased incidence of vector-borne diseases such as Lyme disease and West Nile virus; toxic cyanobacteria blooms in lakes and ponds; ecological changes; economic disruption in the agriculture and forestry sectors; damage to highways, roads, and railroad tracks; stress on automobile and train cooling systems and resulting mechanical failures; power outages caused by excessive demand for electricity or by the sagging of electrical lines in high temperatures; and strains on water supplies, particularly if high temperatures are exacerbating a drought.

The following list indicates the history of heat events reported for Orange County in the NCEI Database. The database typically only reports events for which heat indices meet or exceed the regional advisory thresholds (see above), but interestingly, a March 2012 event is also reported due to the records it broke and the widespread economic damage it caused. Town-specific data were not available for any heat events.

² The heat index factors in relative humidity as well as air temperature to provide a measure of apparent temperature (i.e., what temperature feels like to the human body).

History of Occurrences

Date	Event	Location	Extent
07/20/2022- 07/25/2022	Heat event	Orange County	A heat wave hit Vermont and much of the country in mid-July, 2022. Heat indices for Union Village, East of Strafford, ranged from 90-95°F for six consecutive days. No available data on the size of the land area that was impacted.
06/28/2021- 07/1/2021	Heat event	Orange County	Heat indices in Union Village, East of Strafford, ranged from 91-93°F between June 28 th and July 1 st . No available data on the size of the land area that was impacted.
6/19/2020- 6/25/2020	Heat event	Orange County	Heat indices in Union Village, East of Strafford, ranged from 91-94°F between June 19 th and June 25 th . No available data on the size of the land area that was impacted.
6/30/2018 – 7/6/2018	Heat event	Orange County	Heat indices ranged from 95 to 110°F across Vermont. Maximum temperatures reported at Union Village Dam in East Thetford ranged from 92 to 95 between July 1 st and 6 th . No available data on the size of the land area that was impacted.
3/17/2012 – 3/24/2012	Heat event	Orange County	Maximum temperatures reported at Union Village Dam in East Thetford ranged from 81°F to 83°F from March 21 st to the 23 rd . No available data on the size of the land area that was impacted. This event broke record temperatures and cut short the sugaring season. Damages to the maple sugaring industry in Orange County were estimated at \$1 million.
7/21/2011 – 7/24/2011	Heat event	Orange County	Heat indices ranged from 100 to 108°F along the Connecticut River Valley on July 21 st . Between July 21 st and 24 th , maximum temperatures ranged from 91 to 96°F at Union Village Dam in East Thetford. No available data on the size of the land area that was impacted.
8/1/2006 – 8/2/2006	Heat event	Orange County	On the afternoon of August 2 nd , heat indices in central and southern Vermont ranged from 100 to 105 °F. A maximum temperature of 97°F was reported in Union Village in East Thetford. No available data on the size of the land area that was impacted.

The Global Historical Climatology Network publishes daily maximum temperatures for local weather data stations. Unfortunately, the network does not include any stations in Strafford, but there are stations located in Chelsea, Corinth, and East Thetford. Collectively, those stations have reported an average of about 13 hot days (maximum temperatures at or above 87°F) per year between 1989 and 2019.

Town-specific data is not available for the health impacts of heat events. Limited county-level data are reported by the Vermont Department of Health. The following heat-related emergency department visits were reported in Orange County between 2003 and 2019: 7 in 2019, 7 in 2013, 8 in 2009, and 8 in 2006. This represents the minimum number of emergencies during that time period, as years with fewer than 6 visits were not reported in order to protect patient confidentiality. Barrett Hall, one of the designated shelters for the Town, could potentially be used as a cooling center during heat events. The committee estimates Barrett Hall has capacity for approximately 100 residents, which, the committee considers sufficient to accommodate the needs of the most at-risk residents. However, the Town has never provided a cooling center before, and doing so would first require considerable logistical planning.

The local economy may also be affected by a prolonged extreme heat event. Specifically, local farms such as the Strafford Creamery and Winding Brook Farm could see reductions in dairy, meat, egg, and vegetable production, which would have a direct impact on availability of these products locally.

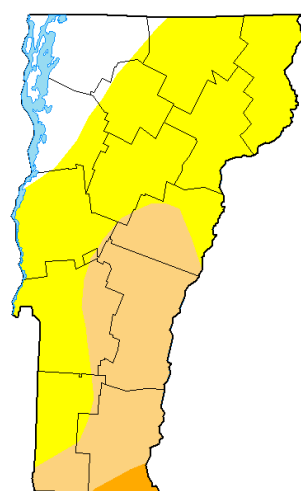
Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Extreme Heat	Town-wide	Structures without air conditioning would be most directly impacted. In the event of power outages, all structures would be affected. The elderly and very young are at risk. Extreme heat could pose a risk to fire response.	The highest maximum temperature recorded in East Thetford was 98°F (2002). Heat indices up to 108°F have been reported in Orange County (2011).	Heat events can damage infrastructure, endanger or kill people, and can cause severe crop damage. 30 Orange County residents visited the Emergency Room due to heat-related illness between 2013-2019. A record-breaking warm spell in March 2012 caused approximately \$1 million in damages to the maple sugar harvest in Orange County.	Highly likely/ Likely

5. Drought

According to the State Hazard Mitigation Plan, drought is defined as a water shortage based on a specified need for water in a conceptual supply and demand relationship. As a hazard, drought can be difficult to define and measure, since the effects of drought can build over time and can impact the environment long after the drought period has passed. There is no universal methodology for defining a drought event or assessing its impact. Drought can affect a town's ability to access water, especially if residents rely on wells and groundwater for their daily water needs. Drought can also place added stress on plants, trees and wildlife, and can make a community more susceptible to other hazards such as wildfire, invasive species, and erosion. Economically, drought can significantly impact food production, and can impact the livelihood of farmers as well as the quality and variety of food products available to residents.

As of August, 2022, much of Orange and Windsor counties were in a D1 Moderate Drought. Rainfall deficits of nearly 6 inches over the previous 90 days resulted in extremely dry soils and lower stream flows. Moderate drought can lead to crop damage and low water levels in wells and streams. Water shortages often

U.S. Drought Monitor Vermont



Drought Intensity by Vermont County

August 23, 2022
(Released Thursday, Aug. 25, 2022)
Valid 8 a.m. EDT

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:

Deborah Bathke
National Drought Mitigation Center



droughtmonitor.unl.edu

result during moderate drought, and municipalities may implement voluntary water restrictions as a measure to conserve water. With more severe levels of drought, such as D2 or D3, communities may see imposed water restrictions, and may experience more common shortages and larger agricultural losses. D4, Exceptional Drought, is the most severe measure, and can result in reservoir shortages, and major agricultural losses.

Significant periods of drought in Vermont include declared statewide droughts in June and July of 1995, and severe drought in 2001 and 2002, which resulted in nearly 100% of the state experiencing D1 (moderate) drought conditions. A period of severe drought (D2) occurred between 2016 and 2017, with about 80% of the state experiencing at least moderate drought. The impacts of drought are widespread, and are often felt at the county, regional, and state level. Local data on drought is not readily available.

Drought can reduce water levels, which can put stress on farms, wildlife, and residents with shallow wells. Importantly, low water levels can impact emergency response and the ability of firefighters to access this resource during emergencies. Drought also increases the likelihood of wildfire, especially along south-facing hillsides. This coupling of higher wildfire risk and less water access is of particular concern. The town pond could serve as an alternative filling location for fire responders in case of water shortages elsewhere.³

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Drought	Region-wide	Crops and livestock, homes and businesses that rely on groundwater and wells, local ecosystems are also at risk. Drought can exacerbate other hazards such as wildfire and erosion.	1995 statewide drought led to water shortages and restrictions on water use in some parts of the state. Crop losses were reported as a result of the drought.	Impacts can be environmental, and financial, and are felt locally and regionally. Wells can dry up, leaving residents without water. Crops can suffer, leading to economic losses. Ecosystems can become stressed, making wildlife more susceptible to disease and other pests.	Likely

VI. Mitigation

A. Mitigation Goals

1. To reduce injury and losses from the natural hazard of Flash Flooding/Flooding/Fluvial Erosion.
2. To reduce injury and losses from the natural hazard of Severe Summer Weather & Hurricanes/Tropical Storms.
3. To reduce injury and losses from the natural hazard of Extreme Cold/Snow/Ice Storm.
4. To reduce injury and losses from the natural hazard of extreme Extreme Heat.
5. To reduce injury and losses from the natural hazard of invasive species/infestation.
6. To reduce or avoid the long-term vulnerabilities to all other hazards that could impact the Town of Strafford.

³ For more information on drought-specific recommendations for Strafford, see Appendix F. This educational document was developed by the Strafford Energy and Climate Committee as a framework for developing town-specific strategies for mitigating the effects of drought.

B. Excerpted Town Plan Goals & Objectives Supporting Local Hazard Mitigation

- To manage and maintain quality services that meet the needs of the residents of Strafford. (p. 23)
- Support and encourage the development of local health care facilities and mental health care services to provide residents access to health care as close to home as possible.
- Strafford's policy is to support and continuously update the Rapid Response Plan and Emergency Management Plan. (p. 27)
- To provide and maintain a safe, energy efficient, and cost effective transportation system integrating all modes of travel (auto, pedestrian, bicycle, and mass transit) and meeting the needs of the public in a manner consistent with the other goals, policies and implementation tasks of this Town Plan. (p. 33)
- It is the policy of the town to consider the relationship of a road to surrounding features of the landscape when planning improvements needed to safely accommodate increasing traffic. (p. 33)
- It is the policy of the Town to require development on private roads to adhere to town access standards and to provide safe year-round access for town services, particularly fire and rescue. (p. 33)
- Groundwater resources are used by new development in such a manner that protects the public right to adequate quality and quantity of the resource. (p. 35)
- Land use activities which potentially threaten groundwater quality shall be carefully reviewed and monitored to prevent undue loss of groundwater quality, including excessive drainage carrying sand and sediment from town roadways. (p. 35)
- Developments adjacent to wetlands should be planned so as not to result in undue disturbance to wetland areas or their function. Mitigating measures to protect the function of a wetland are an acceptable measure. These measures are avoidance, minimization and compensation. (p. 38)
- Flood hazard areas are maintained as open space, greenways, non-commercial recreation and/or agricultural land. (p. 44)
- No net loss of flood storage capacity occurs in an effort to minimize potential negative impacts. These impacts include the loss of life and property, disruption of commerce, and demand for extraordinary public services and expenditures that result from flood damage. (p. 44)
- Design culverts and bridges, at minimum, to meet Vtrans Hydraulics Manual, ANR Stream Alteration Standards, and Vtrans Codes and Standards. Maintain culverts to ensure they are effective during severe weather events. (p.44)
- Utilities or facilities serving existing development (e.g. water lines, electrical service, waste disposal systems, roads, and bridges) may be located within these areas only when off-site options are not feasible and provided that these utilities or facilities are relatively protected from flooding damage. (p. 45)

- Continue to maintain its membership in the National Flood Insurance Program. (p. 44)
- Maintain Strafford’s upland forests and watersheds predominately in forest use to ensure high quality valley streams and to ensure that flood flows reduced. (p. 45)

The Strafford Town Plan was updated and adopted on 10/13/2021.

C. Hazard Mitigation Strategies: Programs, Projects & Activities

Vermont’s Division of Emergency Management & Homeland Security encourages a collaborative approach to achieving mitigation at the local level through partnerships with Vermont Agency of Natural Resources, Vtrans, Vermont Agency of Commerce and Community Development, Regional Planning Commissions, FEMA Region 1 and others. That said, these agencies and organizations can work together to provide assistance and resources to towns interested in pursuing hazard mitigation projects.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii), 201.6(c)(3)(iii) and 201.6(c)(3)(iv).

With each mitigation strategy, general details about the following are provided: local leadership, possible resources, implementation tools, and prioritization. The prioritization category is based upon the economic impact of the action, Strafford’s need to address the issue, the cost of implementing the strategy, and the availability of potential funding. The cost of the strategy was evaluated in relation to its benefit as outlined in the STAPLEE guidelines (includes economic, political, environmental, technical, social, administrative, and legal criteria). A range of mitigation strategies was vetted by the committee, and those that were determined to be feasible are included in the table below.

Strategies given a “High” prioritization indicate they are either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A “Medium” prioritization indicates that a strategy is less critical or the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A “Low” prioritization indicates that the timeframe for implementation of the action, given the action’s cost, availability of funding, and the community’s need to address the issue, is more than four years.

The Town of Strafford understands that, in order to apply for FEMA funding for mitigation projects, a project must meet more formal FEMA benefit cost criteria. A project seeking FEMA funds would undergo a full benefit-cost assessment in the FEMA-approved format. The Town must have a FEMA-approved Local Hazard Mitigation Plan as well.

The following strategies will be incorporated into the Town of Strafford’s long-term land use and development planning documents. Where appropriate, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ river corridor bylaws. Specifically, the Strafford Planning Commission will incorporate mitigation strategies included in this Plan into the Strafford Town Plan’s goals, policies, and recommendations when the Town Plan is next updated. The incorporation of the goals and strategies listed in the Local

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

Mitigation Action	Who (Leadership)	When (Timeframe)	Prioritization (Mitigation Project Status)	How (Funding/ Support)
ALL HAZARDS				
<i>Install dry hydrants on Robinson Road and Cross Road, and vulnerable rural areas to protect town infrastructure from structural fires and to protect the health of residents.</i>	Fire Department	One hydrant per year (Summer 2023, Summer 2024)	High	Local resources. VT Dry Hydrant Grant Program
<i>Ensure that Strafford's Local Emergency Management Plan (LEMP) is kept up-to-date, identifies vulnerable areas, and references this plan.</i>	Emergency Management Director.	Yearly	High	Local resources; TRORC.
<i>Acquire and install a gasoline powered generator at the United Church to be used in an emergency.</i>	Road Foreman	Fall 2023	High	Local Resources
<i>Keep four Red Cross shelters, Newton School, Barrett Hall, Tyson Gym, and United Church, stocked with cots, blankets, and MRE (Meals Ready to Eat).</i>	Emergency Management Director.	Ongoing	High	Local resources.
<i>Take a yearly inventory of equipment and supplies at town shelters. This will ensure these shelters are maintained with adequate supplies in case of emergency.</i>	Emergency Management Director.	Yearly	High	Local Resources
<i>Continue to implement best practices for seasonal mowing. Mechanical control methods will reduce the spread of invasive species.</i>	Road Foreman, Conservation Commission, Energy and Climate Committee	Summer 2023 – 2024	High	Local Resources.
<i>Continue the community education program for municipal staff and residents in addressing invasive species.</i>	Conservation Commission	Summer 2023	High	Local Resources.
Flash Flood/ Flood/Fluvial Erosion// Severe Summer Weather// Hurricanes/ Tropical Storms				

Mitigation Action	Who (Leadership)	When (Timeframe)	Prioritization (Mitigation Project Status)	How (Funding/ Support)
<i>Develop a schedule and program to replace undersized culverts. Appropriately sized culverts effectively handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding damage.</i>	Road Foreman	Ongoing	High	Local resources, TRORC.
<i>Continue to identify streambanks that have high risk of fluvial erosion that could benefit from riparian plantings or Better Roads grant. Riparian buffers prevent erosion, restore river floodplain, and help reduce the intensity of flood events; therefore, protecting town infrastructure and human health.</i>	Conservation Commission, Energy and Climate Committee, Road Foreman	Summer 2024-Summer 2025	Medium	Local resources, TRORC, State resources.
<i>Upgrade four culverts, #31, 32, 34 and 34a on Brook Road. All are in poor condition and undersized.</i>	Road Foreman	Summer 2024-Summer 2025	High	Local resources, TRORC, state resources.
<i>Upgrade three culverts, #15, #16, and #21a on Robinson Road. All are in poor condition and are undersized.</i>	Road Foreman	Summer 2024-Summer 2025	High	Local resources, TRORC, state resources.
<i>Revise Flood Hazard Area Zoning Ordinance to prevent the construction of infrastructure in areas that are vulnerable to flooding and severe weather.</i>	Planning Commission	Summer 2024-Summer 2025	Medium	Local resources, TRORC.
<i>Anchor fuel tank behind Coburn's General Store on Route 132 in order to secure it in the event of flooding.</i>	Fire Chief	Summer 2023	High	Local Resources
<i>Consider adopting River Corridor regulations, which will incorporate VT ANR's River Corridor Map. These regulations will help residents and planners know what land is necessary for riparian functions and will prevent the threat of flooding to current and future infrastructure.</i>	Planning Commission	2023-2024	Medium	Local Resources
Extreme Cold/Snow/Ice Storms				

Mitigation Action	Who (Leadership)	When (Timeframe)	Prioritization (Mitigation Project Status)	How (Funding/ Support)
<i>Identify power critical customers that are vulnerable to power outages.</i>	Emergency Management Director	Every six months.	High	Local Resources
<i>Once specific at-risk residents are identified, develop a plan to reach out to those (and all) residents to educate them about accessible heating centers and Red Cross facilities in Strafford. Knowledge and ability to access these areas by residents will reduce the risk to human health in the event of a hazard.</i>	Emergency Management Director	Fall, 2023	High	Local Resources
<i>Post on the listserv prior to extreme cold and storm events to provide residents with information on where to access resources and assistance.</i>	Emergency Management Director	Ongoing	High	Local Resources
<i>Budget to ensure the Town has sufficient funds to provide safe winter travel conditions, which will reduce the threat to the health of residents.</i>	Selectboard	Yearly	High	Local Resources
Extreme Heat				
<i>Notify residents, especially at-risk residents, via the town listserv of what resources and assistance is available during extreme heat events.</i>	Emergency Management Director	Ongoing	High	Local Resources
<i>Utilize Barrett Hall in cases of extreme heat as a cooling station.</i>	Emergency Management Director	Ongoing	High	Local Resources
Drought				
<i>Educate the public on strategies for minimizing water usage during periods of drought.**</i>	Energy and Climate Committee	Yearly, depends on presence of drought.	High	Local Resources
<i>Develop an ordinance to limit the extraction of water from public waterways during periods of drought.**</i>	Selectboard	2024-2025	Medium	Local Resources

*Depending on the mitigation action, local resources may include the following: town personnel/staff time; town volunteer time; town budget line items, donations, cash from capital campaigns, among others.

**See Appendix F for drought language collected by the Strafford Energy and Climate Committee.

Appendices

Appendix A: Critical Stream Crossings

Critical crossings group one includes stream crossing structures on town highways that cross third order streams or larger. Headwater streams generally include first through third order. Third order was included as these headwater streams will have larger drainage areas and may have larger structures that are more difficult to replace and have a larger impact on the road network. Most of these are bridges.

Label	Material	Height	Width	Length	Comments	Road Name
338	1	72	72	30	eroding beneath footers. Waterfall in the middle	VAN DYKE RD
133	10	72	72	72		BROOK RD
200	1	18	8	24		JUSTIN MORRILL MEM HWY
043	10	72	72	24		WETMORE RD
042	1	26	10	12		BROOK RD
337	10	72	72	72	concrete headers – deep pool below	VAN DYKE RD
204	1	18	5	22		JUSTIN MORRILL MEM HWY
113	1	72	72	12		TOGNACCI RD
069	10	96	96	72	multiplate	MILLER POND RD
039	1	72	72	13		BROOK RD
213	10	72	72	60	multiplate	JUSTIN MORRILL MEM HWY
187	1	15	10	24	1919, rotting concrete	JUSTIN MORRILL MEM HWY
278	10	72	72	120	brook runs thru it	ROUTE 132
131	10	64	64	36	good concrete buttress	ALGER BROOK RD
076	1	84	84	34		MILLER POND RD
068	10	48	48	36		BROOK RD
010	10	36	36	48	concrete header is paved over – a little short	JUSTIN MORRILL MEM HWY
136	11	5	5	24		ROBINSON RD
250	10	18	18	24		ROUTE 132
018	10	72	72	48	multiplate	JUSTIN MORRILL MEM HWY
270	1	72	72	96	huge. Brook runs thru it	ROUTE 132
025	1	24	12	60	brand new	JUSTIN MORRILL MEM HWY
320	1	144	144	24	7 feet high. 1926. Footers are failing	OLD CITY FALLS RD
061	10	108	108	72	multiplate culvert, at the junk yard	MILLER POND RD
295	10	36	36	48		OLD CITY FALLS RD
340	10	72	72	24	deep pool downstream	VAN DYKE RD
081	10	60	60	29		MAPLE HILL RD
247	1	108	108	24	crosses stream by school	ROUTE 132
012	13	36	36	48		COBURN RD
135	10	60	60	48		ALGER BROOK RD

BridgeType	Inspection Notes	Location	RouteLogBr	Structure Number	Street Name	ST
	9/15/2014 Structure is in satisfactory condition. The curbs need concrete repairs, having all loose material removed and then patched. The guardrail should be replaced to meet standards. The beams need general cleaning and painting. JWW/JDM					
ROLLED BEAM	07/22/	0.1 MI TO JCT W CL2 TH2	00030	100910003009101	BROOK	RD
	9/17/2014 This structure needs to have new approach and bridge guardrail installed that meets standards, as well as new posts for the approach rail. There is heavy bank erosion on the upstream end of abutment 1 that should have anti erosion protection					
ROLLED BEAM		0.1 MI TO JCT W CL3 TH23	00027	100910002709101	OLD CITY FALLS	RD

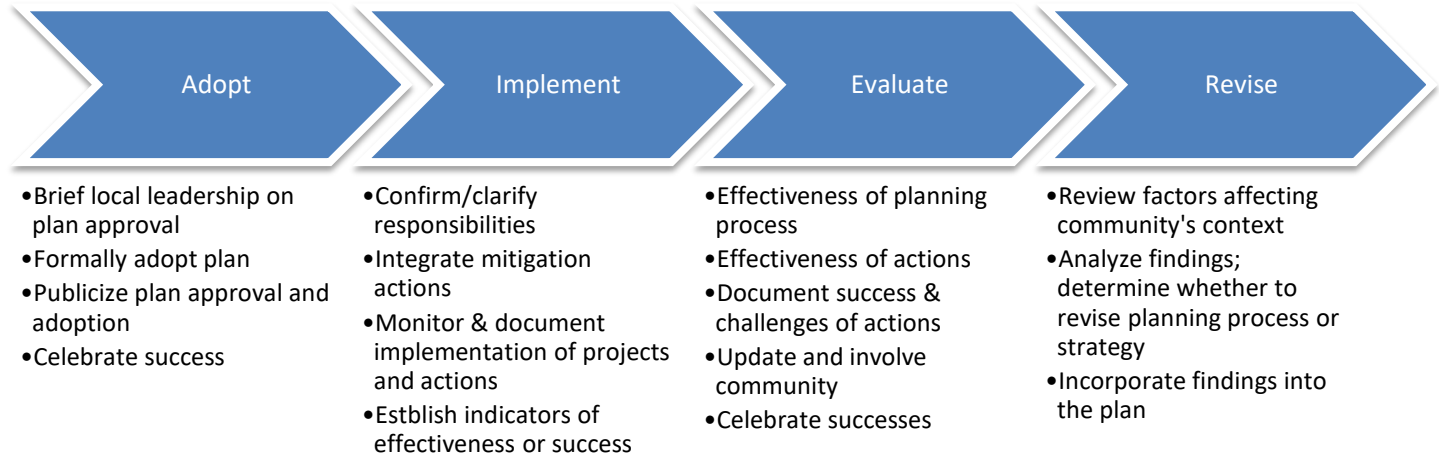
	9/17/2014 Structure is in good condition. JWW/JDM 07/22/2014 – Bridge is in good shape. ~ MJ/JS 07/16/2012 No maintenance is needed at this time. JWW 09/02/11 Irene inspection, no major concerns at this time. MJK JM					
CONCRETE SLAB	07/28/2010 – MJ/D5	0.15 MI TO JCT W C3 TH22	00020	100910002009101	OLD CITY FALLS	RD
CONCRETE SLAB	9/17/2014 Structure is in good condition. JWW/JDM New structure; added in 2012.	0.x MI S TO JCT W TH2	00052	100910005209101	TAYLOR VALLEY	RD
CONCRETE T-BEAM	9/15/2014 Structure is in satisfactory condition. JWW/JDM 7/22/2014 – Bridge is in satisfactory condition. T beams could use some spot cleaning and patch repair. Approach rail system could use improvement. Rail at the southeast corner is somewhat lo	0.2 MI TO JCT W CL3 TH24	00028	100910002809101	JUSTIN MORRILL MEM	HWY
CONCRETE SLAB	9/17/2014 Structure is in good condition. JWW/JDM New structure; added in 2012.	0.7 MI TO JCT W CL3 TH7	00022	100910002209101	JUSTIN MORRILL MEM	HWY
ROLLED BEAM	9/15/2014 & 5/29/2014 New approach and bridge guardrails need to be installed. Most of the approach rail lays on the ground and the bridge rail height is 21", this does not meet the standard of 28" and needs to be replaced. The beams need general clean	0.02 MI TO JCT W CL2 TH1	00061	100910006109101	TYSON	RD
2 SP RLD BM W TIM DK	9/17/2014 Two of the pressure treated timber posts of the pier bent on the downstream end have large voids in the top of the posts due to rot. The pier bent footing is undermined through at the upstream end for the first 3'. A new pier bent should be	@ JCT W CL3 TH7	00016	100910001609101	MUNDEL	RD
CONCRETE T-BEAM	6/26/2014 Due to the water level, unable to see the soffit area and the beams. Soffit area should be reinspected when water level is down. ~FRE/TJB 7/9/2013 The deck and substructure continue to deteriorate. There is deep spalling along the base of	0.4 MI S JCT. VT.132 W	00029	200177002909102	ROUTE 132	
ROLLEDBM W TIMBER DK	9/15/2014 This structure is in good to satisfactory condition. Anti scour protection should be put in place along both abutments to prevent further undermining of the footings. JWW/JDM 07/22/2014 – Channel has chronic contraction scour issues. Bot	0.05 MI TO JCT W CL2 TH2	00072	100910007209101	EASTBURN	RD

Critical crossings group two includes significantly undersized structures, usually culverts, were identified from the ANR-DEC stream geomorphic assessment survey with openness ratios less than 50%. This measure refers to when structure's width is less than half of the stream bankfull width. Several of these structures may have been damaged during TS Irene or other events and may have been replaced. The town, at some point, should look at these sites and assess their status and need for repair/upgrades.

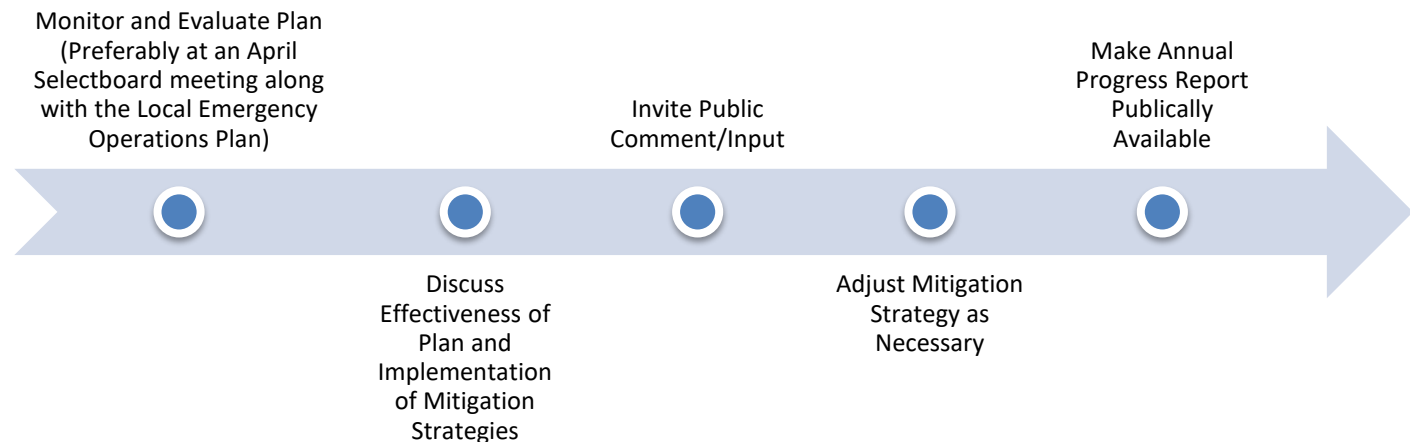
Latitude	Longitude	Road Name	ChannelWidth	StructureLength	StructureHeight	StructureWidth	StructureMaterial
43.91152	-72.39402	TAYLOR VLY RD	8	20	2	2	Steel Corrugated
43.88421	-72.36994	OLD CITY FALLS RD	6.3	36	2.4	3.2	Steel Corrugated
43.8519	-72.43591	ROBINSON RD	11.8	35	3	3	Steel Corrugated
43.8529	-72.43559	ORDWAY RD	11.8	35	3	3.5	Steel Corrugated
43.88547	-72.31336	MILLER POND RD	13.3	40	3.5	3.5	Steel Corrugated
43.87931	-72.40407	WETMORE RD	9.7	30	3.2	2.9	Plastic Corrugated
43.82954	-72.39284	ROUTE 132	12.7	96	6.2	5.6	Steel Corrugated
43.86802	-72.33008	DODGE RD	12.3	24	2.7	3.4	Steel Corrugated
43.83085	-72.37984	ROUTE 132	12.4	93.4	6	6	Concrete
43.92022	-72.36148	VAN DYKE RD	9	36	3.5	4.2	Steel Corrugated
43.90106	-72.39052	TAYLOR VLY RD	12	30	3.1	4.4	Steel Corrugated
43.8544	-72.36637	ALGER BROOK RD	18	39.5	3.7	5.3	Steel Corrugated
43.90423	-72.29952	AYERS RD	9.7	32	4.2	3.8	Steel Corrugated
43.84916	-72.43578	ROBINSON RD	11.8	32	4	4	Steel Corrugated

Appendix B: Five-Year Review and Maintenance Plan

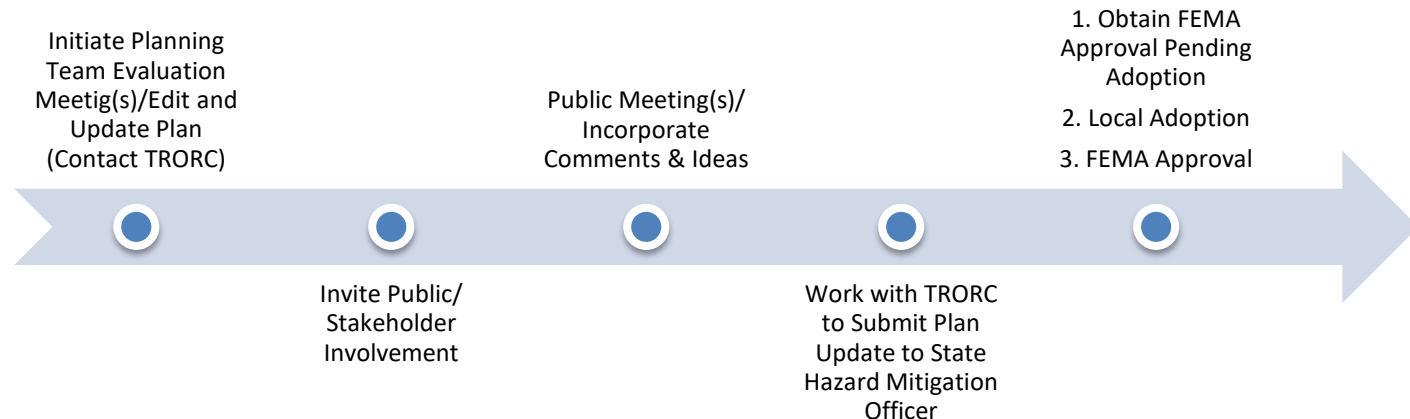
Five-Year Local Hazard Mitigation Plan Review/Maintenance



After Plan Adoption—Annually Implement & Evaluate



Fifth Year, and After a Major or Federally Declared Disaster Directly Impacting the Town Evaluate and Revise



Appendix C: List of Priority Culverts (2021 Culvert Inventory)

tw_n_hwy_cd	comment4	local_id	cul_type	cul_matl	hdr_matl	hdr_cond	height	width	length	Overall Condition
TH35	AMES RD	3	30	10	0	4	12	12	36	Poor
TH15	AYERS RD	1	30	10	0	4	15	15	24	Poor
TH5	BROOK RD	17	30	10	0	4	48	48	48	Poor
TH5	BROOK RD	18	30	13	0	4	48	48	48	Poor
TH41	CROSS RD	6	30	10	0	4	12	12	36	Poor
TH69	FURNACE FLATS RD	3	30	10	0	4	12	12	30	Poor
TH21	JORDAN RD	6	30	10	0	4	15	15	24	Poor
TH20	KENDALL RD	4	30	13	0	4	18	18	36	Poor
TH24	MAPLE HILL RD	4	30	10	0	4	15	15	30	Poor
TH4	MINE RD	19	30	13	0	4	18	18	36	Poor
TH6	OLD CITY FALLS RD	14	30	10	0	4	60	60	36	Poor
TH23	PENNOCK RD	16	30	99	0	4	1	1	1	Critical
TH40	ROBINSON RD	4	30	10	0	4	15	15	36	Poor
TH1	ROUTE 132	21	30	10	0	4	18	18	48	Poor
TH16	SAWNEE BEAN RD	3	30	10	0	4	12	12	36	Critical
TH16	SAWNEE BEAN RD	6	30	10	0	4	12	12	36	Critical
TH16	SAWNEE BEAN RD	10	30	10	0	4	15	15	36	Poor
TH36	STAGE RD	4	30	10	0	4	12	12	36	Poor
TH36	STAGE RD	6	30	10	0	4	12	12	36	Poor
TH7	TAYLOR VALLEY RD	1	30	10	0	4	15	15	30	Poor
TH7	TAYLOR VALLEY RD	3	30	10	0	4	18	18	36	Poor
TH7	TAYLOR VALLEY RD	4	30	10	0	4	15	15	36	Poor
TH7	TAYLOR VALLEY RD	9	30	10	0	4	15	15	24	Poor
TH13	TURNPIKE RD	5	30	10	0	4	12	12	72	Poor
TH13	TURNPIKE RD	6	30	10	0	4	24	24	72	Critical
TH13	TURNPIKE RD	16	30	10	0	4	15	15	24	Poor
TH13	TURNPIKE RD	19	30	10	0	4	18	18	36	Poor
TH12	VAN DYKE RD	3	30	1	0	4	72	72	30	Poor
TH27	WETMORE RD	3	30	13	0	4	18	18	24	Poor
TH27	WETMORE RD	5	30	11	0	4	12	12	24	Critical
TH27	WETMORE RD	8	30	10	0	4	15	15	36	Critical
TH37	WHITCOMB HILL RD	1	30	10	0	4	15	15	30	Poor

Appendix D: Public Notices

PUBLIC NOTICE

- Hazard Mitigation Planning

The Town of Strafford is in the process of updating its Local Hazard Mitigation Plan. Local Hazard Mitigation Plans enable towns to qualify for grant funds, and they make our communities safer. The upcoming Strafford Hazard Mitigation planning meeting is scheduled for Monday, August 29, 2022, at 7:00 PM at the Justin Morrill Homestead, 214 Justin Morrill Memorial Highway, Strafford, VT 05072. The focus of the meeting will be to review top hazards, assess town capabilities, and discuss plan maintenance. The meeting is open to all interested community members. Local Hazard Mitigation Plans are part of an effort by the Federal Emergency Management Agency (FEMA) to reduce damage from foreseeable natural and human-caused areas. Examples of projects in local plans include increasing culvert sizes, regulating flood hazard areas, stabilizing landslides, and tree trimming near power lines. For more information, please contact Kyle Katz at kkatz@trorc.org.

Notice in the Valley News, 08/22/22

HAZARD MITIGATION PLAN UPDATE Strafford Vermont

We are looking for your input!

Join the conversation on how we can make Strafford more resistant to natural hazards. At the meeting, we will discuss priority hazards, town capabilities, and plan maintenance.

Local Hazard Mitigation Plans enable towns to qualify for grant funds, and they make our communities safer, and enable towns to identify projects such as increasing culvert sizes, regulating flood hazard areas, stabilizing landslides, and tree trimming near power lines.

If you are unable to attend the upcoming meeting, you can still participate in the planning process by taking our hazard mitigation feedback survey by scanning the QR code on this poster.

For more information on hazard mitigation planning, or on how to be involved in the planning process, please contact Kyle Katz, Email: kkatz@trorc.org

Where and When:

The Morrill Homestead
214 Justin Morrill Memorial Hwy
Strafford, VT
Tuesday
August 29 - 7PM

SCAN THE QR CODE TO TAKE THE SURVEY!

TRORC
Two Rivers-Ottawa-Quechee
REGIONAL COMMISSION

Poster placed in public places in town, 08/22/22

Dear Town Official,

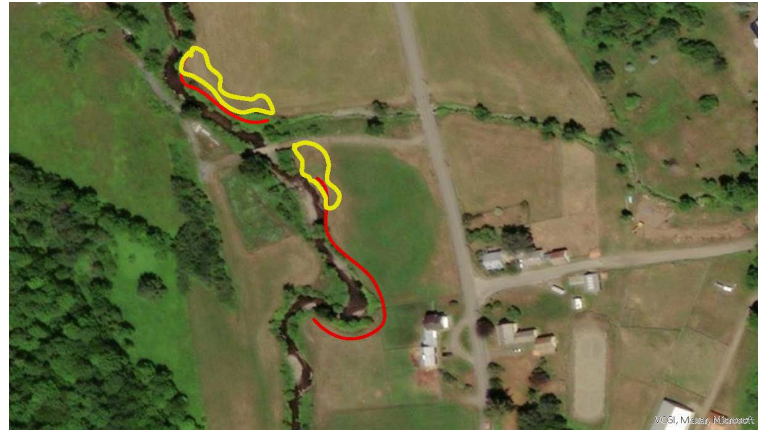
On behalf of the Town of Strafford, per 44 CFR 201.6 Local Mitigation Plans Requirement §201.6(b)(2), jurisdictions that are updating or creating a Local Hazard Mitigation Plan are required to send a draft of the plan to all neighboring communities for comment. The Strafford Hazard Mitigation Plan is attached for your review. Any comments on this plan must be emailed back to me by Monday, November 28th for consideration.

Notice sent to neighboring municipalities, 11/15/22

Appendix E: Riparian Buffer Tree Planting Project (2022)

This project was undertaken in 2022 through a Flood Resilience Program grant, and involved the planting of 400 trees along sections of the West Branch of the Ompompanoosuc River. Trees were planted at strategic points near areas and infrastructure that have experienced, or might experience in the future, significant flooding or erosion. Members of the community along with Newton School students were involved in planting and were educated about the importance of healthy, meandering rivers and vegetated riverbanks.

Projects such as this one can reduce the impacts of flooding on structures, roads, and utilities, through the creation of a vegetated streambank buffer that can assist in holding the soil in place during high water and flood events. Riparian forests can store floodwaters and release them slowly.



Areas indicated for tree planting



Volunteers assist planting trees along the Ompompanoosuc



Trees established, Fall 2022

Appendix F: Drought Language Developed by the Strafford Energy and Climate Committee

A) Educate the public on strategies for minimizing water usage during periods of drought

Strafford has no “city” water, resident’s water comes from private springs, shallow wells, or deep drilled wells. For shallow/spring wells, these can be severely effected by low rainfall/drought conditions. Those with drilled wells may avoid immediate danger of losing water in drought conditions, however while the wells may be owned by private landowners and on private property, the water source is a common resource—the deep aquifers in Vermont’s bedrock, driven by the planet’s water cycle.

The U.S. Geological survey says this about groundwater and wells:

When a water bearing rock readily transmits water to wells and **springs**, it is called an aquifer. **Wells** can be drilled into the aquifers and water can be pumped out. **Precipitation** eventually adds water (**recharge**) into the porous rock of the aquifer. The rate of recharge is not the same for all aquifers, though, and that must be considered when pumping water from a well. Pumping too much water too fast draws down the water in the aquifer and eventually causes a well to yield less and less water and even **run dry**. **In fact, pumping your well too much can even cause your neighbor's well to run dry if you both are pumping from the same aquifer.** - <https://www.usgs.gov/special-topics/water-science-school/science/aquifers-and-groundwater>

And, according to the U.S. EPA, “The Earth might seem like it has abundant water, but in fact less than 1 percent is available for human use. The rest is either salt water found in oceans, fresh water frozen in the polar ice caps, or too inaccessible for practical usage. While population and demand on freshwater resources are increasing, supply will always remain constant. And although it’s true that the water cycle continuously returns water to Earth, it is not always returned to the same place, or in the same quantity and quality.” — <https://www.epa.gov/watersense/how-we-use-water>

With these in mind, and with a lens of moving Strafford towards our 2030 goal of net zero carbon, the following are suggestions for general information, education and guidelines for water usage and water attitudes in town.

In Vermont we are spoiled by a relative abundance of fresh water, and it is easy to think that it is a limitless resource. But as the weather and climate change, and the ecosystem attempts to process decades of chemical applications and various detrimental land management practices, it is prudent to address water usage and management in daily life as well as for hazardous drought conditions. In the past few years, Vermont has been experiencing a higher than normal amount of drought conditions.

Drought concerns include lower water quality (high bacteria/high concentration of toxins) in shallow wells, in ponds, lakes, streams and rivers. Droughts cause stress on ecosystems, affecting the forests, all the creatures great and small. In terms of direct effect on humans, it can negatively affect cultivated crops, livestock and human health, not to mention the huge inconvenience of not having readily available water. In addition, the danger of fire dramatically increases in drought conditions, adding to possible hazardous situations.

Best practices recommended by state and federal governments as well as organizations working on water issues for responsible water usage includes:

Bathroom

- 1) Consider installing low-flow toilets, faucet aerators, showerheads
- 2) Take shorter showers, and when possible turn off water while sudsing
- 3) Turn the water off while brushing teeth and washing hands

Laundry and Kitchen

- 4) Consider installing water-efficient appliances such as washing machines and dishwashers. [Look for the WaterSense label](#)
- 5) Match the water level to the size of the load of laundry
- 6) Run the dishwasher with full loads only
- 7) When cooking, peel and clean vegetables in a large bowl of water instead of under running water.
- 8) Fill your sink or basin when washing and rinsing dishes.
- 9) Check for and fix any plumbing leaks

Outdoors—yard, lawn, garden

- 10) Design landscaping and agriculture for the most efficient water usage
- 11) Consider rain barrels to collect rainwater to use as primary or as a backup irrigation

In addition, in drought conditions:

- 12) Cut back on—or cut out—outdoor water use such as watering your lawn, watering your landscaping. Take a break from sprinkler use.
- 13) Postpone washing your car until drought conditions are over
- 14) More details from the EPA:
 - Maximize the use of natural vegetation and establish smaller lawns. For portions of your lot where a lawn and landscaping are desired, ask your local nursery for tips about plants and grasses with low water demand (such as creeping fescue). Consider planting more trees, shrubs, ground covers, and less grass. Shrubs and ground covers provide greenery for much of the year and usually demand less water. Use native plants in flower beds. Native plants have adapted to rainfall conditions in New England and often provide good wildlife habitat. Cluster plants that require extra care together to minimize time and save water.
 - When mowing your lawn, set the mower blades to 2-3 inches high. Longer grass shades the soil improving moisture retention, has more leaf surface to take in sunlight, allowing it to grow thicker and develop a deeper root system. This helps grass survive drought, tolerate insect damage and fend off disease.
 - Only water the lawn when necessary. If you water your lawn and garden, only do it once a week, if rainfall isn't sufficient. Avoid watering on windy and hot days. Water the lawn and garden in the morning or late in the evening to maximize the amount of water which reaches the plant roots (otherwise most of the water will evaporate). Use soaker hoses to water gardens and flower beds. If sprinklers are used, take care to be sure they don't water walkways and buildings. When you water, put down no more than 1 inch (set out a empty cans to determine how long it takes to water 1 inch) each week. This watering pattern will encourage more healthy, deep grass roots. Over-watering is wasteful, encourages fungal growth and disease, and results in the growth of shallow, compacted root systems that are more susceptible to drought and foot traffic. If an automatic lawn irrigation system is used, be sure it has been properly installed, is programmed to deliver the appropriate amount and rate of water, and has rain shut-off capability.

- Apply mulch around shrubs and flower beds to reduce evaporation, promote plant growth and control weeds.
- Add compost or an organic matter to soil as necessary, to improve soil conditions and water retention.
- Collect rainfall for irrigation in a screened container (to prevent mosquito larvae growth).
- When washing a car, wet it quickly, then use a bucket of water to wash the car. Turn on the hose to final rinse (or let mother nature wash your car when it rains).
- Always use a broom to clean walkways, driveways, decks and porches, rather than hosing off these areas.

https://www3.epa.gov/region1/eco/drinkwaterwater_conservation_residents.html

B) Develop an ordinance or advisory to limit the extraction of water from public waterways during periods of drought

Vermont does allow for a limited amount of water to be extracted from our public waterways—streams, rivers, ponds and lakes. As stated above, considering that our fresh water is a precious and shared public resource, in drought conditions, the town (ordinance or recommendation?) Policy is to not allow/or allow with a small limit, extraction of water from public waterways during drought conditions

Sidenote: Act 135, enacted just this year 2022, requires Vermont farmers to follow reporting rules for surface water usage/extracting water from public waterways. In a few years they will have to go through a permitting process. This applies to usage of more than 10,000 gallons in a 24-hour period or 150,000 gallons or more over a 30-day period.
<https://agriculture.vermont.gov/irrigation-reporting>

Attachments

Attachment A: Map of the Town of Strafford

