Adopted by the Town of Hardwick Selectboard on

Town of Hardwick

All-Hazards Mitigation Plan Update

P.O. Box 523, 20 Church St.
Hardwick, VT 05843
(802) 472-6120

PA Applicant Number: 005-31825-00 (Town) 005-UQA0M-00 (HEC)

Prepared by:

Town of Hardwick , Vermont

CERTIFICATE OF LOCAL ADOPTION

Hardwick, Vermont

A Resolution of the Town of Hardwick, Vermont Adopting

An Update to the Town of Hardwick All-Hazards Mitigation Plan

WHEREAS, Hardwick recognizes the threat that natural hazards pose to people and property within Hardwick; and

WHEREAS, Hardwick has prepared a multi-hazard mitigation plan update, hereby known as the 2023 Town of Hardwick All-Hazards Mitigation Plan Update in accordance with federal laws, including the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended; the National Flood Insurance Act of 1968, as amended; and the National Dam Safety Program Act, as amended; and

WHEREAS, Hardwick identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Hardwick from the impacts of future hazards and disasters; and

WHEREAS, adoption by Hardwick demonstrates its commitment to hazard mitigation and achieving the goals outlined in the 2023 Town of Hardwick All-Hazards Mitigation Plan Update.

NOW THEREFORE, BE IT RESOLVED BY HARDWICK VERMONT THAT:

In accordance with local rule for adopting resolutions, Hardwick adopts the 2023 Town of Hardwick All-Hazards Mitigation Plan Update. While content related to Hardwick may require revisions to meet the plan approval requirements, changes occurring after adoption will not require Hardwick to re-adopt any further iterations of the plan. Subsequent plan updates following the approval period for this plan will require separate adoption resolutions.

_____

Date

_____

Selectboard Member

_____

Selectboard Member

_____

Selectboard Member

_____

Selectboard Member

_____

Selectboard Member

_____

Attested to by Town Clerk

Executive Summary

In early 2023, Hardwick began to develop this Local All-Hazards Mitigation Plan Update from the last approved plan from December 18, 2017. Due to the magnitude of the July 2023 flood event (DR-4720) impacting the Town of Hardwick, the town requested help from the Northeast Vermont Development Association (NVDA) in finalizing the updated plan for submission. NVDA then contracted with the consultant who drafted the 2017 Mitigation Plan and work on the update began in late July A few weeks later, President Biden declared a major flooding disaster for the entire state of Vermont and it was widely accepted that Hardwick had been hit especially hard. In addition to DR-4720 and other flood events, it should be noted that the previous planning period included the COVID-19 pandemic - an event with unprecedented health, social, and economic impacts that severely disrupted the normal operation of town government.

The 2023 Hardwick All-Hazards Mitigation Plan is an update of the 2018 plan and identifies changes, advancements, and future needs in the areas most vulnerable to the profiled hazards. Also included are the proposed mitigation actions for the next 5-year planning cycle. Statuses of the previous planning period's actions are also included in this update. The description and results of the 2023 planning process are contained herein and represent the collaborative efforts of the newly formed Hazard Mitigation Planning Team and associated residents, towns, non-profits, and agencies that contributed to the development of this plan. As hazard mitigation is a sustained effort to permanently reduce or eliminate long-term risks to people and property from the effects of reasonably predictable hazards, the town has communicated its efforts related to developing this plan to its residents, businesses, and surrounding municipalities. Thisprovided these groups a formal opportunity to give input and review relevant sections of the plan. The eligibility to receive federal hazard mitigation grants and optimize state-level reimbursement or "match" dollars during a federally declared disaster is dependent on a federally approved plan. The Town of Hardwick remains committed to sustaining its mitigation efforts and, by developing this plan update, will have a guide for action that will foster enhanced emphasis on mitigation in the years to come. The town realizes that mitigation is inherent to its own resilience as well as means to establishing strong partnerships with regional support agencies and associations, state government and FEMA.

As the town moves towards formally adopting this Local All-Hazards Mitigation Plan update, the purpose of this plan is to:

- Identify specific hazards that impact the town.
- Prioritize hazards for mitigation planning.
- Recommend town-level goals and strategies to reduce losses from those hazards.
- Establish a coordinated process to implement goals and their associated strategies by taking advantage of available resources and creating achievable action steps.

This plan is organized into 5 Sections:

Section 1: Introduction and Purpose explains the purpose, benefits, implications, and goals of this plan. This section also describes demographics and characteristics specific to the town and describes the planning process used to develop this plan.

Section 2: Hazard Identification expands on the hazard identification in the Municipal Plan with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the town and reviews previous federally declared disasters to identify what risks are likely in the future. This section presents a hazard risk assessment for the municipality, which identifies the most significant and most likely hazards that merit mitigation activity. Building upon the identified hazards from 2018 and in line with the 2018 State Hazard Mitigation plan, the updated profiled hazards with associated mitigation actions are introduced in the grid below:

Severe winter/Ice storm	Extreme Temperature (Hot and Cold)	Flooding/fluvial erosion/landslides/inundation
Infectious Disease		

Section 4: Vulnerability Assessment discusses buildings, critical facilities and infrastructure in designated hazard areas and estimates potential losses.

Section 5: Mitigation Strategies begins with an overview of goals and policies that supports hazard mitigation in the most recent Municipal Plan and then formulates a work plan around major infrastructure projects, community awareness and documentation. An analysis of existing municipal actions that support hazard mitigation, such as planning, emergency services and actions of the Public Works department are also included. The following all-hazards mitigation goals are summarized below:

1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial, and agricultural establishments due to various hazards.
3) Maintain and increase awareness amongst the town's residents and businesses of the damage caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
4) Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
5) Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
6) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing municipal plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
7) Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the updated LHMP and use language/actions from it to inform the integration and future update processes. Town

Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budget.

Section 5 also identifies and provides a detailed discussion on the following mitigation actions:

Action #1: Reduce vulnerability to flooding by evaluating capabilities of existing road and storm water management infrastructure, increasing public education and updating municipal services and regulations.

Action #2: Improve resilience to severe winter storms.

Action #3: Reduce impact of extreme hot and cold temperature durations.

Action #4: Raise public awareness of hazards and hazard mitigation actions.

Action #5: Reduce risk and impact of major infectious disease events.

In conclusion, Section 5 provides an Implementation Matrix to aid the municipality in implementing the outlined mitigation actions with an annual evaluation process to be coordinated and administered by the Town Manager and associated departments within Hardwick government.

Table of Contents

SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this Local All-Hazards Mitigation Plan update is to assist this municipality in identifying all hazards facing their community and in identifying strategies to begin to reduce the impacts of those hazards. The plan update also seeks to better integrate and consolidate efforts of the municipality with those outlined in the Municipal Plan as well as the efforts of NVDA, Vermont State agencies, FEMA, and the State Hazard Mitigation Plan. The town is aware that community planning can aid significantly in reducing the impact of expected, but unpredictable, natural and human-caused events. The goal of this plan is to provide hazard mitigation strategies to aid in creating a disaster resistant community.

1.2 Hazard Mitigation

The 2018 Vermont State Hazard Mitigation Plan states:

> *"The impact of anticipated yet unpredictable natural events can be reduced through community planning and implementation of cost effective, preventive mitigation efforts.*
>
> *The State of Vermont understands that it is not only less costly to reduce vulnerability to disasters than to repeatedly repair damage, but that we can also take proactive steps to protect our economy, environment, and most vulnerable citizens from inevitable natural hazard events. This Plan recognizes that communities have the opportunity to identify mitigation strategies during all phases of emergency management (preparedness, mitigation, response, and recovery) to more comprehensively address their vulnerability. Though hazards themselves cannot be eliminated, Vermonters can reduce our vulnerability to hazards by improving our understanding of both the natural hazards we face and their potential impacts.*
>
> *The 2018 Vermont State Hazard Mitigation Plan (SHMP) presents the hazard impacts most likely to affect Vermont and a mitigation strategy to reduce or eliminate our most significant vulnerabilities."*

Hazard mitigation strategies and measures can reduce or eliminate the frequency of a specific hazard, lessen the impact of a hazard, modify standards and structures to adapt to a hazard, or limit development in identified hazardous areas. This plan aligns and/or benefits from the State's 2018 Hazard Mitigation Plan, - as part of the Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency, many state agencies and local organizations have increased awareness of the importance of mitigation planning and have produced plans and resources that towns can use to support their planning efforts. This plan will reference, when relevant, pertinent tools and resources that can be used to enhance mitigation strategies.

1.3 Hazard Mitigation Planning Required by the Disaster Mitigation Act of 2000

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, coordinates available resources, and implements actions to reduce risks. Per *44 CFR Part 201:*

Hazard Mitigation Planning, this planning process establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, local governments now must have an approved local mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan for Pre-Disaster Mitigation funds or grants to be released for either a state or local mitigation project after November 1, 2004.

There are several implications if the plan is not adopted:

- After November 1, 2004, Flood Mitigation Assistance Grant Program (FMAGP) funds will be available only to communities that have adopted a local plan.
- For disasters declared after November 1, 2004, a community without a plan is not eligible for HMGP project grants but may apply for planning grants under the 7% of HMGP available for planning.
- For the Pre-Disaster Mitigation (PDM) program, a community may apply for PDM funding but must have an approved plan to receive a PDM project grant.
- For disasters declared after October 14th, 2014, a community without a plan will be required to meet a greater state match when public assistance is awarded under the ERAF requirements (Emergency Relief Assistance Funding)

1.4 Benefits

Adoption and maintenance of this Hazard Mitigation Plan will:

- Make certain funding sources available to complete the identified mitigation initiatives that would not otherwise be available if the plan was not in place.
- Lessen the receipt of post-disaster state and federal funding because the list of mitigation initiatives is already identified.
- Support effective pre-and post-disaster decision making efforts.
- Lessen each local government's vulnerability to disasters by focusing limited financial resources to specifically identified initiatives whose importance have been ranked.
- Connect hazard mitigation planning to community planning where possible.

1.5 All-Hazards Mitigation Plan Goals

This All-Hazards Mitigation Plan establishes the following general goals for the town and its residents:

- Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial, and agricultural establishments due to various hazards.
- Maintain and increase awareness amongst the town's residents and businesses of the damage caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.

- Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- Develop a mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission and NVDA and will integrate the strategies into the existing Municipal Plan as annexes until the next formal update occurs, when a section devoted to mitigation planning will be integrated into the plan.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets.
- Flood-related data and information originating in the Hazard Mitigation Plan will continue to be reviewed and assessed for relevant inclusion in the Municipal Plan Updates specific to flood resilience.

1.6 Community History and Background

Caledonia County
Chartered: August 19, 1781 (Vermont Charter)
Area: 24,741 Acres = 38.66 Square Miles [Size Rank: 150*]
Coordinates (Geographic Center): N 44° 30' W 72°22'
Altitude: 861 feet ASL
Population (US Census, 2020): 2920

Hardwick is a small, rural community located in Northeastern Vermont that was chartered on August 19, 1781, (see Hardwick Base Map). The Town of Hardwick abuts seven towns; Greensboro, along the Northeastern Border, Walden along the Southeastern Border, Woodbury and Elmore along the Southwestern border, Wolcott along the Northwestern Border, Stannard touches the Eastern corner and Cabot touches the southern corner. The town also abuts three counties; Orleans, Lamoille and Orange.

The Town of Hardwick has two unincorporated villages, Hardwick Village and East Hardwick. Hardwick Village was once an incorporated village but was disincorporated in 1988. The former

Hardwick Village area is characterized by dense development, including single family and multifamily dwellings and various commercial and industrial businesses. The East Hardwick area is much smaller and it is mostly single-family homes, with a few multifamily dwellings and a few commercial buildings.

In the late 1800s, Hardwick was a center of industry, with several factories and productive granite quarries. As time passed, many of the mills closed or changed use and the quarries ceased operation. In the last decade, there has been a boom in industries involved in the processing of agricultural products. The industrial park is nearly full, mostly with agricultural processing facilities, including Vermont Soy, the Sugar Man, the Vermont Food Venture Center, Vermont Natural Coatings, and Jasper Hill Cheese. The rest of the town is sparsely populated and, except for a few commercial businesses, the lands are used primarily for agriculture and forestry purposes.

The Town of Hardwick is part of the Orleans Southwest Supervisory Union, which provides K-12 public education. The town has two public schools. The Hardwick Elementary School serves grades K - 6 grades. The 2023 enrollment is listed at 239 with a capacity of 360 students. The Hazen Union School serves grades 7 – 12. The 2023 enrollment is listed at 299 students with a capacity of 500 students. There are two public preschools in supervisory union, and Head-start has a satellite program in the town.

The Lamoille River runs east to west through the town. Vermont Route 15 and the now defunct Lamoille Valley Railroad bed follow the Lamoille River to the west. Vermont Route 14 runs from north to south through the town as does Route 16. The Town is connected to the rest of Caledonia County via Route 15 to the East where it intersects Route 2 in West Danville.

The town government is run by the selectboard with a Town Manager and several departments. The Town of Hardwick has been involved in six significant Federal Emergency Management Agency (FEMA) events, all involving flooding and/or ice jams. A series of concrete ice retention blocks have been placed in the Lamoille River to mitigate against future (spring-thaw) flooding by breaking up ice jams before heading south towards the village area. To date they have been successful.

Topography & Climate

The Western portion of the town is characterized by steeper slopes and higher elevations, while the eastern portion of the town is lower rolling hills. Most of the bedrock is covered with glacial deposits of varying depths.

The climate in Hardwick is much the same as in the rest of northern Vermont. The following climate data comes from NOAA's recording station in nearby Morrisville, Vermont. The average coldest winter temperatures occur in January, with an average mean temperature of 13.2 degrees and an average nighttime low of 24.9 degrees. The warmest part of the year is in July, with an average mean temperature of 65.7 degrees and an average daytime high of 77.8 degrees Fahrenheit.

The wettest time of the year occurs during July and August with averages of 4.61 inches and 4.38 inches of rain, respectively. The driest period is January through March with average melted precipitation amounts of 2.66 inches in January, 2.59 inches in February and 2.79 inches in March. The bulk of the snow falls in December, January, February, and March with 25.0 inches, 21.9 inches, 21.6 inches and 21.8 inches respectively. The average total snowfall for the year is 104.2 inches. October and November receive an average of 0.8 inches and 8.4 inches of snow, respectively, with April receiving 4.7 inches.

Town Infrastructure

The Town of Hardwick has 1.5 miles of Class 1 roads, 11.3 miles of Class 2 Roads, 52.5 miles of Class 3 Roads, 5.7 miles of Class 4 Roads, and 16.1 miles of State Highway. Much of Main Street and Mill Street in downtown Hardwick was repaved in 2012 and 2014 and 2023. The Town has a 5-year road plan that includes yearly paving projects. Additionally, the Town of Hardwick has developed a long-range plan and a line item allocation in its Capital Budget to refurbish troublesome portions of the Town's Class 3 or dirt roads, which make up the majority of Hardwick's roads. All major bridges located in Hardwick are reviewed by the Agency of Transportation regarding their structural needs and the Town makes improvements to these bridges annually as necessary. The Town also maintains a culvert record system that tracks the location, condition, and installation date of all Town road culverts.

The Town of Hardwick owns its own power company, the Hardwick Electric Department, which provides power to 5 communities in 3 different counties. There are two dams located in the Town. The Mackville Dam is located on Nichols Brook on the southeast side of town and was rebuilt in 2004. The Jackson Dam is located on the Lamoille River on the southwest side of town downstream of downtown and the industrial park. Neither of these dams provide electrical generation. There is no electrical generation in the Town of Hardwick aside from solar voltaic panels and wind generators.

There are two cell towers located in Hardwick, one on Hopkins Hill and one located off of Bridgman Hill.

The Hardwick Community Water Supply system has two wells that supply all of the water used by the village of Hardwick. The municipal wells are located near the Hardwick Industrial Park adjacent to Wolcott Street. The East Hardwick Fire District #1 supplies water to the village of East Hardwick from springs located on Ward Hill to the south. The Town has well head protection areas and plans for providing water in case of a shortage due to unexpected circumstances. Private wells are not permitted within the water distribution area of the Urban Compact.

The Urban Compact of the Village of Hardwick, now the Town of Hardwick, is served by a tertiary wastewater treatment facility built in 1978. The facility has been upgraded one time since its initial construction to increase capacity and to provide a higher level of wastewater treatment. Private septic tanks and leach fields are allowed outside of the collection area of the Hardwick Urban Compact.

Town Emergency Services

EMS Services - Town emergency medical services are provided by a local nonprofit organization known as the Hardwick Rescue Squad (HRS). HRS serves the towns of Hardwick, Craftsbury, Greensboro, Wolcott, and Woodbury. The HRS has its headquarters collocated on Creamery Street with the Hardwick Town Garage.

Town Fire Department - The Town has a well-trained volunteer fire department with up-to-date equipment including a ladder truck, a tanker truck, and a rescue pumper truck. South Main Street in Hardwick Village has seen four significant downtown fires in the last 20 years, one of which resulted from an automobile crashing into a building. Much of the new construction on this street now includes new sprinkler systems and firewalls between structures.

Town Police Department - The Hardwick Police Department consists of 4 full-time officers and 1 part-time officer. The Town has four police cruisers. In 2013, the Police Department moved into new quarters on 54 High Street in Hardwick.

Additionally, there are two main hospitals located outside of town that provide services for Hardwick residents: Copley Hospital in Morrisville, approximately 20 minutes away to the east, and the Central Vermont Hospital in Berlin about 25-30 minutes to the south. The Hardwick

Area Health Center is a Community Health Center. It provides care for both acute and chronic illness to residents of Hardwick and the surrounding communities.

National Flood Insurance Program
Since 1978, Hardwick has participated in the National Flood Insurance Program and is currently in compliance. The first Hardwick FIRM (Flood Insurance Rate Map) was published 6/15/1978.

Information on ERAF Eligibility Criteria – 12.5% State Share can be found at:
http://floodready.vermont.gov/sites/floodready
http://tinyurl.com/erafvt

1.7 Summary of Planning Process

The Town Manager, David Upson, served as the primary point of contact during the update. The planning process was fast-tracked to meet current state policy related to the 30-day post declaration date (July 14th, 2023) to determine status of the town's mitigation plan, where-by influencing ERAF rate. Existing documents were also researched and incorporated into the plan update. The following table presents the Planning Team members and their title:

Table 1-1: 2023 Hardwick Mitigation Planning Team Roster

Name	Title and Organization
Tom Fadden	Town Road Foreman and Fire Chief
Mike Henry	Police Chief
Todd Delarichelier	Hazen Union Shelter Coordinator
Kristen Leahy	Zoning and Floodplain Administrator
Dave Gross	Planning Commission Chair
Mike Sullivan	Hardwick Electric
Eric Remick	Select Board Chair
David Upson	Town Manager
Alison Low	Senior Planner, NVDA
Casey Rowell	Business Manager

The last approved plan for the town was in 2017. July 31st, 2023 marked the kick-off meeting for the plan update. Planning requirements were discussed with a list of next steps. The

opportunity for all stakeholders to participate and provide feedback was announced on the town website and social media page (e.g., Front Page Forum). This is seen as the most efficient way for stakeholders to provide input. The survey introduced the importance and informational needs of a LHMP and asked for specific concerns the residents and/or business owners had in response to all hazards and the July 2023 flood event. Specific to the plan feedback, stakeholders were informed at the August 24th warned meeting to contact the Town Manager's office to review the plan and provide feedback. Agendas, meeting content, and subsequent minutes provided the methodology by which representatives of businesses, schools/academia, and other private organizations that sustain community lifelines, including utilities, were informed of the planning process and ability to provide feedback.

Regional non-profits and other organizations serving vulnerable populations were contacted during plan development. Each entity was informed of the plan update, given opportunity to review and comment on the plan, directed to the online Community Hazard Survey, and asked to provide narrative on how their respective services had been impacted by DR-4720. The community survey is an anonymous feedback tool and any specificity to organizations and/or individuals who provided feedback via the survey is not available. Those serving vulnerable populations within the community saw an increase in requests for help and for the most part, were able to meet these requests with relative efficiency. Those serving individuals in a residential setting had issues of staffing and transportation hurdles, but were able to meet these challenges by-and-large. Hardwick has a robust community service system made up of volunteers, coalitions, and non-profits. Related to DR-4720, Hardwick Neighbor to Neighbor (NtN) became a crucial mechanism of support for disaster recovery. Highlights of this support are included in Appendix E and can support future planning as the work of NtN is considered a benchmark for community mobilization during a disaster. Of note is the NtN Financial Assistance Advocate Initiative -a program that is helping individuals with grant applications through FEMA IA and other funding opportunities.

Table 1-2: Non-Profit and Vulnerable Population Service Provider Contact Roster

Organization
Hardwick Area Health Center
The Northeast Kingdom Council on Aging
Northeast Kingdom Learning Services Hardwick Learning Center:
BAART Programs
Sterling College
NEK Human Services
Hardwick Area Food Pantry
Hardwick Neighbor to Neighbor
The Civic Standard
Center for Agricultural Economy

All neighboring towns were sent notification of the plan's development and were given an opportunity to provide input through email and/or phone call to the town clerk. These include Greensboro, Walden, Woodbury, Wolcott, Elmore, Stannard, and Cabot. No responses were obtained from this solicitation.

Research and feedback on hazards, community capacities, community assets and potential mitigation projects was also conducted in coordination with other important stakeholders. Phone calls, emails and meetings were exchanged and held to involve the expertise of additional town staff, various state agency and regional stakeholders, with an emphasis on vulnerable populations. Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist, the plan was written using data sources that included:

- Surveys and warned, public meetings collecting public comment (issues raised were addressed in plan and the public meeting)
- 2019 Municipal Plan (provided current goals and regulations supporting mitigation, recent capital expenditures and infrastructure value helped to drive vulnerability assessment)
- 2018 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).
- 2015 ACCD VERI Report (provided comparative flood and economic risk data)
- Vermont Agency of Natural Resources (ANR) and Transportation (VTrans) (provided key policy recommendations on environmental conservation, high accident locations, climate change and fluvial erosion data).
- Vermont Departments of Health (VDH) and Environmental Conservation (DEC) (provided information related with public health services that could be impacted during a disaster and state support functions designated to both VDH and DEC. DEC also provided river corridor data for mapping purposes).
- FEMA Open Source (data.gov) Data for Disaster History and PA funding (provided comprehensive declared disaster by year and type as well as project descriptions and cost per event).
- FEMA NFIP "Bureau.Net" database (provided detailed information on repetitive loss properties and associated flood insurance claims).
- EPA's Incident Action Checklist for cold weather resilience of water systems (provides a guidance tool for public works to cross-reference actions on the system).

Based on the information obtained, input from town and state officials, the planning team, state and federal databases and local knowledge, the plan was created. While many small communities in Vermont face similar circumstances (e.g., flooding, winter storms and remote residents), each one has unique considerations and opportunities. There was a point made to capture the subtle characteristics of the town. From this review, the specific risks, vulnerabilities, and mitigation strategies were developed and, when applicable, broken down to the specific entity impacted. The planning progress and requests for input during selectboard meetings are summarized below.

- *7/18/23: Initial meeting with NVDA and town manager to develop plan of action, draft planning team, and name a point of contact for daily correspondence and information.*
- *7/28/23: Community Survey launched and Planning Team named.*
- *7/31/23: Planning Team contacted via email to introduce planning process, calendar, and informational needs. Public notified of update process and ability to provide feedback.*
- *8/2/23 Non-profits and organizations serving vulnerable populations informed of planning process and opportunity to provide feedback.*
- *8/3/23: Meetings and correspondence with town staff in addition to Town Manager and, for project planning, town assets and status of 2017 mitigation action items.*
- *8/8/23: Draft plan sent to planning team for review and comment. No edits were required.*
- *8/9/23: Meeting with Town Manager to discuss draft, planning needs and draft submission. All Neighboring towns sent notification that a draft copy was available starting 8/16/23 via the town's Business Manager.*
- *8/10/23: Draft Plan Submitted to Vermont Emergency Management.*
- *8/17/23: Final meeting to review updated hazards and mitigation actions at warned selectboard meeting. Notification that the draft plan is available for community review and comment made at selectboard meeting. .*

The draft plan was then revised based on input and presented to the town. Much of the input from residents (e.g., survey results) focused on road resilience and snow removal. Survey results are included in the appendix. The revised draft was made available for review at the town office to both residents and bordering municipalities. Minor edits were made to the plan following state recommendations and the final draft was resubmitted to VEM and then to FEMA for formal review and approval pending municipal adoption. A resolution of adoption was then approved by the selectboard.

SECTION 2: HAZARD IDENTIFICATION

For this update, the 2017 hazards profiled have been modified to meet the new FEMA review guidelines. The narrative methodology for the natural hazards profile combines the natural hazard categories outlined in the state mitigation plan and for each, considered prior history, current trends, and available data to estimate risk. These hazards provide the basis of future mitigation strategies. A profiled hazard can have high, moderate, or low risk. Those hazards omitted from full profiling do not pose enough risk to substantiate mitigation efforts at this time due to lack of occurrence frequency and/or vulnerability as assessed in Section 3's Qualitative Risk Estimation Matrix (Table 3-2). Future conditions, including climate change, were considered in the hazard rankings and probability score. While difficult to quantify climate

change, frequency of hazards and data related to climate change are tools used to estimate future risk. Hazards scoring lowest include drought, high winds, landslide, wildfire, earthquake, invasive species, and hail.

While there are commonalties of natural hazard risk across most of the state and county, awareness of historic events, financial burden, state, and town level assessments can support trajectory for the future mitigation actions. As indicated in the 2018 SHMP, the hazards of most concern across the state aligned with the town of Hardwick. Given that the most recent SHMP was written before the COVID-19 pandemic, the town has included pandemic (infectious disease) as a hazard due to the magnitude of impact that the pandemic had. As it pertains to town-level assessments, the planning team reviewed the Natural Hazard and Risk Analysis Tool for changes and additions and felt that while the assessment methodology is distinct from the SHMP Hazard Assessment, there are comparative similarities in scoring relationships. The definitions of each hazard, along with historical occurrence and impact, are described below.

Types of Natural Hazards: weather /climate hazards (drought, hurricane/tornado, high winds, severe winter storm, extreme temperatures, climate change, lightning, hail), flooding, geological hazards (landslide / erosion, earthquake, naturally occurring radiation), and fire hazards.

2017 Profiled Hazards:
- High Winds, Severe Winter/Ice Storm
- Flooding/flash flooding/ice jams/dam failure,
- Extreme Cold Temperature

Additional Hazard: Hazardous Materials Incident

2023 Updated Profiled Natural Hazards:
- Severe Winter Storm/Ice
- Flooding/fluvial erosion
- Extreme Temperatures
- Infectious Disease

Note: Water supply contamination remains a concern for town but will not continue as profiled hazards. These vulnerabilities will be covered in Section 3.

The definitions of each hazard, along with historical occurrence and impact, are described below:

2.1 Profiled Hazards

There have been 32 major disasters declared since 1998 and 5 Emergencies declared since 1977. Hardwick was impacted by a fraction of these declarations but, at times, the impact has been severe. 71 severe weather events were reported between 01/01/2018 and 08/01/2023 in the county. 41 of these resulted in property damage. Of these, the June 20th flash flood of 2019 was

specific to Hardwick. A slow-moving frontal boundary with several waves of low pressure moved across NY and VT during the afternoon of June 20th. Most of the activity was rain showers with a few embedded thunderstorms that caused some localized flash flooding. However, a few of the storms produced wet microbursts that caused minor tree damage. On May 21, 2022, a mid-level disturbance moved into a moderately unstable air mass across Vermont during the late afternoon/early evening of May 21st. Scattered thunderstorms developed in NY and southern Quebec and intensified as they moved east into VT. Several reports of damaging winds and a few observations of hail greater than one inch in diameter were reported.
A few trees were downed by thunderstorm winds in Hardwick. A large branch fell and caused minor property damage to the Hardwick Police department building. A list of the other events with associated narrative can be found here.

The following discussion on natural hazards is based upon information from several sources. General descriptions are based upon the *2018 Vermont State Hazard Mitigation Plan.* Due to rural nature of Northeast Kingdom, there is little historical data available for presentation related to all hazards but when available, relevant data is included.

Table 2-1: Summary of Vermont Emergency Declarations

Number	Year	Type
3595	2023	Flooding
3567	2021	Tropical Storm Henri
3437	2020	Pandemic (COVID-19) national 3/13/20
3338	2011	Hurricane Irene
3167	2001	Snowstorm
3053	1977	Drought

Source: FEMA

Table 2-2: Summary of Vermont Major Disaster Declarations since 1998 (Caledonia County in Bold with events that resulted in PA funding for the town with an "(*)")

Number	Year	Type
***4720**	**2023**	**Severe Storm and Flooding**
4695	**2023**	**Severe Storm and Flooding**
4621	2021	Severe Storm and Flooding
***4532**	**2020**	**COVID-19**
4474	**2020**	**Severe Storm and Flooding**
4356	**2018**	**Severe Storm and Flooding**
4380	**2018**	**Severe Storm and Flooding**
4330	**2017**	**Severe Storms and Flooding**
4207	2015	Severe Winter Storm
4232	2015	Severe Storms and Flooding
***4178**	**2014**	**Severe Storms and Flooding**
4163	**2014**	**Severe Winter Storm**
4140	**2013**	**Severe Storms and Flooding**
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding

***4022**	**2011**	**Tropical Storm Irene**
***4001**	**2011**	**Severe Storms and Flooding**
1995	2011	Severe Storms and Flooding
1951	2010	Severe Storm
1816	2009	Severe Winter Storm
***1790**	**2008**	**Severe Storms and Flooding**
1784	**2008**	**Severe Storms, Tornado and Flooding**
1778	2008	Severe Storms and Flooding
***1715**	**2007**	**Severe Storm, Tornado and Flooding**
1698	**2007**	**Severe Storms and Flooding**
***1559**	**2004**	**Severe Storms and Flooding**
1488	2003	Severe Storms and Flooding
1428	**2002**	**Severe Storms and Flooding**
1358	2001	Severe Winter Storm
1336	2000	Severe Storms and Flooding
1307	1999	Tropical Storm Floyd
1228	1999	Severe Storms and Flooding
1201	1998	Ice Storm

Source: FEMA

Table 2-3: Hardwick PA Funding by Disaster

Disaster Number	Declaration Date	Incident Type	Applicant Name	Number of Projects	Federal Share Obligated
1307	11/10/1999	Severe Storm(s)	HARDWICK (TOWN OF), HARDWICK ELECTRIC DEPARTMENT	2	$52,362.06
1559	09/23/2004	Severe Storm(s)	HARDWICK (TOWN OF)	4	$11,119.57
1698	05/04/2007	Severe Storm(s)	HARDWICK ELECTRIC DEPARTMENT	2	$6,142.27
1715	08/03/2007	Severe Storm(s)	HARDWICK (TOWN OF)	6	$79,898.79
4022	09/01/2011	Hurricane	HARDWICK ELECTRIC DEPARTMENT	1	$14,421.22
4022	09/01/2011	Hurricane	HARDWICK (TOWN OF)	1	$9,051.30
4163	01/29/2014	Severe Ice Storm	HARDWICK ELECTRIC DEPARTMENT	1	$30,316.86
4207	02/03/2015	Severe Storm(s)	HARDWICK ELECTRIC DEPARTMENT	2	$85,165.06

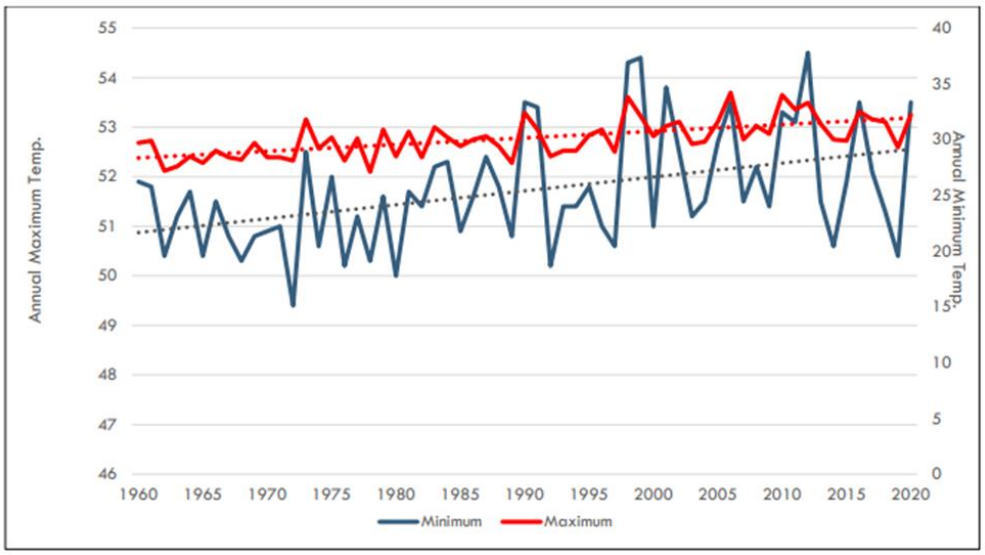
2.1.1. *An Introduction to Climate Change:*

"Over the past several decades, there has been a marked increase in the frequency and severity of weather-related disasters, both globally and nationally. Most notably, the Earth has experienced a 1°F rise in temperature, which has far-reaching impacts on weather patterns and ecosystems. This statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer), is known as climate change. The Intergovernmental Panel on Climate Change (IPCC) forecasts a temperature rise of 2.5°F to 10°F over the next century, which will affect different regions in various ways over time. Impacts will also directly relate to the ability of different societal and environmental systems to mitigate or adapt to change. Increasing temperatures are forecasted to have significant impacts on weather-related disasters, which will also increase risk to life, economy and quality of life, critical infrastructure, and natural ecosystems. The IPCC notes that the range of published evidence indicates that the costs associated with net damages of climate change are likely to be significant and will increase over time. It is therefore imperative that recognition of a changing climate be incorporated into all planning processes when preparing for and responding to weather-related emergencies and disasters. Most of the natural hazards identified in this plan are likely to be exacerbated by changes in climate, either directly or indirectly. The National Aeronautics & Space Administration (NASA) reports that global climate change has already had observable effects on the environment: glaciers are shrinking, sea ice is disappearing, sea level rise is accelerating, heat waves are occurring more frequently and intensely, river and lake ice is breaking up earlier, plant and animal ranges have shifted, and trees are flowering sooner. Though climate change is expected to have global reach, the impacts differ by region. While the southwestern United States is expected to experience increased heat, wildfire, drought and insect outbreaks, the northeastern region is predicted to experience increases in heat waves, downpours, and flooding. Accordingly, consideration of climate change was identified as a key guiding principle of the 2018 SHMP, addressed in each of the pertinent hazard profiles and incorporated into all relevant mitigation actions." 2018 SHMP

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2022, there were 24. It is commonly accepted that weather extremes are becoming more commonplace in Vermont. Since 2011, record setting snow, rain and cold have been experienced in the state. In recent years, it has become evident that human activities, mostly associated with the combustion of fuel, have added to the natural concentration of greenhouse gases in the atmosphere and are contributing to rapid climate change on a global scale. While projections of the effects of climate change vary, it is generally predicted that Vermont will have warmer temperatures year-round, with wetter winters and drier summers. An increase in the size and frequency of storms is also predicted. Thus, climate change in the next century will likely increase the chance of weather-related hazards occurring. An increase in precipitation may also result in increased flooding and fluvial erosion. Drier summers may increase the chance of drought and wildfires. A warmer climate may also result in the influx of diseases and pests that cold winters previously prevented. The severity of climate change is difficult to predict, though

the effects may be mitigated somewhat if greenhouse gas emissions are reduced soon. In 2011, Governor Shumlin formed the *Vermont Climate Cabinet*. The Cabinet, chaired by the Secretary of Natural Resources, is a multidisciplinary approach to enhance collaboration between various State Agencies. Its primary objectives include providing the Governor with advisory information and facilitating climate change policy adoption and implementation. In 2013, the Vermont Agency of Natural Resources (ANR) released the Climate Change Adaptation Framework which addresses climate change exposures, vulnerability-specific elements within each of the natural resource sectors, and ongoing and proposed actions that can be or have been taken to prepare for the expected changes. In line and in conjunction with the ANR report, the primary goal of a VTrans climate change adaptation policy is to minimize long-term societal and economic costs stemming from climate change impacts on transportation infrastructure.

Table 2-3: Caledonia County Temperature Ranges from 1960-2020



2.1.2 Profiled Hazards

Severe Winter Storm

Winter storm frequency and distribution varies from year to year depending on the climatological patterns. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches. Winter storms impact the entire planning area and can include snowstorms, cold, blizzard and ice. According to the *2018 Vermont State Hazard Mitigation Plan*:

> *"Severe winter storms bring the threat of heavy accumulations of snow, cold/wind chills, strong winds, and power outages that result in high rates of damage and even higher rates of expenditures. A heavy accumulation of snow, especially when accompanied by high winds, causes drifting snow and very low visibility. Sidewalks, streets, and highways can become*

extremely hazardous to pedestrians and motorists. Severe winter storms develop through the combination of multiple meteorological factors. In Vermont and the northeastern United States, these factors include the moisture content of the air, direction of airflow, collision of warm air masses coming up from the Gulf Coast, and cold air moving southward from the Arctic. Significant accumulations of ice can cause hazardous conditions for travel, weigh down trees and power lines, and cause power outages. Freezing rain can also be combined with snowfall, hiding ice accumulation, and further hindering travel, or with mixed precipitation and potentially ice jams or flooding."

The winters of 1969-72 produced record snowfalls for nearby St. Johnsbury, and greater than normal precipitation was recorded in 8 of the 11 years during 1969-79. According to the available history specific to the region, the max 24-hour snowfall occurred February 24-25, 1969 at 34'' with an additional 2.12'' of rain during the period. The winter of 2010-2011 was the third snowiest on record with a total of 124.3 inches for the county. The record for the county was 145.4 inches set in 1970-1971. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase in snow fall totals and cold temperature duration, the town realizes that further consideration is required. NOAA's National Centers for Environmental Information is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. NCEI has analyzed and assigned RSI values to over 500 storms going as far back as 1900. New storms are added operationally. As such, RSI puts the regional impacts of snowstorms into a century-scale historical perspective. The index is useful for the media, emergency managers, the public and others who wish to compare regional impacts between different snowstorms. The RSI and Societal Impacts Section allows one to see the regional RSI values for particular storms as well as the area and population of snowfall for those storms. The area and population are cumulative values above regional specific thresholds. For example, the thresholds for the Southeast are 2", 5", 10", and 15" of snowfall while the thresholds for the Northeast are 4", 10", 20", and 30" of snowfall. 2010, 2012 and 2015 have some of the highest rankings for notable storms. These rankings are based, in part on the severity of the storm using the following system. Since 2000, there has only been one event that reached a category 4 in the Northeast, five reached Category 3, eight were "significant" and all others were notable. Despite having considerably more snow than the U.S. average, Hardwick has had no major PA funding related to damage from snow events.

Table 2-4: NOAA's Regional Snowfall Index (RSI)

CATEGORY	RSI VALUE	DESCRIPTION
1	1–3	Notable
2	3–6	Significant
3	6–10	Major
4	10–18	Crippling
5	18.0+	Extreme

Specific snow totals for Hardwick were unavailable but county-based data provides an accurate portrait of the magnitude that the town can expect to experience in the future. The Town has seen

damage from declared snow disasters in the past, primarily dealing with debris removal from downed trees. The potential for even a robust highway department becoming overwhelmed to manage a major snowstorm without outside assistance exists every winter. In January of 2015, the area received 28'' of snow compared to only 11.3'' in 2014. The county experienced historic January snowfall totals in 1987 (47.5''), 1978 and 1979 (46.5'', 45.8''). Total average snowfall in December is 26.2'', January is 22.6'', February averages are slightly less at 16.9'' and March is 18.3''. February 14th-15th, 2007 saw the greatest 24-hour max snowfall total at 23.5''. The snowfall totals are annual averages based on weather data collected from 1981 to 2010 for the NOAA National Climatic Data Center. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches. The 2018 SHMP has the following information related to severe winter storms:

"There are no standard loss estimation models or methodologies for the winter storm hazards. Potential losses from winter storms are, in most cases, indirect and therefore difficult to quantify. According to the 2014 National Climate Assessment, there is an observable increase in severity of winter storm frequency and intensity since 1950. While the frequency of heavy snowstorms has increased over the past century, there has been an observed decline since 2000 and an overall decline in total seasonal snowfall."

Ice Storm

Major Ice Storms occurred in January in1998 and again in December of 2013 and 2014. The North American Ice Storm of 1998 was produced by a series of surface low pressure systems between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2'' in some areas. Hardwick received .5 to 1 inch of ice. The last ice storm event occurred in December 2014 and cost the Hardwick Electric Department approximately $45,000 for repairs. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out prior to 2013. The town expects to have another ice storm, but unlike rain and snow events, the occurrence of a major ice storm is not expected every year. In the records available to the town regarding power outage, the longest duration outage was in December of 2014 at 72 hours and affecting 90% of Hardwick residents.

Ice maps can be found at: www.wrh.noaa.gov/map/?wfo=sto

Extreme Cold

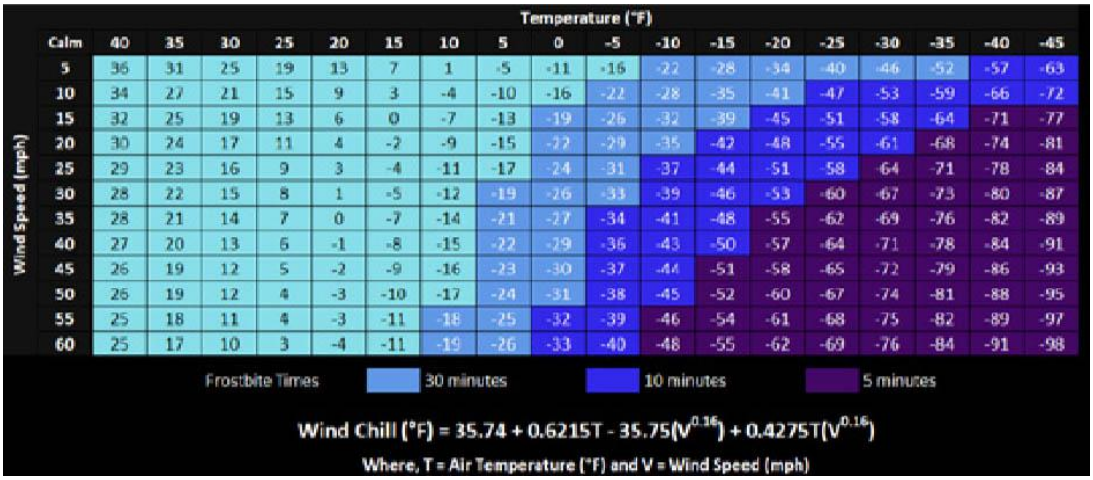
Recent extremes in cold temperatures are a concern. 2015 tied the coldest winter (January to March) on record (1923) for Vermont according to the NOAA's National Climatic Data Center whose dataset dates to 1895. Cold temperatures are expected in the Northeast, but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock

during extreme temperatures, especially cold extremes, is a real concern for Hardwick and the rest of the state. Hardwick's winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit and a max-low of -26 degrees Fahrenheit in February. However, January of 1970 had a mean temperature of 6.6 degrees Fahrenheit which is the coldest mean temperature for the county and January is the statistically coldest month in all of Vermont. Since 1900, January produced temperatures in the negative 20's and 30's consistently for Caledonia County with record cold temperatures occurring in 1914 (-38). Cold temperatures are expected in the Northeast, but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g., power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real concern for farmers in Hardwick and the rest of the state and while the temperatures for the town remain within averages seen in the last 85 years, the town expects dangerously cold temperatures every winter. The impact of extreme cold is summarized in the 2018 State Hazard Mitigation Plan:

"Extreme cold temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. burst pipes from ice expansion and power failure). What constitutes "extreme cold" can vary across different areas of the country based on what the population is accustomed to in their respective climates. Exposure to cold temperatures can cause frostbite or hypothermia and even lead to heart attacks during physically demanding outdoor activities like snow shoveling or winter hiking. When temperatures dip below freezing, incidents of icy conditions increase, which can lead to dangerous driving conditions and pedestrian-related slipping hazards. A large area of low pressure and cold air surrounding the poles, known as a polar vortex, is strengthened in the winter. When these polar vortex winds are distorted, due to cyclical strengthening and weakening or interaction with high-amplitude jet stream patterns, they have the potential to split into two or more patterns, allowing artic air to flow southward along a jet stream. As this arctic air is able to access more southerly regions, extreme cold conditions can be observed in Vermont, which also have the potential to remain over the region for extended periods"

Prior to the summer of 2021, the region had not seen the risk of drought conditions in decades but with wells running dry in other areas of the NEK, the town is aware of the potential for this. High temperatures can help to create severe storms as the one evidenced on September 11th, 2013, where record heat helped to produce damaging hail and winds in parts of the NEK and other areas of Vermont and New York. Recent extremes in cold temperatures is a concern and impact the entire planning area and region. 2015 tied the coldest winter (January to March) on record (1923) for Vermont according to the NOAA's National Climatic Data Center whose dataset dates to 1895. While the temperatures for the town remain within averages seen in the last 85 years, dangerously cold temperatures are expected every winter. The NOAA Wind Chill Chart identifies those temperatures and associated wind speeds that may cause frostbite if skin is exposed to the air over a certain period of time:

Table 2-7: NOAA Wind Chill Chart



In anticipation of extreme cold temperatures, the National Weather Service may issue the following watches, warnings, or advisories, which are aimed at informing the general public as well as the agricultural industry**:**

- Wind Chill Warning: Dangerously cold wind chill values are expected or occurring
- Wind Chill Watch: Dangerously cold wind chill values are possible
- Wind Chill Advisory: Seasonably cold wind chill values but not extremely cold values are expected or occurring
- Hard Freeze Warning: Temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants
- Freeze Warning: Temperatures are forecasted to go below 32°F for a long period of time, killing some types of commercial crops and residential plants
- Freeze Watch: Potential for significant, widespread freezing temperatures within the next 24-36 hours

Flooding

There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur because of ice jams in rivers adjoining developed towns and cities. While ice jam risk for the town is considered low, these events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area.

The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private and/or beaver dams. Rainstorms are the cause of most flooding in town. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and

erosion damage to property and infrastructure. The 2018 Vermont State All-Hazards Mitigation Plan discusses flooding extensively:

> *"Flooding is the most common recurring hazard event in Vermont. In recent years, flood intensity and severity appear to be increasing. Flood damages are associated with inundation flooding and fluvial erosion. Data indicate that greater than 75% of flood damages in Vermont, measured in dollars, are associated with fluvial erosion, not inundation. These events may result in widespread damage in major rivers' floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of both inundation flooding and fluvial erosion can be exacerbated by ice or debris dams, the failure of infrastructure (often as a result of undersized culverts), the failure of dams, continued encroachments in floodplains and river corridors, and the stream channelization required to protect those encroachments."*

Vermont experienced major floods long before Federal disaster assistance became available. But in November of 1927, Vermont experienced catastrophic flooding. In the month before the flood, rains more than 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 10 inches of rain falling over the course of a few days. The flood inundated parts of many towns and damaged or destroyed numerous bridges in the county. As the history of the flooding cited above bears out, the geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Numerous floods have resulted in Presidentially Declared Disasters and an influx of federal disaster assistance. Of these disasters, the 1973 flood inflicted the most widespread damage, and the residual rains of Hurricane Belle in 1976 resulted in the second highest amount of federal disaster assistance in Vermont.

Widespread, steady rainfall from frontal systems, tropical cyclones, or "northeasters" can result in flooding of large areas. Extensive and disastrous floods are rare but can result from intense spring rains combined with warm, humid winds that rapidly release water from the snowpack. Such was true for the devastating flood of March 11-12, 1936. During this flood, total rainfall and snowmelt ranged from 10 to 16 inches over the southeastern half of the State. Rainfall alone can cause disastrous flooding similar to that in November 1927. During that flood, rainfall totals of 5-9 inches were common, and much more occurred at higher altitudes. Intense rainfall caused extensive flooding on September 21, 1938, when the "great hurricane" reached landfall in the southern area of the State. Severe thundershowers more commonly cause localized street and cellar flooding.

In July of 2023 catastrophic flooding caused by a storm system that dropped between 6 to 9 inches of rain in many areas throughout the state resulted in widely spread damage in town. The storm, which initially struck New York before moving to New England, resulted in severe flooding that shut down major roads and highways and prompted hundreds of evacuations. Two major rivers, the Winooski and the Lamoille, surpassed water level records set during 2011's Hurricane Irene. An estimated 45 floodplain properties sustained damage and 7 were either completely totaled or substantially damaged. 16 properties were damaged outside of the floodplain. Five were either completely totaled or substantially damaged. The town saw significant damage to roadways and sewer systems and the Town Wastewater/Water Plant. Hazen Union Gymnasium, a designated emergency storm shelter, hosted nearly 50 people.

Sections of Routes 14, 15, and 16 were closed. The Inn by the River suffered significant damage. Jackson Bridge in Hardwick was severely damaged, as were sections of the recently completed Lamoille Valley Rail Trail. There were multiple 911 calls to assist with evacuations, stranded cars, and debris floating down the Lamoille River, which crested at record levels in the early morning hours of Tuesday. An excerpt from the Hardwick Gazette depicts the magnitude of damage and threat to personal health and safety:

"Some of the debris seen on the banks of the Lamoille from North Main Street all the way down through the lower part of the village stemmed from the Inn by the River, which all but fell into the river on Monday night. The owners and their guests all made it out of the motel safely before the bank eroded, taking the structure with it.

Hardwick Police Chief Michael Henry advised that residents were asked to evacuate from Granite, Cottage, and Wolcott Streets Monday evening as both the Cooper Brook and Lamoille River continued to rise from excessive rainfall. Molleur Drive in East Hardwick was also evacuated due to flooding from a small creek. An emergency shelter was opened at Hazen Union School Monday afternoon. Volunteers oversaw the shelter, which hosted 40 people overnight. By Tuesday evening, the shelter was able to close as services were restored. Routes 14 and 15 by the Jackson Dam re-opened Tuesday evening, allowing residents to access Morrisville. Route 15 to St. Johnsbury from the intersection with Route 16 became passable Tuesday morning. No one was injured or killed as a result of the destruction and members of the public were at the ready to assist their neighbors.

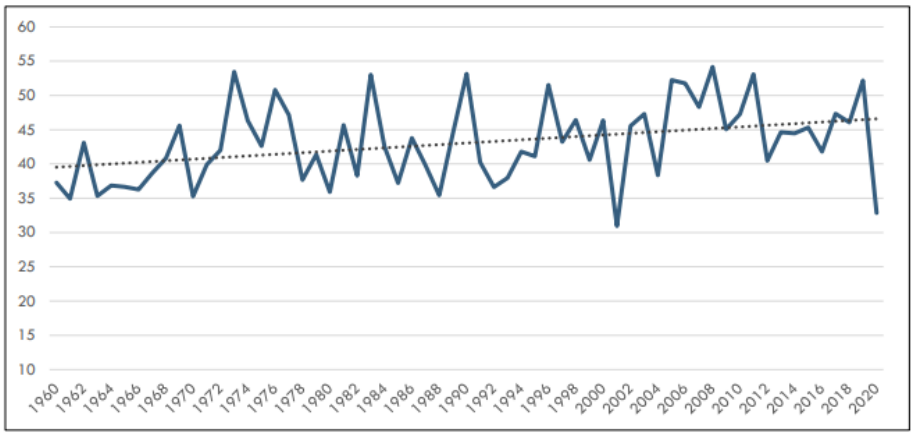
The National Weather Service reports that five to nearly eight inches of rain fell over our region between the time the storm started Sunday and ended Tuesday. Antecedent moisture existed in the form of torrential rainfall earlier in the week from thunderstorms on July 4, which triggered minor flash flooding in East Hardwick, Walden, and Stannard. Rainfall from repetitive thunderstorms in that event totaled half an inch to an inch and a half of rain by gauge report. One location in North Danville reported 1.3 inches of rain in 30 minutes. These storms were also accompanied by strong downbursts that knocked trees down and cut power to parts of East Hardwick."

Of all the road damage in Hardwick, the washout of Jackson Bridge just east of the intersection of Route 14 and 15 was the most significant. Major travel routes to and from town in all directions were cut off due to flooding. Approximately 75% of the town's back roads were affected. Emergency personnel conducted one water rescue operation on Wolcott Street and low-lying areas downtown near the river were evacuated, Town Manager David Upson said. Guests left the Inn by the River, a motel on the east side of town between Route 15 and the Lamoille, before half of the building washed away. The other half was teetering on the edge of the river bank.

Recent history, including the flooding events of 2011 and the records set in 2015 suggest that increases in total rain fall and severity are to be expected along the lines seen with the records set

across the state recently. There are three sources of historical precipitation data for Vermont. The data are reported at the county level: 1) recurrence time intervals for 24-hour rainfall storm depth, 2) annualized daily frequency of rainfall, and 3) rainfall-intensity frequencies. The first source of data is the recurrence time intervals for 24-hour rainfall storm depth. The recurrence depth data describes the expected intensity of major rainfall events with respect to both rainfall depth and frequency of occurrence.

Table 2-8: Caledonia County Precipitation Totals from 1960-2020



The second source of data is the annualized daily frequencies of rainfall, which were obtained from the National Climatic Data Center (NCDC), Climate Normals program. The data provides the average number of days per year with measurable precipitation (greater than 0.01 inches) on a county-by-county basis. This data allows for the conversion of the annual probabilities derived from the recurrence time intervals to daily probabilities. The annualized estimated daily frequency of measurable rainfall for Caledonia County is 174 days (highest in the state) with 119 days of rain and 55 days of snow. The final source of data is rainfall-intensity frequencies. Hourly precipitation totals throughout the state of Vermont were obtained from the NCDC's Cooperative Observer Program (COOP).

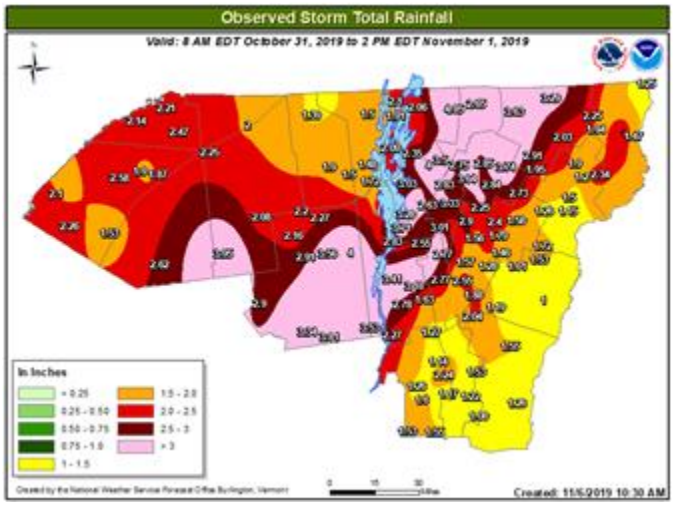
Tropical cyclones (storms) are officially ranked on one of five tropical cyclone scales, according to their maximum sustained winds and which tropical cyclone basin, they are located. Only a few scales of classifications are used officially by the meteorological agencies monitoring the tropical cyclones, but some alternative scales also exist, such as Accumulated Cyclone Energy, the Power Dissipation Index, the Integrated Kinetic Energy Index, and Hurricane Severity Index. Of most recent importance for Vermont was Tropical Storm Irene in 2011. Irene first struck the U.S. as a Category 1 hurricane in eastern North Carolina, and then moved northward along the Mid-Atlantic Coast. Wind damage in coastal North Carolina, Virginia, and Maryland was moderate, with considerable damage resulting from falling trees and power lines. Irene made its final landfall as a tropical storm in the New York City area and dropped torrential rainfall in the Northeast that caused widespread flooding. Irene resulted in the worst Vermont flooding in 83 years.

While not classified as a Tropical Storm, the April 2011 rain totals for the NEK reached nearly 7'' compared to the normal precipitation for the month at 3''. The heaviest rainfall event was

associated with thunderstorms during the late afternoon of April 26th into the early morning hours of April 27th, 2011. These storms resulted in record and near record rainfall and flooding across portions of northern Vermont. Specific records for the town of Hardwick regarding rainfall totals were not available.

The "Halloween" storm of 2019 (DR4474) proved to be the most damaging flood event for many areas of the County in recent memory. This powerful storm system tracked across the eastern Great Lakes late on October 31st, 2019, and produced an axis of 3 to 5 inches of rain, which caused significant flooding across the region. Record rainfall occurred at Burlington, Vermont with 3.30 inches on October 31st, along with a record high temperature of 71 degrees. In addition, very gusty southwest winds developed behind this potent storm, which generated scattered to widespread power outages. Surface wind gusts measured up to 65 mph across northern New York and parts of Vermont, with gusts over 100 mph at the summits. The heavy rainfall washed out numerous roads and culverts from Essex County, New York into parts of central and northern Vermont, while 10 rivers reached flood stage with 8 reaching moderate to major levels. A new record high level of 14.72 feet was attained at North Troy on the Missisquoi River. Extensive flooding was observed in the following river basins: Missisquoi, Lamoille, Winooski, and Ausable, while flash flooding with very sharp rises of smaller streams and rivers occurred across the higher terrain of the eastern Adirondacks into central and northern Green Mountains of Vermont, including the Champlain Valley. Observed total rainfall recordings were 5.26 inches in East Berkshire, 4.85 inches in Enosburg Falls, 4.80 in Fletcher, 4.32 Westford, and 4.0 inches in Elizabethtown, New York. Table 2-7 below shows the storm total precipitation from 31 October at 8 AM to 1 November 2019 at 2 PM.

Table 2-9: Observed storm total rainfall from 8 AM EDT on 31 October to 2 PM EDT on 1 November 2019



Inundation and Floodplains

Inundation-related flood loss is a significant component of flood disasters; the more common mode of damage is associated with the dynamic, and oftentimes catastrophic, physical adjustment of stream channel dimensions and location during storm events. These adjustments

are often due to bed and bank erosion, debris and ice jams, or structural failure of or flow diversion by man-made structures. A greater threat is erosional damage. The state of Vermont has been conducting geomorphic assessment to identify areas vulnerable to erosional damage.

A section of the Lamoille River flows through town, including the "village" area. Hardwick has received digital GIS FIRM data, allowing for greater analysis of flood risks. Flood risk information presented on FIRMs is based on historic, meteorological, hydrologic, and hydraulic data, as well as open-space conditions, flood control works, and development. To prepare FIRMs that illustrate the extent of flood hazard in a flood prone community, FEMA conducts engineering studies referred to as Flood Insurance Studies (FISs). Using information gathered in these studies, FEMA engineers and cartographers delineate Special Flood Hazard Areas (SFHAs) on FIRMs. SFHAs are those areas subject to inundation by a flood that has a 1-percent or greater chance of being equaled or exceeded during any given year. This type of flood is referred to as a base flood. A base flood has a 26-percent chance of occurring during a 30-year period, the length of many mortgages. The base flood is a regulatory standard used by Federal agencies, and most states, to administer floodplain management programs, and is also used by the National Flood Insurance Program as the basis for insurance requirements nationwide.
Of all types of natural hazards experienced in Vermont, flash flooding has historically resulted in the greatest magnitude of damage suffered by private property and public infrastructure. Most communities have undertaken significant mitigation measures in recent years. However, flash floods can strike at any time in areas that are not identified as typical flood hazard areas, and thus they continue to cause public and private damage.

Major roads and highways, Class One and Two, are governed and maintained by the Vermont Agency of Transportation, or VTRANS, and their highway district #7 covers the Town of Hardwick. Many of these Class Two roads experience flooding during flash floods, and as a result maintenance and repair of this infrastructure has been ongoing. VTrans staff have worked with the Town of Hardwick to adopt Local Codes and Standards as best practice. The standards require upgrades on new roads, culverts, and bridges to help withstand local flood related damages. Regarding flood inundation issues, the *2018 Vermont State Hazard Mitigation Plan* states:

"Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients, flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability. Urban flooding usually occurs when drainage systems are overwhelmed and damages homes and businesses. This flooding happens in all urban areas, but specifically in Burlington where the area is located at the bottom of a gradient, which adds to the intensity of this localized flooding…
…Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are

right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.

All of Vermont's major rivers have inhabited floodplains. While residents in mountain valleys are at risk, they may not be aware of the danger or may choose to ignore it. There are many reasons property owners are reluctant to relocate to less flood prone ground, not the least of which is the lack of personal experience of flooding. In addition, many communities originated beside rivers and streams, some of the most attractive property is located in vulnerable areas. Lakeshore property in Vermont is vulnerable to flooding from high water levels, either by surface water erosion or flooding. Occasionally, water-saturated ground and high-water tables cause flooding to basements and other low-lying areas. Lakeshore property is highly desirable and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property."

Fluvial Erosion

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the town's streams and rivers. This is a part of normal natural processes and, as such, is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges, and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *2018 Vermont State Hazard Mitigation Plan* contains the following discussion of fluvial erosion:

"In Vermont, most flood-related damage is due to fluvial erosion. Erosion occurs when the power of the flood (i.e. the depth and slope of the flow) exceeds the natural resistance of the river's bed and banks. Rivers that have been overly straightened or deepened may become highly erosive during floods, especially when the banks lack woody vegetation, or when the coarser river bed sediments have been removed. In areas where rivers are confined due to human activity and development, they have become steeper, straighter, and disconnected from their floodplains. The more trapped the river is, the greater power it will gain, which eventually results in a greater degree of damage to critical public infrastructure such as roads and stream crossings, as well as homes, businesses, community buildings and other man-made structures built near rivers. Fluvial erosion is also increased downstream when all the eroded materials (i.e., sediment and debris) come to rest in a lower gradient reach, clog the channel, and cause the river to flow outside its banks. When severe enough, fluvial erosion can also be the cause of Landslides (see Landslides). The land area that a river accesses to meander and overtop its banks to release flood energy without excessive erosion is known as the River Corridor. A river corridor includes the meander belt of a stream or river and a buffer of 50'. The River Corridor,

as defined in Vermont statute, is: the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in section 1422 of this title, and for minimization of fluvial erosion hazards, as delineated by the Agency of Natural Resources in accordance with river corridor protection procedures.

Vermont's River Corridor maps delineate river corridors for larger streams and rivers, and standard setbacks for smaller, upland streams. The setbacks were determined by factoring in the same stable stream slope requirements used when delineating a river corridor using a meander centerline setback. These maps are located on the Vermont FloodReady and Vermont Natural Resources Atlas websites."

The Vermont Agency of Transportation (VTrans) applies the term "scour critical" to stream crossing structures especially vulnerable to streambed scour—the undermining of bridge supports by water action and erosion. A spreadsheet database is maintained by VTrans and continually updated by the Bridge Inspection Program. Structures inspected are only those of 20 ft. or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not consider debris jams, outflanking, channel change, or other issues commonly associated with fluvial erosion. Water supply source and distribution systems are also endangered by fluvial erosion. Many water distribution systems involve buried pipes that cross streams, which are vulnerable to fluvial erosion. In December 2014, the Vermont Department of Environmental Conservation (DEC) released the "Flood Hazard Area and River Corridor Protection Procedures" guide, outlining specific actions and considerations. While fluvial erosion potential has not been addressed yet, new data is constantly becoming available, such as the recently released River Corridors Base Map by the Agency of Natural Resources. While exposure is limited by the length and character of the rivers within the town, the potential for significant property damage under unique circumstances is a concern. New FEMA floodplain and river corridor maps have been created and the town is anticipating their release to further support regulations that will serve to minimize or eliminate the impact of fluvial erosion. Extent data related to the fluvial erosion hazard for the town is unavailable.

Ice Jams

Ice jams, which can cause rapid and catastrophic flooding, are considered increasingly hazardous in parts of Vermont. In addition to the inundation damage they cause, ice jams can block infrastructure such as roads and culverts. The Town has experienced significant ice jams on the Lamoille River in the past. After substantial ice forms on the rivers, several days of unusual warmth coupled with rainfall can lead to ice breakup. The chunks of ice form jams which cause localized flooding on rivers. Ice jams are most prevalent during the January thaw (late January) as well as in March and April during the spring thaw on the Lamoille River. In 1994, with the engineering assistance from the US Army Engineer Research and Development Center of the Cold Regions Research and Engineering Laboratory (CRREL), the Town installed sloped granite ice control structures in the riverbed of the Lamoille River just east of the Village area to help retain ice floes in order to prevent ice jams and flooding further down the river. The structures have been very effective controlling ice upstream of the Village and adjacent to Route 15. The Town occasionally expends local tax dollars as a preventative effort to break up the ice jams on

the west side of the village. The Town experienced minor ice-related flooding along Wolcott Street in 2010 and in 2014. A list of historic ice jams, including municipalities and streams, is maintained by DEMHS and the Vermont Agency of Natural Resources (ANR). The US Army Corps of Engineers Cold Regions Research and Engineering Laboratory maintains a more specific database of ice jams, which includes over 903 events in Vermont with the latest occurring in 2013. Despite Hardwick not having any recorded events, nearby Passumpsic had 19 (10th highest in the state) and St. Johnsbury had 38 (5th highest in the state) with the Connecticut River being number one in the state with 84 recorded ice jams and the Passumpsic River with only one. *(Source: http://rsgisias.crrel.usace.army.mil/apex/f?p=524:39:10954063060296::NO::P39_STATE:VT)*

High Hazard Dams

The 2018 Vermont State Hazard Mitigation Plan states the following:

"While a rare occurrence, dam failure and resulting flooding can be devastating and threaten life and property downstream of dams. Dam failure can occur not only during large storms and high flows, but also during normal, sunny day conditions. While the depths and extents of flooding caused by dam failure are most severe during storms when reservoir elevations and rivers are at their highest, the public is generally conscience of flooding under these conditions. For this reason, it is often the sunny day failure scenario, that occurs with no warning, that is most dangerous. Dam failure is caused by the overtopping or structural failure of a dam resulting in a significant, rapid release of water, which can lead to flooding. Structural failure can be caused by many factors, such as internal soil erosion in earth embankment dams, sliding or overturning of concrete dams, gate failure, or caused by other means, such as deliberate sabotage. Dams are classified according to their potential for causing loss of life and property damage in the area downstream of the dam if it were to fail using the general classification system: High Hazard, Significant Hazard, and Low hazard. It is important to note that the hazard class is independent of the condition of a dam. Depending on the entity that regulates the dam, these definitions have minor but notable differences. In Vermont, dams are regulated by four distinct entities depending on the purpose and owner of the dam:

• Dams that are part of the production of power (i.e. hydropower) constructed before 1935 (with a few exceptions) are regulated by the State of Vermont Public Utility Commission (PUC). The PUC regulates approximately 25 dams, six of which are considered HIGH hazard and five of which are considered SIGNIFICANT hazard.
• Hydropower Dams constructed after 1935 (with a few exceptions) are regulated by the Federal Energy Regulatory Commission (FERC). FERC regulates approximately 80 dams, 18 of which are considered HIGH hazard and seven of which are considered SIGNFICANT hazard.
• Dams owned by the Federal Government (i.e. United States Army Corps of Engineers, USACE) are essentially self-regulated by that agency. Federal entities regulate approximately 5 HIGH hazard dams and one SIGNIFICANT Hazard dam.
• Non-federal, non-power dams are regulated by the Department of Environmental Conservation, (DEC). The DEC regulates approximately 41 HIGH Hazard Dams and 110 SIGNIFICANT hazard dams.

In 2018, the Vermont State Legislature passed a law updating the existing regulation of dams, Statute 10 V.S.A. Chapter 43 which applies to the DEC and PUC. The purpose of the law is to serve to protect public safety and provide for the public good through the inventory, inspection, and evaluation of dams in the State. The law aims to provide a definition for a dam, update and modernize the State's dam inventory and give the DEC rulemaking authority for items such as exemptions, registration, hazard classifications, EAPs, inspections and design standards. These rules will be developed over the next several years."

Following DR4720 (July 2023 Flooding Event), state inspectors fanned out to examine the conditions of more than 350 dams in Vermont. Inspectors found defects in at least 60 dams. Five of those dams were classified as "high" hazard, which means a "probable or certain" loss of life downstream in case of failure. Twenty-two were "significant" hazards — like the Hands Mill Dam in Washington, VT — meaning failure could cause "major or extensive" property loss. However, none of those 27 dams are "at risk of imminent failure." But at least three small dams failed completely during the flooding: the Hands Mill Dam in Washington, the Clark Sawmill Dam in Cabot, and the Lyons Dam in Peru, according to state officials. No injuries were reported, and it's not clear how much damage, if any, the failure of those dams caused downstream.

There have been no recent or historically relevant flooding events associated with the failure of any dam in Vermont. However, as stated in FEMA Guide P-956 "*Living with Dams: Know Your Risks*" (2013): "Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events." There are two hydro-electric dams in Hardwick.

The Mackville dam was completely rebuilt in 2000. This dam is located in the Southeast of Hardwick. HED is required to maintain safety checks, inform the public of inundation plans, and have an early warning system in place. Regular maintenance is ongoing to assure safety measures. Should a large flood event occur beyond the magnitude of the historical past of the region, the possibility exists for a major breach of a dam and severe inundation throughout the downstream areas. A well-situated, higher magnitude earthquake could also cause severe damage to dams. The Jackson dam is located on the Lamoille River on the southwest side of town downstream of downtown and the industrial park.

Extreme Heat

Extreme heat and prolonged periods of hot weather have direct and indirect effects on other hazards such as drought, wildfire, invasive species, and infectious disease. Vermont has a climate where extreme heat is less likely than other regions in the country. However, heat-related events do occur and are beginning to occur in much greater frequency. Extreme heat and prolonged periods of hot weather have direct and indirect effects on other hazards such as drought, wildfire, invasive species, and infectious disease. While climate change specific to extreme temperatures is considered a high risk, associated hazards are not, by default, included as high risk. Vermont has a climate where extreme heat may be less likely than other regions in the country, but observation of temperature increases in the state have resulted in some concern. Heat-related occur in much greater frequency. Extreme maximum temperatures are often observed during drought years, and in many cases, the records that are broken were long-standing and set during previous droughts. It should be noted that a heat wave could be either a

boon or a bane depending upon the time of year and the antecedent conditions. For example, the hot conditions of August 1996 followed a cool, wet summer, thereby providing an extra boost for plants. The 2018 Vermont State Hazard Mitigation Plan states the following:

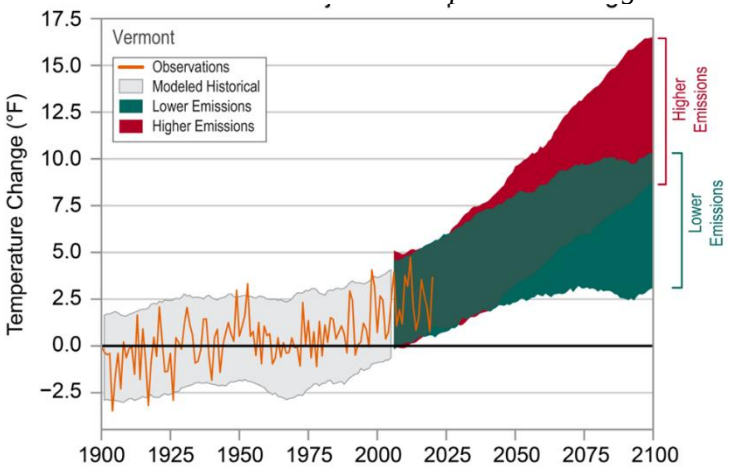
"Extreme hot temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. damage to asphalt roadways from softening). What constitutes "extreme heat" can vary across different areas of the world based on what the population is accustomed to in their respective climates. An example of this difference in acclimatization can be understood when comparing analyses of excess mortality due to heat: in New York City, the data show that the heat index threshold needs to reach at least 95°F to measure a significant rise in heat-related mortality, whereas the threshold in Montreal, Canada, only 400 miles north, is 91°F and did not need to factor in heat index. Similar epidemiological analyses completed by the Vermont Department of Health suggest that the heat threshold in which hospitals in the State see a rise in heat-related emergency room visits is 87°F . Temperature fluctuations are a result of several meteorological processes. Due to the tilt of Earth's axis, regions of the globe receive varying levels of solar radiation. The delta between these levels produces circulation patterns at the global level, which drive air and storm system movement via air masses. Air masses, as defined by NOAA, are thousands of feet thick and extend across large areas of the earth. Air masses that form over tropical ocean regions will become exceptionally hot and humid, while those masses above high latitude continents will become cool and dry. When these air masses meet, a front is created; fronts can either be cold or warm. In addition to these air mass and front-related impacts humans feel at ground level, movement of narrow bands of strong wind high in the atmosphere, known as jet streams, maneuver weather systems below and transfer heat and moisture across the globe. The speed and intensity of the jet stream will affect the duration and temperature associated with a cold or warm front. Extremely high temperatures can occur when a high-pressure system (under which air is descending toward the Earth's surface) develops and intensifies. Under such conditions, the potential for a heat wave exists. A heat wave is a period of three or more consecutive days during which the maximum temperature meets or exceeds 90°F."

In anticipation of extreme heat events, the National Weather Service (NWS) may issue the following advisories:

- *Excessive Heat Outlook: A period of excessive heat is possible within the next 3 to 5 days.*
- *Heat Advisory – Take Action: A period of excessive heat is expected. The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Heat Advisories are issued when heat indices are expected to reach at least 95°F.*
- *Excessive Heat Watch: A prolonged period of dangerous excessive heat is possible within about 48 hours.*
- *Excessive Heat Warning – Take Action: A prolonged period of dangerous excessive heat is expected within about 24 hours. The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Excessive Heat Warnings are issued when heat indices are expected to reach at least 105°F.*

The National Centers for Climate Information show that temperatures in Vermont have risen about 3°F since the beginning of the 20th century. While there are no data trends on the number of hot days (days with temperatures of 87°F or greater), the past 11 years (2010-2020) was the warmest period in history. Under a higher emissions pathway as shown below, we can expect unprecedented warming to continue through this century, while the intensity of extreme winter cold will drop as well.[1]

Table 2-7: Observed and Historical Temperature Change Scale



Source: NOAA National Centers for Environmental Information, State Climate Summaries 2022. https://statesummaries.ncics.org/chapter/vt

Unseasonal Heat

Higher spring and fall temperatures are leading to longer freeze-free seasons, as well as "backward" or "false" springs, where warming temperatures in the late winter or spring are followed by snow or freezing rain. These events are happening more frequently, and rapid thawing and refreezing are likely to damage roads. Early spikes in temperatures can also curtail maple production and disrupt the region's outdoor recreation sector.

March 8-9, 2000 is the only excessive heat event for Vermont on NOAA's records, impacting Windham and Bennington Counties. Temperatures climbed through the 60s to near 70°F on both afternoons. At the Albany International Airport, the high of 66°F on March 8 established a new record high, eclipsing the old record of 64°F set in 1942. On March 9, the temperature reached 68°F, replacing the old daily record high of 66°F set in 1977. March of 2012 set new records:

March 17, 2012: Winter of 2011-12 had temperatures that averaged 4-5°F above normal and snowfall 40-60% of normal. This combination accounted for snow pack across the region to be largely below normal or even non-existent by mid-March. In Vermont, temperatures climbed into the 70s on March 18 and low-80s.

March 19-22, 2012: Record heat was recorded across all of Vermont with maximum temperatures 30-40°F above normal and some daily records being broken by 10°F or more. This event caused an estimated reduction of 30% of maple sugar production, resulting in an estimated

[1] Runkle, J., K.E. Kunkel, S.M. Champion, L.-A. Dupigny-Giroux, and J. Spaccio, 2022: Vermont State Climate Summary 2022. NOAA Technical Report NESDIS 150-VT. NOAA/NESDIS, Silver Spring, MD, 4 pp.

impact of nearly $10 million. In addition, there was a significant loss of ski industry revenue due to a 25-50% reduction in snow loading.

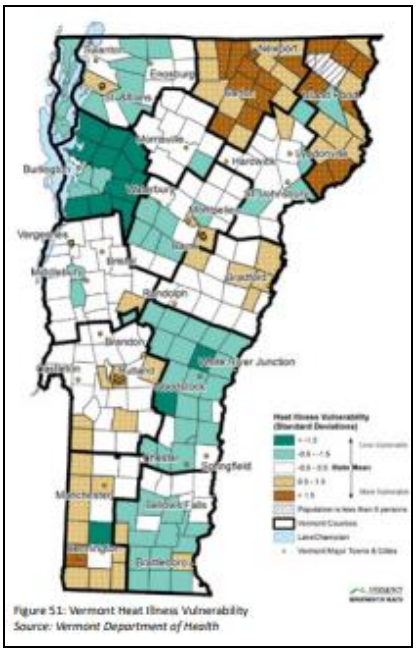
Dangerously High Summer Heat
Heat is most likely to pose the greatest risk to human health in July, which is typically the hottest month of the year. In July of 1911, there was a 12-day average of 90.75°F. The summer of 1949 was also very hot, with 25 days above 90°F. It is important to note here, however, that hot weather can have health impacts at even lower temperatures, with health risks increasing considerably when temperatures reach the mid-to-upper 80s). Between 2000 and 2017, the number of recorded days per year with a daily temperature high greater than or equal to 85°F peaked during the 2016 summer at 45 days, closely followed by the summer of 2015 at 41 days in Burlington. A heat wave across Vermont in late July 2022 resulted in seven consecutive days of temperatures above 80°F from July 20 through July 26. The maximum temperature reached 89°F on July 21 and July 24.

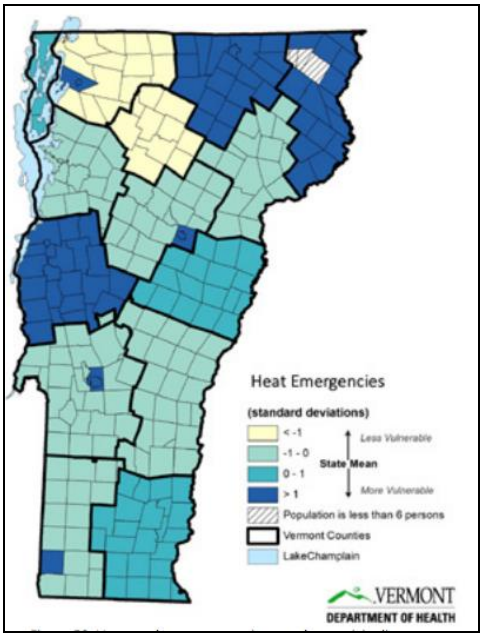
- *August 1-2, 2006: A heat ridge moved into Vermont during the early morning of August 1. Temperatures soared into the 90s but significantly more important were dewpoints that reached the middle to upper 70s to produce excessive heat index values of 100°F to 105°F, some of the highest values in nearly a decade.*

- *July 21, 2011: Temperatures across much of southern Vermont warmed into 90s with dew points in the 70s, combined with the hot temperatures and resulted in heat indices of 100°F to 104°F. This was the 2nd day of a 3 to 4-day heat wave across a large portion of Vermont with heat index values of 100°F to 108°F across the Champlain and Connecticut valleys as well as some interior valleys. One death is attributed to this event in Windsor County.*

The Heat Vulnerability in Vermont report suggests that Vermonters are at a greater risk for serious, heat-related illness – potentially even death – when the statewide average temperature reaches or exceeds 87°F. The Health Department's Climate & Health Program has reviewed six heat vulnerability themes (population demographics of a town or city, socioeconomic status, health status of residents, environmental characteristics, the ability of town residents to acclimate to hot temperatures and emergency room visits for heat illness) and determined a thematic vulnerability for each. In general, those at higher risk during hot weather include older adults and children, people with chronic medical conditions, people active outdoors, people without air conditioning, and people living in more urbanized parts of Vermont. The hot-weather vulnerability maps by theme and more information regarding the health impacts of increasing temperatures and prolonged periods of hot weather are available at the Department of Health's Climate & Health website: www. healthvermont.gov/environment/climate. The northeast portion of Vermont has the highest concentrated heat illness vulnerability and heat emergency ratings as seen in the maps below.

Table 2-8: Heat Vulnerability and Emergency Mapping





Source: https://www.healthvermont.gov/sites/default/files/documents/pdf/ENV-CH-hot-weather-planning-guidance.pdf

Vermont data indicate that Vermont residents experience heat-related illnesses at temperatures lower than in many other parts of the country. This is likely related to how infrequently hot weather occurs in Vermont, which has several impacts:

- We do not experience enough hot weather for people's bodies to adapt to hotter conditions.
- Many homes in Vermont are not adequately weatherized and do not have air conditioning.
- At a state and community level, we have not developed plans and policies needed to be prepared for hot weather.
- At an individual level, it can be hard to adapt behaviors to stay safe during hot weather, and Vermont has a large population of older adults, who are at more risk for heat-related illnesses.

The primary impact of extreme heat or prolonged periods of hot weather is to human life. Hot conditions, especially when combined with sun and high humidity, can limit the body's ability to thermoregulate properly. Prolonged exposure to hot conditions can lead to heat cramps, heat exhaustion, heat stroke, or exacerbate other pre-existing medical conditions. Some of these impacts require medical attention and can be fatal if left untreated. Heat kills more people in the US each year than any other type of weather event.

A new guidance report released by the Vermont Department of Health highlights the health risks from extreme heat. The report is informed by the 2021 heat wave in the Northwestern US and Western Canada, an area with a similar summer climate to Vermont. More than 1,400 people died during that event. Between 2009 and 2019, the Vermont Department of Health reports that there were an average of 104 heat-related emergency department (ED) visits per year and 12 total heat-related deaths across the state. Heat-related ED visits have trended up over that period

by more than 2 additional ED visits each year. 2018 was the deadliest year in recent record, with 173 heat-related ED visits and 5 heat-related deaths in total, including 90 ED visits and 4 deaths during a 6-day heat wave in early July. These numbers only include ED visits and deaths specifically attributed to heat in a hospital or death record. (Data at the County level is not available.). Heat-related illnesses mainly occur between May and September. It takes time for our bodies to adjust to warmer weather, so unseasonably hot days early in the year can be particularly harmful.

Table 2-8a: Heat Index with ED Visits

	May	June	July	August	September
Average daily high heat index* (°F), Burlington Airport	68°	75°	83°	81°	72°
Heat-related ED visits, statewide total, per month (2009-2019)	14	19	47	17	7

The risk for heat-related illnesses and deaths increases substantially when the heat index reaches 90°F or above in Burlington – which is equivalent to about 85°F in cooler places like Hardwick. All ED visits and deaths (related to any cause) increase as the heat index rises, as many chronic physical and mental health conditions are worsened by heat exposure.

Table 2-ba: Heat Index Magnitude and Frequency with ED Visits and Deaths

Max heat index (°F), Burlington Airport	Days per year*	Heat-related ED visits, per day*	Heat-related deaths, total*	All ED visits, per day*	All deaths, per day*
Less than 80°	97	0.2	2	742	12.9
80° - 89°	46	1	2	778	13.3
90° - 94°	6	3	2	789	14.1
95° or hotter	3	7	6	795	14.2

* Heat-related data are reported for May-September, 2009-2019. ED visits and deaths are statewide totals.

Vulnerable Populations

Although all Vermonters can be affected by hot weather, there are specific factors that can increase an individual's risk for experiencing heat-related health impacts. The risk for heat illnesses tends to be greater for the following groups of people:

People Living in Urban Areas: Only about one-third of Vermonters live in urban areas as defined by the US Census, but a disproportionate number of heat-related deaths from 2009-2019 (10 of 12) occurred in municipalities that are at least partially urban. Urban heat risk data collected by Health Department volunteers in 2020 were used to estimate that on a hot day, the heat index can be as much as 15°F hotter in the most urban locations in Vermont compared to largely undeveloped and wooded locations.

People Who are Unusually Sensitive to Heat Exposure: This category can include anyone not acclimated to hot weather, especially older adults and young children, pregnant women, people who are overweight or have a chronic medical condition, people using drugs, alcohol or some prescription medications, and people who experienced a prior heat illness. The most severe heat-

related impacts in Vermont have been experienced by older adults. Ten of the 12 people that died in Vermont from a heat-related cause between 2009 and 2019 were over the age of 50.

Additional vulnerabilities related to extreme heat

Vector-born disease

Data suggest that health impacts are also associated with prolonged hot weather and increasing average temperatures. For example, increases in the incidence of vector-borne diseases (e.g. Lyme, West Nile and Eastern Equine Encephalitis) in Vermont and New England at-large have been observed and are attributed to warming conditions. The increases in average annual temperatures and shortened winters have allowed mosquitos and ticks to become more active earlier in the spring and remain active later in the fall. Because the incidence of Lyme disease in Vermont is higher than the national average at present, lengthening vector seasons is of great concern to the health community in Vermont. People working in the outdoors – loggers and farmers, for example – are most vulnerable to vector-borne illness.

Cyanobacteria blooms: Hot weather can increase thermal stratification in water bodies, where shallow water layers are much warmer and do not readily mix with cooler, deeper water layers. Stratified water layers are most common in late summer and early fall, providing more favorable conditions for development of cyanobacteria blooms in Vermont's lakes and ponds. Some types of cyanobacteria can release natural toxins or poisons (called cyanotoxins) into the water, especially when they die and break down. Swimming or wading in water with cyanobacteria may cause minor skin rashes, sore throats, diarrhea, stomach problems, or occasionally more serious health problems. Children and pets are at higher risk of exposure because they are more likely to play near the shoreline and drink water while swimming.

Drought & Wildfire

As temperatures continue to rise, there is likely to be a heightened consideration for water supplies. Higher temperatures will lead to increased evapotranspiration, soil drying rate and the frequency of short-term droughts, limiting water availability for tree growth. With a changing forest complexion and greater levels of evapotranspiration, extreme heat and prolonged hot weather could also lead to an increase in the occurrence of wildfires in Vermont.

Forest impacts & invasive species

Native forests and ecosystems are projected to experience negative impacts of these warming trends, as well. Northern hardwood species like maple, yellow birch and American beech are anticipated to be nearly eliminated in the State, replaced by those tree species that thrive in warmer, drier conditions, like oak and pine. Additionally, the changing climate will allow for greater survival and reproduction of forest pest species, as trees that are stressed due to lower water availability reduce their ability to maintain sufficient defense mechanisms, and become more vulnerable to pest invasion and disease.

Planning Considerations:

Community cooling sites can be an essential resource for community members who do not have access to air-conditioning and need extra assistance to stay safe during hot weather. To be most

effective, cooling site **locations** should be identified and advertised before hot weather occurs. The Vermont Department of Health maintains a map of known cooling sites at healthvermont.gov/climate/heat. Here are the characteristics of an optimal cooling site:

Table 2-9: Cooling Site Options

Minimum recommendations	Encouraged amenities
Air-conditioned	Public transit or personal transportation assistance
Free entry	Activities available for guests
Convenient for community to access	Separate room for families and children
American Disabilities Act compliant	Access to wi-fi and power for personal devices
Access to restrooms	Food/snacks provided
Access to water	Provisions for pets
Electricity for medical equipment	Back-up generator available
Refrigeration for medications	Extended hours as needed
Seating available for all guests	On-site health and social services
Widely advertised throughout community	Law enforcement or other site safety officer

Experience has shown that individuals can be reluctant to leave their homes, even in the event of an emergency. Successful messaging about cooling sites in the event of an extended heat advisory will depend largely on communication with property managers of rental properties, visiting nurses, and other home service providers for at-risk populations.

Infectious Disease

Climate change, global travel, and population density can all influence infectious disease incidence and prevalence. Small communities do have some level of protection from some infectious disease but others, like Lyme disease can affect any community. The 2018 State Hazard Mitigation Plan states:

The Vermont Department of Health defines an infectious disease as one that is caused by micro-organisms, such as bacteria, viruses, and parasites. A vector-borne disease is an infectious disease that is transmitted to humans by blood-feeding arthropods, including ticks, mosquitoes and fleas, or in some cases by mammals (e.g. rabies).

Infectious Disease Trends & Vulnerability According to the Centers for Disease Control (CDC), the number of reported cases of vector-borne infectious disease has more than tripled between 2004 and 2016. Those infectious diseases that fall into the first threat classification category identified in Table 38 (i.e. currently present in Vermont and which may be exacerbated by climate change) are already exhibiting increased prevalence in New England. For example, with both temperature (see: Extreme Heat) and precipitation (see: Inundation Flooding & Fluvial Erosion) expected to increase in Vermont, West Nile Virus mosquito vector activity will likely increase, as well as the vector's period of activity. Similarly, between 1964 and 2010, counts of Eastern Equine Encephalitis (EEE) have continued to rise in New England, though they remain constant in the southeastern states. Perhaps the most significant trend in infectious disease vulnerability in Vermont is that of Lyme disease, where Vermont ranks second in highest rate of

disease incidence in the nation. The Vermont Department of Health reports that the number of reported cases of Lyme disease have increased dramatically over the last decade, and with shrinking winters, the potential for infection through tick bite continues to grow. Additionally, Vermont's increase in forest cover could provide a more suitable habitat for ticks and their hosts, which may lead to further spread of Lyme disease in the State. Outdoor laborers and recreationalists are especially vulnerable to Lyme disease, as exposure to ticks is greater. The southern and western halves of the State are more vulnerable to Lyme disease, as the warmer climate contributes to longer period of vector activity. Vermont is typically not vulnerable to diseases such as HIV/AIDS, SARS, cholera, malaria, and resistant tuberculosis, though they are considered to be major disasters in some parts of the world. However, an incident that caused water supplies to become contaminated or resulted in people eating spoiled food could have significant health implications. An animal infected with the rabies virus would be a localized threat. The potential for large-scale infection of Vermont's commercial animal population with foot and mouth disease, bovine spongiform encephalopathy (i.e. Mad Cow Disease), or any number of poultry viruses, while unlikely, could cause widespread economic problems. A health threat might also result from an act of bio-terrorism.

Pandemic planning in Vermont appears to ebb and flow. Following the H1N1 Virus Outbreak in 2009-2010, increased emphasis on pandemic planning was seen across the state. From 2010 to 2019 however, without another major U.S. event, emphasis on pandemic planning diminished. While Vermont, due to its rural nature, has some level of protection from national infection rates during a pandemic, the financial implications experienced during the COVID-19 pandemic in 2020 hit the state extremely hard.

COVID-19 was a new disease, caused by a virus not previously seen in humans. COVID-19 is highly contagious and people with COVID-19 who do not have any symptoms can spread the virus to other people. On March 13, 2020, President Trump declared a nationwide emergency pursuant to Sec. 501(b) of Stafford Act to avoid governors needing to request individual emergency declarations. All 50 states, the District of Columbia, and 4 territories were approved for major disaster declarations to assist with additional needs identified under the nationwide emergency declaration for COVID-19. Additionally, 32 tribes were working directly with FEMA under the emergency declaration. FEMA announced that federal emergency aid had been made available for the state of Vermont to supplement the state and local recovery efforts in the areas affected by the Coronavirus Disease 2019 (COVID-19) pandemic beginning on January 20, 2020 and continuing. Public Assistance federal funding was made available to the state and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency protective measures (Category B), including direct federal assistance under Public Assistance, for all areas in the state of Vermont affected by COVID-19 at a federal cost share of 75 percent.

In early 2020, there was a quick return to the tenets of effective pandemic planning. Preparing for hospital surge, high death rates and the medical equipment necessary for both patients and health care workers are examples of the state's early focus. Public information and guidance on safety, isolation, travel, and quarantine also became extremely important while mitigating the pervasive economic consequences of reducing work forces, sending students home, and closing businesses. Additionally, Vermont had to consider the implication of, and work to control, the

immigration of people from other states. Both infection risk and taxing of local resources were the main concerns associated with this real consequence of the pandemic.

While the Northeast Kingdom remained insulated from infection rates (and subsequent deaths) seen elsewhere in the state (e.g., Burlington), issues of border closure, implementing safety protocol and procedures and economic resilience were experienced in every community, including Hardwick. Despite having relatively low illness and death, the economic and operational consequences of pandemic are of concern to the town. Having the capacity to navigate the funding opportunities as result of the pandemic for the town and residents is a concern in addition to providing resources to residents to mitigate spread (e.g., testing and vaccination services) and assure continuity of operations for government and community-based organizations. *(https://www.healthvermont.gov/response/coronavirus-covid-19/current-activity-vermont#town*

The Vermont Food Venture Center was instrumental in ameliorating the underlying weakness in the regional food system uncovered by the pandemic -- when grocery shelves were bare. In 2021, the Center for an Agricultural Economy (the operator and owner of the Vermont Food Venture Center, which is located in the Hardwick industrial park) created the "Produce to Pantries" in partnership with the Hardwick Area Food Pantry (HAFP) sites in three towns: Hardwick, Craftsbury and Albany. After participating in phases 1 and 2 of the USDA Farmers to Families food box program in 2020, CAE was able to channel existing relationships and infrastructure to create a similar program that engaged small-scale, emerging, and local farms and pantry sites. The partnership drew on the CAE's relationships with farmers and supplemented a gap in staff and volunteer capacity at participating pantry sites.

Produce to Pantries has been a success on all levels - the quality of produce exceeds what is otherwise available to pantries, local farms are paid for their products and feel great about supporting their community, and pantry-goers enjoy knowing that these foods were grown by their neighbors. They also served 50,000 meals through the Everyone Eats program.[2]

The planned expansion to the neighboring property -- the Hardwick Yellow Barn business accelerator -- will increase the aggregation and distribution capacity by creating a new headquarters for their direct delivery service, Farm Connex. The project went millions of dollars over budget due to disruption of the global supply chain caused by the pandemic. It was originally slated for construction at the beginning of 2020 and is just commencing in 2023. A planned expansion of the Jeudevine Library also went significantly over budget due to COVID disruption. Both budgetary hurdles show unequivocally that the town experienced a significant economic setback from the pandemic.

SECTION 3: RISK ASSESSMENT

This section first explores and defines specific locations of known, historic risk within the town with a disaster and non-disaster expenditure summary. Following, a qualitative risk analysis is documented for each hazard category. The highest ranked hazards, coupled with historic data, therefore, substantiate the profiled hazards in this update.

[2] https://hardwickagriculture.org/about/case-studies/vermont-everyone-eats-two-million-meals-served

3.1 Designated Hazard Areas

3.1.1. Flood Hazard Areas

The Upper Lamoille is the only watershed in Caledonia County that flows west to Lake Champlain. The Lamoille headwaters are located in the town of Greensboro. The portion of Caledonia County in the Lamoille Watershed includes the town of Hardwick and parts of Wheelock, Stannard, and Walden. The Vermont Department of Environmental Conservation maintains the Lamoille River Tactical Basin Plan. The plan is an assessment of the health of the watershed and includes over 140 targeted actions and over 1000 individual related projects. Basin 7 contains a small portion of Orleans and Caledonia, including Hardwick and portions of Craftsbury, Greensboro, Wheelock, Stannard, and Walden. The basin includes the Lamoille River as well as its tributaries, though the main portion in the Northeast Kingdom is the Upper Lamoille. The main stressors in the Upper Lamoille include flow alteration, and land and channel erosion. Hardwick Lake and Caspian Lake have been affected by water level fluctuation. Haynesville Brook, Tucker Brook, and Stannard Brook have erosion issues due to flooding. Based on digitized FIRMs that are geo-referenced with E911 addresses for structures, there are 96 structures within in the 100-year Flood Hazard Area. The maps were last revised in 2002. Some structures that appear to be in the Flood Hazard Area are not, and conversely, there may be some that may well be in it but are not shown to be. The digitized maps are based on base flood elevations and since the actual first floor elevations for most structures are not known, the graphic representation is a reasonable estimate. High risk areas for flooding are: Wolcott Street, Granite Street, Cottage Street, Brook Street and all low-lying areas adjacent to Route 14 South. *Source: NFIP Insurance Report: Vermont*

Table 3.0: Hardwick Community Report Summary

96	Buildings in the Special Flood Hazard Area (SFHA) (estimated from e911 sites).
17	Flood Insurance Policies in SFHA (Zone A, AE, AO, A 1- 30)
18%	Percent of buildings in the SFHA with flood insurance in force.
2	Critical or public structures in SFHA or 0.2% flood hazard area (est. from e911 sites.)
7%	Percent of buildings in the SFHA.
06/15/1984	National Flood Insurance Program (NFIP) (Enrollment Date)
DFIRM	Flood Insurance Rate Map Standard (Digital FIRM (DFIRM), Rough Digital, Paper)
Hardwick	NFIP Status: Regular Program

3.1.2. Fluvial Erosion Hazard Areas (River Corridors)

About two-thirds of Vermont's flood-related losses occur outside of mapped floodplains, and this reveals the fundamental limitations of the FEMA FIRMs. A mapped floodplain makes the dangerous assumption that the river channel is static, that the river bends will never shift up or down valley, that the river channel will never move laterally, or that riverbeds will never scour down or build up. River channels are constantly undergoing some physical adjustment process. This might be gradual, resulting in gradual stream bank erosion or sediment deposit – or it might be sudden and dramatic, resulting in a stream bank collapse. The losses experienced during the May 2011 storms and Tropical Storm Irene were most often related to the latter, regionally. In fact, this type of flood-related damage occurs frequently in Vermont, due in part to the state's

mountainous terrain. Land near stream banks are particularly vulnerable to erosion damage by flash flooding, bank collapse, and stream channel dynamics. The Vermont Department of Environmental Conservation, Agency of Natural Resources, has identified river corridors, which consist of the minimum area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition. In other words, the river corridor provides "wiggle room" for a stream as its channel changes over time. Keeping development out of the river corridors therefore reduces vulnerability to erosion.

3.1.3. River Corridors

About two-thirds of Vermont's flood-related losses occur outside of mapped floodplains, and this reveals the fundamental limitations of the FEMA FIRMs: A mapped floodplain makes the dangerous assumption that the river channel is static, that the river bends will never shift up or down valley, that the river channel will never move laterally, or that riverbeds will never scour down or build up. In reality, river channels are constantly undergoing some physical adjustment process. This might be gradual, resulting in gradual stream bank erosion or sediment deposit – or it might be sudden and dramatic, resulting a stream bank collapse. The losses experienced during the May 2011 storms and Tropical Storm Irene were most often related to the latter. In fact, this type of flood-related damage occurs frequently in Vermont, due in part to the state's mountainous terrain. Land near stream banks are particularly vulnerable to erosion damage by flash flooding, bank collapse, and stream channel dynamics. The Vermont Department of Environmental Conservation, Agency of Natural Resources, has identified river corridors, which consist of the minimum area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition. In other words, the river corridor provides "wiggle room" for a stream as its channel changes over time. Keeping development out of the river corridors therefore reduces vulnerability to erosion. Statewide river corridors maps were released in 2015. These maps were developed using remote sensing data, such as valley widths, slope, land use and encompass all streams with a drainage area of two square miles or greater.

3.1.4 Repetitive Loss Properties

The town has seven properties in the FEMA/State of Vermont buy-out process. More may be added as assessments are underway during the development of this update. Another structure is being demolished and not rebuilt (by the private individual). In addition, there are four mobile homes that were substantially damaged as result of DR4720. These may be removed or bought out, options are being explored. This information comes from the town Zoning and Floodplain Administrator. FEMA is not currently providing the NFIP repetitive loss and severe repetitive loss data for LHMPs due to Personally Identifiable Information (PII) concerns.

3.2 Non-designated Hazard Areas

Ice Storm Damage

High winds, large snowstorms, heavy rains, and thick ice storms are common in Hardwick. With high elevations and residents living in remote areas, this could be a very serious problem. Power outages do occur but are not frequent. While ice storms can be expected annually, a large ice storm event such as the January 1998 storm that wreaked havoc on northern New England and

Quebec, Canada is infrequent. This type of storm forms when the lower levels of the atmosphere and the ground are at or below freezing, but rain is falling through warmer air aloft. The water freezes at the lower levels on trees, power lines and roads leading to and causing power outages and disruptions in everyday life. More common are the light events of freezing rain or mixed precipitation. Local town road crews are very efficient with sand and salt when weather warnings trigger extra attention to roads. Ice and snow events have caused damage in Hardwick, but generally damage has been less than experienced elsewhere in the State. The last ice storm event occurred in December 2014 and cost the Hardwick Electric Department approximately $45,000 for repairs. *1998 data: https://www.fema.gov/disaster/1201*

High Winds and Lightning

Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. High tension lines near tree stands are at increased risk of damage and the Vermont Agency of Transportation, HED and the town work to keep limbs trimmed. As with many Vermont communities characterized by natural terrain, the issue power loss and property damage from downed trees is more common than in urban areas. Historically, these instances are short term and have not posed a serious risk for the town or its residents.

3.3 Previous FEMA-Declared Natural Disasters and Non-Declared Disasters

While the Town of Hardwick has had a history of flooding, losses to public infrastructure have intensified in recent years. Disasters in 1999, 2007 and 2015 caused significant damage throughout the town. The July 2023 flood not only hit Hardwick very hard in relation to other areas of the county and state but has taken its place as what may be the worst in town history. From the wastewater system to multiple roads, culverts, homes, the Hardwick Bridge, a town vehicle, and the recently completed Lamoille Valley Rail Trail, the complete damage portrait and associated costs will become clearer as time moves forward. Hardwick has received public assistance funding from FEMA for the following natural disasters:

Table 3-1: Town of Hardwick, FEMA-declared disasters, and snow emergencies, 1999-Current:

DR	Date	Type
1307	11/10/1999	Severe Storms
1559	09/23/2004	Severe Storms
1698	05/04/2007	Severe Storms
1715	08/03/2007	Severe Storms
4022	09/01/2011	Trop. Storm
4163	01/29/2014	Severe Winter Storm
4207	02/03/2015	Severe Winter Storm
4330	08/16/2017	Severe Storms
4720	07/14/2023	Severe Storms

Non-declared disasters (e.g., snow and rainstorms) have not resulted in damage above and beyond normal maintenance. Extreme, long-lasting cold temperatures during winter months do pose a concern for the town as in many communities where the price of heating fuel often exceeds residents' ability to pay. Coupled with high unemployment, there is an increased risk for the town's residents to not meet the financial requirements for adequate heat, especially during long periods of extremely cold temperatures. Without adequate provisions, 48 hours of extremely cold temperatures could create a serious health hazard.

Non-Declared Disaster Summary:

As with any municipality, maintaining transportation routes through road, bridge and culvert repair and replacement is ongoing and requires fiscal, environmental, communication and engineering planning to be successful. The work accomplished in Hardwick since 2017 that was not directly related to a declared disaster has supplemented the work accomplished in direct response to disaster-related damage to town roads and bridges. The cumulative effect of this work has served to enhance overall resilience to future events while assuring to the best degree possible, consistent use of transportation infrastructure in the face of severe weather precluding a level of disaster declaration.

3.4 Hazard Assessment and Risk Analysis

Although estimating the risk of future events is far from an exact science, the Planning Team used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis, which was subsequently reviewed and revised by town officials in 2023. This analysis assigns numerical values to a hazard's affected area, expected consequences, and probability and supports the inclusion of all profiled hazards in this plan. This quantification allows direct comparison of very different kinds of hazards and their effect on the town and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. The following scoring system was used in this assessment:

Area Impacted: scored from 0-4, rates how much of the municipality's developed area would be impacted.

Consequences: consists of the sum of estimated damages or severity for four items, each of which are scored on a scale of 0-3:

- Health and Safety Consequences
- Property Damage
- Environmental Damage
- Economic Disruption

Probability of Occurrence: (scored 1-5) estimates an anticipated frequency of occurrence based on prior experience and current information.

To arrive at the Overall Risk Value, the sum of the Area and Consequence ratings was multiplied by the Probability rating. The highest possible risk score is 80.

3.3.1. Natural Hazards and Hazardous Material Incident

According to the updated Hazard and Risk Estimation for Hardwick, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter Storm (32)

- Flooding (56)
- Extreme Cold (24)
- Fluvial Erosion (20)
- Infectious Disease (20)
- Ice Storm (16)
- Extreme heat (16)

Table 3-2: Natural hazards risk estimation matrix

Hardwick Hazard & Risk Analysis: NATURAL HAZARDS	Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Extreme Heat	Infectious Disease	Wildfire	Winter Storm	Ice Storm	Extreme Cold	Earthquake	Invasive Species	Hail
Area Impacted														
Key: 0 = No developed area impacted														
1 = Less than 25% of developed area impacted														
2 = Less than 50% of developed area impacted														
3 = Less than 75% of developed area impacted														
4 = Over 75% of developed area impacted	1	3	1	1	1	1	4	1	3	3	2	1	1	1
Consequences														
Health & Safety Consequences														
Key: 0 = No health and safety impact														
1 = Few injuries or illnesses														
2 = Few fatalities or illnesses														
3 = Numerous fatalities	1	1	1	0	1	1	2	1	1	1	1	1	0	1
Property Damage														
Key: 0 = No property damage														
1 = Few properties destroyed or damaged														
2 = Few destroyed but many damaged														
3 = Few damaged but many destroyed														
4 = Many properties destroyed and damaged	1	4	1	1	2	0	0	1	1	1	1	1	0	1
Environmental Damage														
Key: 0 = Little or no environmental damage														
1 = Resources damaged with short-term recovery														
2 = Resources damaged with long-term recovery														
3 = Resource damaged beyond recovery	2	3	1	1	1	1	0	2	1	2	1	1	1	0
Economic Disruption														
Key: 0 = No economic impact														
1 = Low direct and/or indirect costs														
2 = High direct and low indirect costs														
2 = Low direct and high indirect costs														
3 = High direct and high indirect costs	2	3	1	2	1	1	3	1	2	3	1	1	1	1
Sum of Area & Consequence Scores	7	14	5	5	6	4	9	6	8	8	6	5	3	4
Probability of Occurrence														
Key: 1 = Unknown but rare occurrence														
2 = Unknown but anticipate an occurrence														
3 = 100 years or less occurrence														
4 = 25 years or less occurrence														
5 = Once a year or more occurrence	2	4	2	4	1	4	2	1	4	2	4	1	1	2
TOTAL RISK RATING														
Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence	**14**	**56**	**10**	**20**	**6**	**16**	**18**	**6**	**32**	**16**	**24**	**5**	**3**	**8**

3.5 Hazard Summary

According to the risk estimation analysis, the highest rated hazards for Hardwick are:

1. Flooding/fluvial erosion
2. Severe Winter/Ice Storm
3. Extreme Temperatures (cold/heat)
4. Infectious Disease

Flood-related disasters have had the greatest financial impact on the town. While no deaths or injuries have been recorded for declared or non-declared disasters, the potential for health and safety risk during a severe winter storm are considered higher than that posed by a flooding event. Lighting and high winds further the risk for power loss and while high winds can occur any time of year (and normally occur in unison with rain or snow events). The town is vulnerable to power loss and in colder months, this could place the residents of the town in harm's way. While the history of major power loss over extended periods of time is minimal, there have been repetitive short-term outages. This duration poses a health and safety risk to residents as well as limiting response capabilities of town staff. With the recent severity of cold temperatures lasting for longer durations, accessibility of heating fuel is a concern and this accessibility is defined by transportation issues resulting from a major storm where roads are impassable and from resident's ability to pay for the fuel. As with many disaster scenarios, many hazards categories are related to one another. Natural hazards can cause a technological problem which can then cause a societal problem. In mitigating a natural hazard, there is the potential for a cascade of protection for both the technological and societal considerations the town has defined as concerns.

SECTION 4: VULNERABILITY ASSESSMENT

Vulnerability refers to the potential impact of a specific loss related to an identified risk. Hardwick is a small town with very few buildings aside from residential. While the loss of any one facility would cause a disruption in town services and operations, the overall vulnerability is low. There are roads, bridges, and culverts vulnerable to flooding and those are identified below. Loss of equipment function for the highway department is a vulnerability for the town but the risk is not due or predicted to be a result of a disaster, merely, the required maintenance expected of highway-related machinery. For this section of the plan, the planning team looked at prior history and worst-case scenarios. The primary vulnerability for the town is transportation-related infrastructure.

Of the profiled hazards, the following vulnerability rating (high, moderate, low) is given below. This vulnerability rating is based on the disaster case history for the town and when the greatest financial impact was seen due to the disaster. A "high" vulnerability reflects substantial case history ($\geq$2 in last five years) of events with an economic impact requiring action. A "moderate" vulnerability reflects limited case history ($\leq$2 in last five years) of an event with and economic impact requiring action. A "low" vulnerability reflects little to no case history in the last five years. The specific vulnerability to the population as a whole or any specific sub-population

(e.g., older adults) is subjective because there is no historical data to rank vulnerability to health and safety of Hardwick residents, workers, or travelers.

Vulnerability Narrative for Profiled Hazards:

Severe winter/ice storm: Moderate
Summary: While snow and ice events are distinct hazards, the likelihood of these two hazards occurring at a level of concern is considered equal. While a major ice event can have catastrophic consequences for the entire planning area, these events are rare. While all structures are vulnerable to major snow loads, there is little evidence to support concern over structure failure due to snow loads on roofs, ice on gutters, etc. Town snow removal equipment is vulnerable to damage with greater use, especially during emergency situations as well as road damage from plowing. Populations caught outdoors, commuting, or working outside during a serve winter storm are more vulnerable to cold-related injury and/or snow related accidents but winter comes every year and residents, and the town are accustomed to making intelligent decisions regarding safety and protection of infrastructure. Special populations (e.g., aging, disabled, etc.) are more vulnerable in terms of mitigating structure loads, hazardous travel and relocating to safety.

Extreme Heat and Cold: Moderate
Summary: Recent evidence shows that greater extremes in temperature and overall weather fluctuation are occurring with increased frequency. A long-duration cold snap can cause significant damage to structures due to bursting pipes and the residential health and safety considerations include factors related to financial resources, fuel supply, sheltering, provisions and employment. Extreme heat is a risk for the town because of the health and environmental variables associated with this growing threat.

Infectious Disease: Moderate
Summary: Not only is the COVID-19 current during the drafting of this plan but it will likely remain active for some time to come. While Vermont has remained relatively insulated from the worst-case scenarios already seen in other states in regard to infection rates and deaths, there have been significant financial impacts for the region and state. There are several important considerations for the town and villages to consider. Issues such as large scale tax revenue reductions from failure to pay to how a major storm event could compromise pandemic response (e.g., sheltering operations and resource allocation) need to be examined.

Flooding (including fluvial erosion/dam breech/inundation): High
Summary: Flooding is the most common recurring hazard event in the state of Vermont. There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash floodingand urban flooding. Flooding has also been known to occur as a result of ice jams in rivers
adjoining developed towns and cities. These events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of

infrastructure (especially culverts), private and/or beaver dams. Rainstorms are the cause of most flooding in Hardwick. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and erosion damage to property and infrastructure.

Previous experiences have proven to the town that flooding is the greatest risk and another flood event is probable. With this conviction, the need to complete viable mitigation actions to town infrastructure becomes incredibly important and the town remains aware of this. The estimated Capacity-Disruption Levels Given a Measured Rainfall Event can be interpreted as the conditional probability that a particular roadway capacity disruption occurs, given that a rainfall event occurs. For Caledonia County, the probability that the intensity of a rain event will result in approximately a 2%, 7.5%, or 13.5% roadway capacity reduction are 28.2%, 69.2%, or 2.6%, respectively *(Source: A Risk-Based Flood-Planning Strategy for Vermont's Roadway Network, 2015).*

4.1 Infrastructure

The Center for Disaster Management and Humanitarian Assistance defines critical facilities as: "Those structures critical to the operation of a community and the key installations of the economic sector." As mentioned in the summaries above, some critical facilities have increased vulnerability during specific hazard events. Hardwick has three critical facilities in the Special Flood Hazard Area – the Fire Station, the Wastewater Treatment Facility and the HED maintenance garage. The town should consider a full range of options to mitigate risk to these structures in the future in order to ensure continuity of services during a disaster. Potential mitigation measures should include either relocation of the facility or its elevation/flood-proofing to the 500-year flood level (this is the elevation for a flood event that has a 0.2% annual chance of flooding).

Flooding is the highest risk profiled hazard and town infrastructure has high vulnerability to damage during major flood events. According to the Grand List, the Town of Hardwick owns 33 properties totaling 153.96 acres. These include 0.40 acre for the Memorial Building, 14.00 acres for the wastewater treatment facility, 70.5 acres on Buffalo Mountain Road and 36.5 acres on Hopkins Hill Road. In addition to the Town-owned lands, the Hardwick School District owns 13.1 acres associated with the elementary school and the Hazen Union School District owns 96.7 acres with the high school. Hardwick Electric also owns 7 properties totaling 380.3 acres, most of this associated with 320 acres on Billings Road. The East Hardwick Fire District owns 94.38 acres. Town assets include:

1. Memorial Building is a combination of town offices, vault, and town hall. It is currently valued at $422,700 and the land is valued at $36,000.
2. The current Fire Station (mentioned above under discussion) is evaluated at $329,000 and land valued at $57,500.
3. The town garage on Creamery Rd is valued at $223,600 collectively. The land is valued at $32,500.

4. The Wastewater Treatment Facility is valued at $247,900. The land is valued at $110,700.
5. The Police Station on High Street is valued at $373,400. The land is valued at $57,500.

The information presented below summarizes town infrastructure and high vulnerability areas.

4.2.1 Town Highways

Vermont's local roads are classified according to their importance and general use. This classification system applies to all town highways and is used to determine the amount of state highway assistance provided to each community. Class 1 roads are those highways that while the responsibility of the town to maintain, are extensions of the state highway system and carry a state highway route number. Hardwick has 1.5 miles of class 1 roads including portions of Routes 14 and 15 that ran through the former village. Class 2 roads are the most important highways serving as corridors between towns, and consequently carry a large volume of local and regional traffic. Center Road, East Main Street (Greensboro Bend), Hardwick Street/East Church Street, and Belfry Road are Class 2 roads (see Table 7). Class 3 roads are comprised of secondary town highways that are passable year-round by standard vehicles. Class 4 roads are dirt roads typically functional for only part of the year for normal traffic. The following table illustrates town highway mileages in Hardwick and surrounding communities.

Table 4-2 Town highway mileage by class

Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Interstate	Total 1, 2, 3, State Hwy
1.5	11.3	52.5	5.7	16.1	0	0	81.4

Source: data derived from VTrans TransRDS GIS data –Municipal Plan 2019

4.2.2 Bridges, Culverts, and Dams

Bridges

There are 26 bridges on town highways in the VTCulverts database and while this resource rates condition, the impact of DR 4720 (July 2023 Flooding) may alter condition ratings and therefore are not included in this update.

Culverts

The combination of roads, steep slopes, and running water not only constitute areas of higher road erosion risk, it also often marks areas where the Town of Hardwick has installed and maintains culverts and bridges. VTCulverts.org shows that Hardwick has 478 culverts and, while this resource rates importance and status of these culverts, the impact of DR 4720 (July 2023 Flooding) is likely to alter condition ratings and therefore are not included in this update.

Dams

There are two dams located in the Town. The Mackville dam is located on Nichols Brook on the southeast side of town and was rebuilt in 2004. The Jackson dam is located on the Lamoille River on the southwest side of town downstream of downtown and the industrial park. Neither of these dams provide electrical generation. There is no electrical generation in the Town of Hardwick aside from solar voltaic panels and wind generators.

4.2.3 Water and Wastewater

The Hardwick Community Water Supply system has two wells that supply all of the water used by the village of Hardwick. The municipal wells are located near the Hardwick Industrial Park adjacent to Wolcott Street. The East Hardwick Fire District #1 supplies water to the village of East Hardwick from springs located on Ward Hill to the south. The Town has well head protection areas and plans for providing water in case of a shortage due to unexpected circumstances. Private wells are not permitted within the water distribution area of the Urban Compact. The water system was not compromised during the July floods of 2023 and maintained full operational function through the event and after.

The Urban Compact of the Village of Hardwick, now the Town of Hardwick, is served by a tertiary wastewater treatment facility built in 1978. The facility has been upgraded three times since its initial construction to increase capacity and to provide a higher level of wastewater treatment. Private septic tanks and leach fields are allowed outside of the collection area of the Hardwick Urban Compact. The Hardwick Wastewater Plant serves 583 customers, covering the same area as the water lines. The Hardwick Sewer Department, like the Water Department, is funded entirely by user fees and receives no money from the Town General Fund. The wastewater treatment facility is an aerated lagoon system built in 1980. It has a rated capacity of 371,000 gallons of domestic sewage per day. The Wastewater Plant suffered a major blow during the July 2023 floods. The Buffalo Street and Route 14S lift stations were flooded out and compromised Outside of the village service area; all sewage is treated via individual, on-site septic systems. Permitting and enforcement of these systems is the responsibility of the State Department of Environmental Conservation Regional Office in St. Johnsbury.

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

The Town of Hardwick owns its own power company, the Hardwick Electric Department, which provides power to 5 communities in 3 different counties. It serves 90% of Hardwick with the remaining 10% served by Washington Electric. There are two cell towers located in Hardwick, one on Hopkins Hill and one located on Bridgman Hill.

4.3 Estimating Potential Losses in Designated Hazard Areas

Most properties in Hardwick that received repetitive damage are out of the 100-year floodplain. Although the FIRM maps have been recently updated, they are not compatible with the GIS maps containing contours, rivers, roads and structures and it is not possible to accurately estimate the amount of potential loss at this time. Given the frequency of flooding in Hardwick, it is recommended that the base flood elevations for the NFIP maps be confirmed and that 1’ contour maps for the Village area be obtained that are geo-referenced to Vermont Geographic Information System standards based on orthophoto mapping. Accurate FIRMS combined with the contour maps will make it possible to specifically identify what are structures and areas will be impacted by flooding. If one percent (1%) of all properties in Hardwick were damaged, the value would be assessed at $1,865,826 based on the equalized Grand List. If all structures in the Flood Hazard Area were inundated and averaged $50,000 of damage per structure, the estimated damage total is $3,900,000. During the 2018 fiscal year, the Town allocated $807,944 for maintaining the Town highways and garage. In addition to the operation funds identified above,

the Town of Hardwick set aside $291,375 of funding for equipment purchases and specific highways projects. With an average allocation of $12,373 per mile of road in FY18-19, the town can use this to estimate the extent of financial risk resulting from DR4720. That information is forthcoming. While the allocation of funds may not change, total expenditure (including grant-funded projects) will help define and plan for worst case situations related to damage and financial impact.

Table 4-5: Town of Hardwick Hazard Risk and Vulnerability Summary

Hazard	Vulnerability	Extent (Storm Data from most severe event)	Impact (economic/health and safety consequence)	Probability
Flood	Culverts, bridges, road infrastructure. There are 96 structures within the 100-year Flood Hazard Area. 77 mobile homes w/out land, 130 with land, 3critical or public infrastructure in SFHA/.2% FHA	In July of 2023, a foot of rain fell in nearby Montpelier and Rutland. This is the most rain in any month on record. The greatest 24-hour rainfall record for immediate region occurred in late August 2011 at 4.01''. The greatest level of precipitation in any month occurred in August 2011 at 11.12'' No detailed data was available for fluvial erosion damage in town in terms of numbers of acres lost during each event.	DR4720 will likely result in the greatest financial cost to the town. With the magnitude of infrastructure damage, including the wastewater plant, recovery will be costly. Prior to 2023, DR 1715 (8/2007) resulted in greatest financial impact and damage to roads and bridges with nearly $80,000 in FEMA funding for 6 projects.	High
Fluvial Erosion	Roads and property adjacent to streams/rivers	Road scouring results from drainage issues. Erosion occurs at shoreline.	No current data on erosion	Moderate

Extreme Cold/ Snow/Ice Storm	The entire planning area 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. The winter of 2010-2011 was the third snowiest on record with a total of 124.3 inches for the county. The record for the county was 145.4 inches set in 1970-1971.	For roof collapse: monetary damages will depend on each structure but, collapse of barn roof is often a total loss. This does not include the loss of livestock. The collapse of a house roof may be at a 50% loss. For car crashes due to poor driving conditions: minimal damage to vehicle to totaled vehicle and operator injury. Health impacts could vary significantly. Loss of energy or communication capabilities may occur and impede recovery. DR 4207 resulted in $85,000 in FEMA funding to the electric plant with 2 projects.	High
Infectious Disease	The entire planning area is vulnerable in both health and financial stability	COVID-19 has far-exceeded severity of 2009-2010 HINI Pandemic	2020 COVID-19 has resulted in the greatest infectious disease-related financial consequence for the planning area in history	High
Extreme heat/drought	The entire planning area is vulnerable in both human and environmental health and financial stability	The northeast portion of Vermont, has the highest concentrated heat illness vulnerability and heat emergency ratings	Between 2000 and 2017, the number of recorded days per year with a daily temperature high greater than or equal to 85°F peaked during the 2016 summer at 45 days, closely followed by the summer of 2015 at 41 days in Burlington. A heat wave across Vermont in late July 2022 resulted in seven consecutive days of temperatures above 80°F in Hardwick from July 20 through July 26. Maximum temperature reached 89°F on July 21and July 24 of 2022.	High

SECTION 5: MITIGATION STRATEGIES

The greatest advancement in mitigation planning the town has achieved is from the direct experiences in responding to, and recovering from, the major disasters that have impacted the town in the last decade. These disasters have, to a large extent, redefined how the entire state views and approaches mitigation. The work of state agencies, including those devoted to transportation, planning and emergency management, have also changed the way towns go about their day-to-day operations and planning, both in emergency situations and out. Specifically, and of considerable importance is the VTrans Municipal Grants In Aid Program. This program provides technical support and grant funding to promote the use of erosion control and maintenance techniques that save money while ensuring best management practices are completed in accordance with the Vermont Department of Environmental Conservation's Municipal Roads General Permit (MRGP.). This plan update allows for a continuation of the systematic documentation of mitigation efforts in the next planning cycle. A planning period that will likely redefine what flood mitigation looks like for the town of Hardwick. The magnitude of the July 2023 flood event has stressed the importance of hazard mitigation more than ever and the town is dedicated to doing its very best in preventing damage caused by the hazards profiled in this update.

5.0 Land Use and Development Trends Related to Mitigation

Hardwick has grown minimally since 2017. The town and village have zoning regulations in place to guard against future development in inappropriate locations such as flood prone areas. Due to the increasing commercial activity on Route 15, and the fact that there are frequent problems due to flooding and traffic accidents, Hardwick has taken action to develop traffic calming in this area. All development strategies are carefully reviewed by the Zoning Administrator and the Planning Commission. Specific physical projects are reviewed by the Development Review Board. Many upgrades in commercial structures are being required to include fire safety features. All buildings being improved in, or near frequently flooded areas are

required to elevate or provide additional mitigation measures. There have been no changes in development in hazard prone areas that have impacted vulnerability since the last approved plan. The most recent municipal plan states:

"The development pattern of Hardwick is typical of the communities throughout northern Vermont. This pattern is one of traditional New England settlement with compact village centers surrounded by agricultural and forest lands. The villages of Hardwick and East Hardwick, both located along the Lamoille River, serve as the activity centers of the community with community services, commercial and industrial activity, and higher density residential development. Both of these areas were historically mill sites and both benefited by having direct access to the railroad. These historic centers also maintain much of their historic character with many older buildings having been renovated. This rich concentration of historic resources is reflected in the fact that five historic districts have been designated within the Town of Hardwick.

The Lamoille River enters the town in the northeast and exits in the southwest. In addition to the productive soils found in the flood plains along the bottom, the valley is also home to important transportation corridors providing access to the community via state highways.

Areas such as Bunker Hill, Bridgman Hill, Center Road, Hopkins Hill, Hardwick Street, and Ward Hill all have their own concentrations of agricultural land uses. Low density scattered residential development exists throughout these areas with densities highest closer to village centers. The community's higher elevations and steep slopes are typically forested - much of which is covered with mixed hardwoods, with stands of softwood dominating the highest ground. Most of this forestland is in medium sized blocks from 100 to 500 acres and serve as private woodlots with some commercial harvesting. In addition to wildlife, recreational and economic benefits, these forestlands provide the backdrop for the seasonal display of color that dominates the landscape every fall." (page 5) Municipal Plan 2019

5.0.1. Proposed Land Use

The Town of Hardwick is divided into seven districts with two overlay districts. These districts include Central Business District, Village Neighborhood, Highway Mixed Use, Compact Residential, Industrial, Rural Residential, and Forest Reserve, as well as the two overlay districts of Flood Hazard Area and Source Protection Area. The current Municipal Plan reviews each district with proposed land use narrative.

5.0.2. Land Use Goals

Hardwick's present patterns of land use is defined by dense residential and commercial uses concentrated in Hardwick village and East Hardwick and sparsely developed agricultural and forest land outside these village centers, with a rural and natural skyline. The following list represents current town policies that support hazard mitigation:

- The Flood Hazard district is intended to protect life and property within federally designated flood hazard areas. New construction should not occur within these areas and existing buildings should be flood proofed.
- Higher density residential developments should be located closer to major roadways and

existing villages to improve emergency service response.
- Mixed-use developments are encouraged to allow commercial, business, and residential uses to be located near each other.
- The scale of new construction and buildings should be in keeping with the development patterns of the immediate surrounding areas.
- Development in areas that require an extension of services, such as sidewalks, electricity, or water, should be discouraged.
- Abandoned, unsafe and unsanitary lots should be remediated in order to improve public safety and facilitate adaptive reuse.
- When subdividing existing lots or building new structures, it is important to maintain the character of residential areas with regards to historic layout and green space.

5.0.3. Land Use Strategies

To protect and enhance Hardwick's land resources, including productive farm and forestland and available earth resources, in order to maintain an adequate land base to sustain farming and forestry operations and to secure needed supplies of sand and gravel for the benefit of existing and future generations.

5.0.4. Future Development and Housing

Despite the advantages of attracting new businesses and housing, the town does not foresee major development occurring in the next five-year planning cycle nor has there been significant development since 2017. Therefore, there has not been a change in vulnerability nor is one perceived in the current planning cycle. The goal is to have safe and affordable housing available in a variety of types for all incomes, ages, and for those with special needs. The Town has a responsibility to its taxpayers and residents to continue to provide the highest level of service while keeping costs under control. Future development - both residential and non-residential - should be encouraged in a manner that is sensitive to this responsibility. Current policies include:

- Multifamily housing is encouraged in our village centers.
- Affordable housing should minimize long-term living costs through high quality design, efficient construction, energy efficiency, and proximity to employment.
- Hardwick supports efforts to assist elderly and disabled residents who wish to remain in their homes, and to community-based health care systems that enable elderly and disabled people to remain in the community.

5.1 Town Goals and Policies that support Hazard Mitigation

5.1.1. Community Goals

a. Minimize the risk exposure and associated expense to Hardwick residents.

c. Consider implementation of special population tracking within the community where-by residents unable to drive or that have no one to depend on can self-identify for inclusion in a maintained database so that rescue personal and emergency managers can account for this demographic.

d. Ensure that the Town and its facilities are prepared to meet the demands of the next flood.

f. For Hardwick to have safe and affordable housing available in a variety of types for all incomes, ages, and for those with special needs.

h. For Hardwick to have a diverse and resilient economy based on agriculture, small business, and light industry that is compatible with Hardwick's scenic landscape and will raise income levels and provide employment for Hardwick residents.

5.1.2. Capital Improvement Goals

a. Provide services and facilities deemed necessary for the orderly and rational development of the Town.

b. To ensure adequate facilities and services are available to protect and enhance the lives of the residents, visitors, and businesses of Hardwick.

5.1.3. Public Participation Goals

a. Continue to solicit input regarding planning issues from town residents and from other entities which can help to offer solutions and insight into the problems the Town faces both now and in the future via formal meetings and advertised opportunities for input.

b. Utilize NVDA to increase awareness, enhance planning and engage in exercises that address needs in the community.

5.1.4. Regulatory Devices Goals

a. Continue to use the Zoning Bylaw. The bylaws have been established to conform to, and be in harmony with, the Vermont Municipal and Regional Planning and Development Act. Any conflicts that are identified between the two documents will defer to Title 24 VSA, Chapter 117 as the prevailing authority.

b. Maintain and continue a Capital Expense Budget and Program for the purpose of ensuring that the rate of growth does not outstrip the town's ability to pay for the associated necessary services such as roads, schools, police and fire protection, solid waste, etc.

c. Develop and maintain a "No Adverse Impact" (NAI) approach to flood hazard management by institutionalizing the best practices set forth by the ASFPM.

d. Utilize best practices in flood-plain management for farm-related development in town.

5.1.5. Natural Resources

a. Ensure that the existing health ordinance is enforced to maintain protection of both surface and groundwater supplies.

b. Ensure that permits issued for development near sensitive areas, such as steep slopes, high elevations, wetlands, scenic vistas, and wildlife habitats, contain conditions assuring conformance to the goals set forth by the state of Vermont and when applicable and feasible, those defined as best practices by floodplain management organizations such as the ASFPM as well as those set forth in this plan and the most recent municipal plan.

c. The town should work with the NVDA and ACCD to continue the process of identifying the Town's land conservation priorities, and to the degree possible, link them to broader regional conservation work.

d. In line with the VTrans mission statement regarding climate change, the town remains committed to:

- Ensure that there are viable alternative routes around vulnerable infrastructure such as bridges and roadways.
- Make safety a critical component in the development, implementation, operation, and maintenance of the transportation system.
- Develop contingency plans for a wide variety of climate impacts to be implemented as data/information becomes available.
- Utilize information technology to inform stakeholders during times of emergency
- Educate the public and other stakeholders on the threats posed by climate change and fluvial erosion hazards.
- Increase inspection of infrastructure if warranted by climate change indicators
- Apply a decision-making framework to incorporate cost-benefit analyses into adaptive plans and policy.
- Work to protect essential ecosystem functions that mitigate the risks associated with climate change.
- Educate individuals within the agency to use best-practices during recovery periods to avoid ecological damage that may further exacerbate risk
- Recognize the interconnected nature of our built environment with ecological processes.
- Protect the state's investment in its transportation system and adapting transportation infrastructure to the future impacts of climate change

e. In line with DEC's best practices regarding fluvial erosion, the town will work to:

- Slowing, Spreading, and Infiltrating Runoff (The State Surface Water Management Strategy is found at http://www.watershedmanagement.vt.gov/swms.html and http://www.watershedmanagement.vt.gov/stormwater.htm)

- Avoiding and Removing Encroachments. http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm http://www.watershedmanagement.vt.gov/rivers/docs/rv_RiverCorridorEasementGuide.pdf

- River and Riparian Management: DEC has prepared a compendium of *Standard River Management Principles and Practices* to support more effective flood recovery implementation; improve the practice of river management; and codify best river management practices in Vermont. The document compiles the most current river management practices based on the best available science and engineering methods to create consistent practice and language for risk reduction while maintaining river and floodplain function. Best practices are established to address common flood damages, including:

- Erosion of banks adjacent to houses and infrastructure.
- Erosion of road embankments
- Channel movement across the river corridor
- Riverbed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains
- Bridge and culvert failure

Source: http://www.watershedmanagement.vt.gov/permits/htm/pm_streamcrossing.htm

5.1.6. Policies

a. Through both town and state-level management, the town will work to:

- Encourage and maintain naturally vegetated shorelines, buffers and setbacks for all rivers, ponds, and streams.
- Allow higher density or cluster development in existing and designated settlement areas and low-density development in the remaining areas
- Reduce flood hazard and repetitive road and driveway washout through continued updates and adherence to priorities in road, bridge, and culvert improvement projects.
- Identify and manage pollution, flooding and fluvial erosion hazards along rivers and streams as they arise.

5.1.7. Transportation Plan

In adjunct to town-specific planning, the town is committed to continually subscribing to all current state standards related to:

a. Maintaining safe operating conditions on the present system of town roads through design and modification to keep traffic at appropriate speeds and to assure the safest possible driving conditions, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available.

b. Protection of existing town roads from flood damage and uncontrolled storm water runoff.

c. Preserving the capacity of town roads and maintain adequate traffic flows and safety.

d. Support the road maintenance crew through Town-provided training sessions. This includes ICS training along with the Road Commission (Selectboard).

e. Support policies and procedures that ensure longevity of essential town-equipment and develop and maintain MOU's with neighboring towns related to equipment use during emergencies.

f. Continue long term access opportunities to gravel and sand deposits for future road maintenance use.

g. Consider developing a standard operating procedure (SOP) based on ICS principles for highway department response events were coordination, communication and support are at a heightened level.

5.1.8. Utilities and Facilities Goals

a. For residents and visitors of Hardwick to have access to a range of broadband opportunities.

b. For mobile telecommunication services to be available at a variety of frequencies, including cellular, PCS, and "WiFi", to meet a variety of information and communication needs.

c. For Hardwick to have 100% coverage for DSL, cable, and cellular phones in town by 2018.

d. Develop policies and procedures that ensures equipment longevity to the greatest extent possible.

e. Sewage and septic: All wastewater in Hardwick is appropriately treated so as to protect public health.

f. Water: All household water supplies should be clean and be of an adequate supply.

g. Public safety: To provide a safe environment in which to work, live, and play.

h. Health facilities: For Hardwick to continue to have a variety of quality local health care options.

i. Child care: To have quality affordable local child care opportunities in Hardwick.

j. Solid waste facilities: For Hardwick's residents and businesses to responsibly dispose of solid waste including efforts to reduce the amount of waste generated and increase recycling.

k. Storm drainage: To provide storm drainage facilities as needed for the proper treatment of storm runoff.

5.1.9. Educational Goals

a. The School Board should work with the Selectboard, the American Red Cross and Fire Department to ensure that the necessary equipment exists at the school for its use as an emergency shelter.

b. Increase emergency planning cohesion between school and town EOPs through mutual participation and presentation at scheduled LEPC meetings and town and/or school meetings.

c. Continue collaboration with the Vermont Chapter of the American Red Cross on their sheltering initiative program to further readiness with training and supplies related to sheltering operations.

5.2 Existing Town of Hardwick Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The ability to expand and improve the identified capabilities to achieve mitigation is considered adequate to protect the town from the profiled hazards. However, there also exists the lack of authority and/or ability to expand and improve on current capabilities. For example, the town does not possess unlimited resources and must operate within the confines of allotted budgets and personnel, even when grant funding is available. Additionally, the town's level of authority in taking actions that directly impact the health and safety of residents (e.g., evacuations, avoiding travel, etc.) are at a

level of recommendation only.

The Selectboard has successfully pursued funding to address needs. Through funding such as Better Back Roads, Structures Grants and FEMA/Hazard Mitigation grants, the town has been able to enhance its resilience and overall preparedness. The town has addressed its current and future needs and, by and large, road improvement projects remain the primary focus for the town and the areas identified were selected based on the condition of culverts and ditches and primarily focused on runoff issues; particularly as the incidence of heavy storms has increased. In many cases, culverts properly sized for normal rain events are overwhelmed by the severe ones. The town will continue to seek local, state, and federal funds to address the sites identified as priorities. Hardwick will earmark the funds necessary to complete one major project each year for the next 5 years and will keep its culvert inventory current to improve its institutional memory.

The town currently participates in the NFIP program and will continue to regulate floodplain use through the Hardwick Unified Development Bylaws concerning floodplain development which were amended on October 6, 2022. These regulations are enforced using the FEMA FIRMs maps which were last revised on 07/17/2002. The ongoing enforcement of these regulations maintains the town's compliance with the NFIP with the Hardwick Zoning and Floodplain Administrator (ZA) being the 'Administrative Officer' charged with implementation.. There are 34 NFIP insurance policy holders within the town, 30 of which are located in the 100-year flood zone. 56 claims have been filed since 1978, with $263,307 in payouts, since 1978. The ZA reviews all plans before any permits are issued. The ZA reviews plans to determine substantial damage (SD) and substantial improvements (SI), and once approved, the ZA then issues a zoning permit. The ZA reviews unsubstantial improvement and damage zoning applications and the Development Review Board reviews all SD and SI applications. Permits are then subject to Section 5.2 Flood Hazard Review in the Hardwick Unified Development Bylaws. After a flooding event, the ZA sends out initial letters and performs SD estimates. All SD determinations are be done by the ZA with the assistance of the State of Vermont. Land use regulations include Zoning By-Laws and a Subdivision Ordinance. The town does not, nor does it plan to, have building codes in the future. Zoning bylaws, current and applied governance related to structures (e.g., state building codes for commercial buildings and energy codes) are adequate and effective.

The town has also adopted municipal road and bridge standards that meet or exceed the 2013 standards and has an approved and adopted a Local Emergency Operations Plan and a Municipal Plan. Related to flood resilience goals and strategies, the 2019 Municipal Plan puts forth the following policies to best encourage a flood-resilient community:

- New development in identified flood hazard, fluvial erosion, and river corridor protection areas should be avoided. If new development is to be built in such areas, it should not exacerbate flooding and fluvial erosion.
- Flood plains and upland forested areas that attenuate and moderate flooding and fluvial erosion should be protected and restored.
- Flood emergency preparedness and response planning should be encouraged. Hardwick Municipal Plan.
- Maintain and regularly update the Local Emergency Operations Plan.

- Continue to meet the VTrans Road and Bridge standards. Encourage participation in regional road foreman trainings and Transportation Advisory Committee meetings.
- Attempt to achieve yearly updating of the Town's transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool.
- Identify and replace undersized and failing culverts.
- Relocate the Fire Station and HED garage out of the floodplain or flood proof these structures to 500- year flood standards.
- Maintain and regularly update the Local Hazard Mitigation Plan (pages 28-29)

Table 5-1: Existing municipal capabilites that support hazard mitigation

Type of Existing Protection	Description /Details/Comments	Key Points	Responsible Party
Emergency Response			
Police Services	Hardwick PD, Vermont State Police/ Caledonia County Sherriff	The Police Department's service area includes the Town of Hardwick. The Department currently maintains a staff of 4 full-time Certified Police Officers, 1 part-time Police Officers, The Officers consist of a Chief of Police, Detective, and uniformed Patrol Officers.	Police Chief/Selectboard
Fire Services	Hardwick Fire Department	Hydrants are well distributed throughout the area served by the village water system. If the reservoir is drawn down to a certain level, an automated system sends water from the Town wells to the reservoir, in order to maintain adequate water flows. There are several hydrants in the village area which are maintained by the Fire District. Presently, the hydrants in East Hardwick are not in service due to undersized waterlines feeding them.	Selectboard, Fire Chief
Fire Department Personnel	Currently the Fire Department has 20-23 members	Proper training to respond to major highway accidents that may involve hazardous substances.	See above
Fire Department Mutual Aid Agreements	Hardwick participates in a Mutual Aid Agreement with other area Departments.	None at this time	See above
EMS Services	Hardwick Emergency Response Squad	The Hardwick Emergency Rescue Squad service area includes all of Hardwick Greensboro, Craftsbury, Wolcott, Woodbury, and Stannard, as well as parts of Walden, Elmore, West Wheelock, and East Calais.	EMS/Fire Chief
Other Municipal Services			
Highway Services	Public Works Department	Winter operations plan and annual budgeting completed.	Road Commission/Foreman
Highway personnel	6 FTE	None at this time	See above
Water / Sewer Department	1 FTE and 1 PTE	None at this time	n/a
Planning and Zoning personnel	1 PTE	None at this time	Zoning and Floodplain Administrator, HPC
Emergency Plans			

Local Emergency Operations Plan (LEOP)	2023	Assure sheltering plans and contact information are up to date and vulnerable populations addressed.	Selectboard. EMD, NVDA
School Emergency/Evacuation Plan(s)	2023	Increased collaboration (with town staff, LEPC, NVDA), knowledge of roles and drills are next step. Investigate logistics of using school notification for all-hazard notification.	School Crisis Team, selectboard
Dam Emergency Plans	2023	The Mackville dam was completely rebuilt in 2004. This dam is located Southeast of Town. Jackson Dam is located on the Lamoille River on the Southwest side of town, downstream of downtown and the Industrial Park. HED is required to maintain safety checks, inform the public of inundation plans, and have an early warning system in place. Regular maintenance is ongoing to assure safety measures.	Hardwick Electric Department
Shelter, Primary	Hazen Union High School	Assure continued communication lines are open and contacts are correct.	EMD, NVDA, Selectboard
Replacement Power, backup generator	Yes, installed	None at this time	See above
Shelter, Secondary:	Hardwick Elementary School	Assure continued communication lines are open and contacts are correct.	See above
Replacement Power, backup generator	no	None at this time	See above, WVFD
Municipal Plans			
Town / Municipal Comprehensive Plan	2019	Flood resilience goals and policies included	Hardwick Planning Commission and the Hardwick Selectboard, Zoning and Floodplain Administrator
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	2022	Awaiting River Corridor and FEMA SFHA maps	Planning Commission, ZA
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Yes	Continue best practices and a no-adverse-impact policy approach to development.	Development Review Board and the Zoning and Floodplain Administrator
Culvert and bridge Inventory	2019	https://vtculverts.org/map https://vtculverts.org/bridges#list Keep up to date.	Road Foreman

5.3 Town of Hardwick All-Hazards Mitigation Goals

The following goals were developed by the planning team, vetted during a warned community meeting, and approved by the Town of Hardwick during the development of this plan:

- Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial, and agricultural establishments due to various hazards.

- Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- Recognize the linkages between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management and the planning and development of various land uses.
- Maintain existing municipal plans, programs and ordinances that directly or indirectly support hazard mitigation.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan into the multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard and NVDA and integrate the strategies into the existing municipal plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- Maintain mechanism for formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating and capital plans & programs as they relate to public facilities and infrastructure within political and budgetary feasibility. The Planning Commission will review the plan and use language/actions from it to inform the integration and update process. Town Meeting Day will serve as the formal time that mitigation strategy budgetary considerations will be approved and incorporated into the town budgets.

5.4 Mitigation Actions

While the town has seen little change in demographics and/or population, community impact and subsequent needs resulting from the pandemic provided new challenges and insights. Given this new awareness of the social vulnerabilities (e.g., loss of income, aging population, and access to health care) seen with the pandemic in addition to the health risks and that the town has continued to make progress in mitigating risk to the natural hazards, there is an opportunity to shift focus on addressing some lower priority items that serve enhance community resilience in a wholistic manner. In following FEMA guidance, the following mitigation action categories form the basis of the town's future mitigation actions. For each mitigation action to follow, an indication of the responsible party will be identified with the abbreviations listed below:

Mitigation Action Groups:

(P) Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

(PP) Property Protection: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter-resistant glass.

(PEA) Public Education & Awareness: Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

(NRP) Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

(SP) Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms

5.4.1. Current Capabilities, and Need for Mitigation Actions

The Municipal Plan's goals and policies that support hazard mitigation and the existing mitigation actions demonstrate the variety of policies and actions forming the foundation of this All-Hazards Mitigation Plan Update. Generally, the Town considers its existing capabilities are adequate to address the identified priority hazards in this update. As with most towns in the state, mitigating flood-prone areas is a continuous effort that sees increased attention following a major event. The town remains aware and diligent in keeping up with mitigation actions for all municipal systems. There exists a collaborative spirit that not only is valued, but serves to enhance efficiency of action for what needs to be done. The Town regards its current hazard mitigation efforts carried out by the road departments as adequate to address winter storm impacts to local roads, however, temporary road closure due to winter storms may isolate parts of town. Winter storms are often the cause of power loss and telecommunications failure. Tree trimming and vegetation management coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. The town can also incorporate the use of public information to support community resilience during a power outage. As part of the strategies defined in this plan, the town will develop a plan for mass communication and, if telecommunication lines are down, a method for alerting residents of the alternate means of information dissemination and/or protocol (e.g., shelter logistics). Major infrastructure that has seen repeated damage due to flooding is a concern for the town and remaining active in identifying priorities, working with State Transportation and Natural Resource Agencies as means to increasing infrastructure resilience is a priority.

Progress in Mitigation Efforts

The resulting mitigation actions taken in response to the events of 2011 have served to protect the town during subsequent flooding events. Integration of these actions for this update are reflected through an altered approach to future mitigation actions. Natural hazards serve as the primary focus moving forward. As the last plan included both social and technological "hazards", upon further analysis, the town has determined that these are topics of vulnerabilities.

The table in Appendix B provides status updates on the mitigation actions listed in the 2017 plan. Those actions specific to infrastructure projects completed are listed below. Actions from the previous plan not addressed below have been determined to be low priorities for the town. A low priority action from 2017 is defined by one or more of the following attributes:

- An action that is no longer considered a necessary strategy to mitigate risk by respective experts at the city, state, and or regional level.
- An action that is not feasible or required to maintain daily operations and/or protection systems.
- An action that is not associated with reducing risk to a natural hazard with an acceptable cost-benefit ratio.

2017 Mitigation Actions: Infrastructure Projects

- Ditching and Stone Enhancement Projects
    1. Cobb School Road (800'): *Completed*
    2. Bunker Hill Road (1200'): *Completed*
    3. Brown Farm Rd. (700'): *Completed*
    4. Ward Hill (600'): *Completed*
- Complete planning study to assess the efficacy of installing duckbill gates on storm drains in Village along Cooper Brook near Bridge 43 and 66: *Not Done and no longer planned due to competing demands and low benefit-cost.*
- Assess efficacy and feasibility of maintaining drop-down barricades for the wastewater treatment facility: *Not done and no longer planned due to destruction of facility during DR4720 (July 2023 flooding).*
- Develop procedure for ongoing lockdown of manholes during high rain events: *Not done but will re-assess efficacy of this mitigation action during next planning cycle.*
- Assess and develop plan to protect structures in NFIP: *Complete via current Zoning Regulations and Flood Resilience Strategies. Under consideration for further improvement.*
- Increase capability of HED to mitigate outages through budgetary allotment, planning and consistent mitigation of risk variables: *Completed within budget and additional funding not sought.*

5.4.2. Specific Mitigation Actions

The following actions define the mitigation measures to be taken by the town in the next five years:

Action #1: Reduce vulnerability to flooding by evaluating capabilities of existing road and storm water management infrastructure, public education and through municipal services and regulations.

Action #2: Improve resilience to severe winter storms.
Action #3: Reduce impact of extreme hot and cold temperature durations.
Action #4: Raise public awareness of hazards and hazard mitigation actions.
Action #5: Reduce risk and impact of infectious disease.

5.4.2. Prioritization of Mitigation Strategies

Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple "*Action Evaluation and Prioritization Matrix*" in order to affect a simple prioritization of the mitigation actions identified by the town. This method is in line with FEMA's STAPLEE method. The following list identifies the questions (criteria) considered in the matrix so as to establish an order of priority. Each of the following criteria was rated according to a numeric score of "1" (indicating poor), "2" (indicating below average or unknown), "3" (indicating good), "4" (indicating above average), or "5" (excellent).

- Does the action respond to a significant (i.e., likely, or high risk) hazard (including climate change)?
- What is the likelihood of securing funding for the action?
- Does the action protect threatened infrastructure?
- Can the action be implemented quickly?
- Is the action socially and politically acceptable?
- Is the action technically feasible?
- Is the action administratively realistic given capabilities of responsible parties?
- Does the action offer reasonable benefit compared to its cost of implementation?
- Is the action environmentally sound and/or improve ecological functions?

Scoring: 1=Poor 2=Below Average or unknown 3=Average 4=Above Average 5=Excellent

The ranking of these criteria is largely based on best available information and best judgment of project leads. For example, all road improvement projects were initially identified by Road Foreman and approved for inclusion in this plan by the road commission. It is anticipated that, as the town begins to implement the goals and actions of their Mitigation Strategies, they will undertake their own analysis in order to determine whether or not the benefits justify the cost of the project. Along these lines and as mentioned in a previous section, several action categories have fallen off from priority for the town and are no longer seen as viable methods, due to capacity and/or efficacy, to mitigate risk of natural hazards for the town.

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
2	Reduce vulnerability to flooding by evaluating capabilities of existing road and storm water management infrastructure, public education and through municipal services and regulations.	5	4	5	2	5	3	3	4	4	35
5	Protect infrastructure and population from extreme temperatures	4	2	4	2	3	2	3	3	2	25
4	Reduce vulnerability to pandemic	3	4	5	2	5	3	3	5	1	27
1	Raise public awareness of hazards, hazard mitigation and disaster preparedness	4	5	5	5	5	5	5	5	1	40
3	Improve resilience to severe winter storms	4	3	3	2	4	3	4	3	3	29

Table 5-2: Hardwick Action Evaluation and Prioritization Matrix

5.4.3. Specific Mitigation Actions

With an emphasis on nature-based solutions (i.e., "green-engineering), several specific actions described below fall into the nature-based solution category. These sustainable planning, design, environmental management, and engineering practices integrate natural features or processes into the built environment to promote adaptation and resilience. When an action is a nature-based solution, "NBS" will be included to denote the association.

Action #1: Reduce vulnerability to flooding by evaluating capabilities of existing road and storm water management infrastructure, public education and through municipal services and regulations.

Group: SP, NRP, PP

Hazard Addressed: Flooding and Severe Winter Storms

Lead Responsible Entity: Town of Hardwick Road Foreman

Potential Partner Entities: Hardwick Town Manager, Selectboad/Planning Commission,Vermont Agency of Natural Resources; Vermont Agency of Transportation; NVDA, DEMHS, FEMA and the Agency of Commerce and Community Development

Timeframe: 2024 – 2029 (Specific timeframes included in Implementation Matrix)

Funding Requirements and Sources: FEMA or other hazard mitigation grants; FHWA grants; VAOT grants; Municipal Operating and Capital budgets.

Progress: The Road Foreman continually monitors road and storm water management capabilities. Since 2017, all bridges and culverts have been electronically accounted for and the town is diligent in maintaining a comprehensive plan of action for infrastructure improvement projects.

Specific Identified Tasks:

1) Infrastructure Assessment for Storm Water Vulnerability – Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts, and other storm water management infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. Consider using green infrastructure such as bioswales and rain gardens when feasible (NBS). Utilize culvert designed to allow for the natural flow of water, reduce constriction, and prevent scour at road-stream crossings (NBS).
2) Street reconstruction and street resurfacing (NBS) is considered a viable mitigation action and is the most visible part of the capital program for this planning cycle. The rationale for street resurfacing/reconstruction as mitigation is explained and summarized by the belief that through the consistent attention to areas in need, the town is reducing vulnerability to flood/snow-damaged transportation routes by reducing permeability to moisture invasion. The street construction cost shown in the summary by fund does not include any cost for water and sewer infrastructure. Considering road engineering practices (e.g., permeable road surfaces) that enhance green engineering practices will allow the town to mitigate hazard risk while benefiting the environment. Within political and financial restraints, re-engineer certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects are underway in response to DR4720 (July 2023 flooding) and recovery from this historic disaster will likely involve the entire next planning period.
3) Documenting – Maintain and build capabilities to efficiently capture work and expenditures on sites that could benefit from HMGP/FEMA PA funding, the town will move forward in mitigating the long-term risk associated with vulnerable infrastructure and its subsequent repair costs during the next planning period.

4) Increase Awareness of Funding Opportunities - Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized through trainings and communication with the State Mitigation Office.

5) DR-4720 (July 2023 flooding) Recovery: While response and recovery phases are active during this update's development, full recovery likely stretch through the next planning cycle. The town is and will continue to:

1. Assess conditions of infrastructure damage/destruction for triage action.
2. Assess and develop strategies to reduce risk of landslides in the future, independent of soil saturation when possible.
3. Maintain adequate records and grant management to maximize FEMA Public Assistance for eligible infrastructure projects.
4. Assist and coordinate recovery paradigms for individuals and businesses (e.g., FEMA IA and SBA Loans).
5. Collect lessons learned and develop innovative measures to reduce the impact of high rain events.
6. Create and/or improve debris management response planning.
7. Utilize and incorporate best practice guides for the creation and implementation of enhanced planning and response initiatives (e.g., Toolkit | Agency of Commerce and Community Development (vermont.gov); https://community.fema.gov/ProtectiveActions/s/article/Landslide-Mitigation-Property

6) Property Acquisition through FEMA (and other) Buy-out Program:

1. The town should assess repetitive and significantly damaged property for eligibility in Buy-out programs to assist in mitigating future damages.
2. The town should convey the opportunity to owners of repetitive loss properties and/or those potentially eligible for acquisition in addition to educating property owners on best practices for mitigating future risk of property loss.
3. Utilize best practices for acquired property use and function in-line with town goals.

7) Develop understanding of best practices related to NBS and consider implementation when feasible:

1. Protecting and enhancing landforms that serve as natural mitigation features (i.e., riverbanks, wetlands, dunes, etc.).
2. Using vegetative management, such as vegetative buffers, around streams and water sources.
3. Protecting and preserving wetlands to help prevent flooding in other areas.
4. Establishing and managing riparian buffers along rivers and streams.
5. Retaining natural vegetative beds in stormwater channels.
6. Retaining thick vegetative cover on public lands flanking rivers.

7. Preserving natural areas and vegetation benefits natural resources while also mitigating potential flood losses. Techniques include:
    i) Developing an open space acquisition, reuse, and preservation plan targeting hazard areas.
    ii) Developing a land banking program for the preservation of the natural and beneficial functions of flood hazard areas.
    iii) Using transfer of development rights to allow a developer to increase densities on another parcel that is not at risk in return for keeping floodplain areas vacant.
    iv) Compensating an owner for partial rights, such as easement or development rights, to prevent a property from being developed.

8) The town will work with DEC through coordinated meetings, workshops, and communication to increase understanding of current findings and develop an applicable framework to help guide decisions related to priority infrastructure work and vulnerability.
    1. Using updated and anticipated River Corridor and Floodplain Maps, the town should develop an outreach strategy to residents/structures in or near the defined corridor. This communication should focus on flood resilience measures and opportunities.

Rationale / Cost-Benefit Review: Conducting vulnerability assessments facilitates a targeted and effective approach to road and storm water management infrastructure. This will prove useful in the development and implementation of municipal capital and operating plans as well as the development and implementation of grant-funded mitigation projects. Some areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating against these problems would reduce short- and long-term maintenance costs and improve the flow of traffic for personal and commercial purposes during flooding events. Tracking road work and understanding the HMGP program can open funding streams into the town and can make the application process much easier when required information is already available.

Action #2: Maintain and improve resilience to severe winter storms

Group: SP, PP, PEA
Hazard Addressed: Severe winter weather.

Primary Responsible Entities: Town of Hardwick Road Foreman

Potential Partner Entities: Selectboard, Planning Commission and Emergency Management Director.

Timeframe: 2024 – 2029 (Specific timeframes included in Implementation Matrix)

Funding Requirements and Sources: DEMHS or FEMA hazard mitigation funding; existing programs, contingent on available resources and funding.

Progress: Roads are monitored and altered, when necessary so that plowing can occur without damage to trucks and/or road. Hardwick Elementary School has been identified as the primary emergency shelter. The school does have an emergency generator. The Union Baptist Church is

the secondary shelter and it does have a generator in place. The Fire Department is the third. Snow clearing equipment is regularly serviced, and the town maintains an adequate supply of salt.

Specific Identified Tasks:

1) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
2) Reduce ice storm vulnerability:
    - Enhance collaboration between town road foreman and electric company related to down-limbed induced power failure.
    - Maintain function of generators.
    - Be prepared to reduce work force due to unsafe travel conditions throughout the service area.
    - Potential surface water supply challenges as ice and frozen slush can block valves and restrict intakes.
    - Maintain current concrete ice retention blocks placed in the Lamoille River to mitigate against future (spring-thaw) flooding by breaking up ice jams before heading south towards the village area.
3) Notification: Develop a notification/communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)
4) Residential Programs (NBS): Provide guidance and communication to residents on the structural and mechanical actions that can occur to reduce risk to severe winter storms (e.g. weather-proofing, anchoring, alternative heating sources, tree trimming, financial programs, etc.)
5) Continue to monitor roads for safe and effective plowing: Efficient snow removal is the foundation to winter storm (snow) events, assuring roads are plowable before winter remains an important facet of highway department functions. The town will review its current road equipment plan to assure adequate road and debris clearing capabilities.
6) Increase awareness of ICS structure and recommended practices: The town can mitigate the effects of a severe winter by understanding how a large-scale storm is managed when the State EOC is operational. Additional awareness of local-level roles and responsibilities during statewide event is a mitigation action.

Rationale / Cost-Benefit Review:

This mitigation action serves to reduce the economic impact and risk to both human and animal (livestock and pet) health and safety during severe winter storm events by reducing risk and enhancing the mechanisms of winter storm mitigation in the long term. More formalized policy formation in both staffing and notification procedures, especially pertaining to vulnerable populations where transportation and special needs are a concern could potentially significantly reduce the physical, psychological, and social impacts of a disaster.

Action #3: Reduce risk and impact of a pandemic event
Group: PEA, PP, SP
Risk or Hazard Addressed: Risk to infrastructure, environment, and residents
Lead Responsible Entities: Hardwick Town Manager
Timeframe: 2024 – 2029
Potential Partner Entities: VEM, FEMA
Funding Requirements and Sources: Pandemic planning funding is secondary to financial stability funding in response to potential economic consequences not known to be a serious consequence of infection mitigation efforts. State and Federal funding are primary sources with limited but important local opportunities.

Specific Identified Tasks:

1) Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response, misinformation, and support.
2) Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability.
3) Maintain process for funding acquisition related to COVID-19 for schools, government, impacted residents, and other essential services.
4) Develop and maintain continuity of operations plans for critical government and community services.

Action #4: Protect infrastructure and population from extreme temperatures and drought
Primary Responsible Entities: Emergency Management Director
Potential Partner Entities: Fire Chief, American Red Cross, Vermont's Medical Reserve Corps (MRC), Hardwick Planning Commission
Timeframe: 2024 – 2029 (Specific timeframes included in Implementation Matrix)
Funding Requirements and Sources: Existing programs, contingent on available resources and funding.

Specific Identified Tasks:

1) Economic Resilience:
   - Consider assessing, if feasible, the economic consequences of both extreme cold and heat (with drought) and develop actions steps to best support the community and protect infrastructure/the environment.

2) Zoning and Permitting Review Considerations:
   - Consider stronger ventilation and cooling standards for mixed use development and multi-unit structures with four or more units.
   - Enhance and expand availability of publicly available cooling sites. Hardwick's cooling options will need to serve a range of needs for a diverse population. Some sites will need to be located indoors and operate extended hours.

- Specific mitigation actions to consider:
- Execute an operating agreement with one facility to function as a dedicated cooling site that meets all of the minimum requirements, and at least two of the encouraged amenities
- Promote use of the Vermont Department of Health Cooling Sites map and review the map every time the Local Emergency Management Plan is updated.
- Establish procedures for ensuring that potable water is available for outdoor cooling sites during heat emergencies.
- Work with local housing providers, social service agencies, and the regional planning commission to ensure that cooling options are considered when planning for warming shelters for unhoused populations.
- Improve cooling and ventilation of existing housing stock. Current statewide and regional efforts to weatherize and fuel switch provide an excellent opportunity to address cooling and ventilation as well. Organizations such as HEAT Squad and Northeast Employment Training Organization provide low- and no-cost services to Hardwick's energy-burdened households.

3) Drought Planning: The town should consider what, if any, actions should be considered based off best practices related to drought mitigation, state guidance, and risk (NBS). Examples include encouraging drought-tolerant landscape design through measures such as:

   - Incorporating drought tolerant or xeriscape practices into landscape ordinances to reduce dependence on irrigation.
   - Providing incentives for xeriscaping.
   - Using permeable driveways and surfaces to reduce runoff and promote groundwater recharge.

Notification and Education – Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational resources for homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting through a yearly public service campaign.

- Establish a local energy committee or appoint an energy coordinator to help Hardwick residents become more aware of weatherization and fuel-switching opportunities (NBS)
- Expand on "neighbor-to-neighbor" networks. NEK residents are famously independent and self-reliant, and many individuals will not ask for help, even in more dire situations. The neighbor-to-neighbor efforts that were mobilized during the pandemic response, however, establish a valuable precedent for future emergency responses, including heat emergencies.
- One statewide system that can be used in any community is the Citizens Assistance Registry for Emergencies, CARE (https://e911.vermont.gov/care). Anyone can register in CARE, and it is the responsibility of the local Emergency Management Director to

request the CARE database for their municipality as needed. Registration in CARE is typically low but promoting the use of it annually (such as Town Meeting Day) may help.

- Specific mitigation action to consider:
- Ensure that rental housing management staff, social service agencies, and visiting nurses have relevant and timely information on heat emergencies, including availability of cooling sites.
- Encourage enrollment in CARE.

Drought Planning: The town should consider what, if any, actions should be considered based off best practices related to drought mitigation, state guidance, and risk (NBS).

Rationale / Cost-Benefit Review:
With an increase in extreme weather, there is a need to protect property, the environment, and the population. Given the magnitude of population dependence on social services, indicating economic and other social vulnerabilities, effective outreach, education, and collaboration with resources supports this mitigation action category. Given the high risk for heat related illness in the town, coordination with VDH and planning for such events is important.

Action #5: Raise public awareness of hazards, hazard mitigation and disaster preparedness.
Lead Responsible Entities: Hardwick Town Manager

Timeframe: 2024 – 2029 (Specific timeframes included in Implementation Matrix)

Progress: The Fire Department annually conducts fire preparedness programs and school and family programs related to hazard awareness and disaster preparedness, including providing information on Town Meeting Day. The LEPC meets regularly and covers a host of topics related to emergency preparedness and raises awareness in the community about what organizations are doing around emergency response planning and chemical safety. Town Meeting Day can serve as an annual update and outreach opportunity as well.

Potential Partners: Relevant state agencies and community-based organizations.

Funding Requirements and Sources: Primary funding for this action is embedded into operating budgets of the informational source (e.g., Highway/Fire Department).

Specific Identified Tasks:

1) School Programs: Continue school programs to raise student awareness of hazards, safety, preparedness, and prevention. Explore establishing the school emergency notification system as the primary methodology for all emergency notification procedures and build in the contact information accordingly.
2) Family Programs: Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness, and prevention.
3) Fire Prevention Programs: Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness, and prevention.
    a) Continue use of burn bans within the Hardwick Town Forest for reducing wildfires during high-risk conditions

b) Enhance public education of the risk of wildfires in the Hardwick Town Forest and collaborate with state agencies (e.g., tourism, agriculture) on mixed-media sources to reach the largest audience most efficiently.

c) Review planning, permitting, and zoning in and around the Hardwick Town Forest to reduce risk. Consider controlling tree cover over new structures to reduce spread in the event of a structure fire.

d) Explore opportunities through FEMA for Fire Assistance Grants and Post-fire assistance if needed (https://www.fema.gov/disaster/wildfire-actions#:~:text=Through%20FEMA%2C%20fire%20management%20assistance%20is%20available%20to,to%20help%20communities%20mitigate%20and%20respond%20to%20wildfires).

4) Dam Preparedness: The town should consider developing an outreach strategy based on likely scenarios and the subsequent properties that would be affected. Consider involving state agencies in planning and/or exercises that focus on the logistical considerations after a dam breach.

5) Other hazard awareness programs: Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate as directed by the state department of health and its jurisdictional offices of local health.

6) Hazard Resilience for Property Owners: Develop and maintain education materials to inform property owners on how to protect their homes and businesses through accepted hazard resilience actions (e.g., securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.). Inform the public about severe winter weather impacts with annual outreach related to: traveler emergency preparedness information about severe winter weather hazards and support inclusion of safety strategies for severe weather in driver education classes and materials.

   Rationale / Cost-Benefit Review: Improved public awareness could potentially significantly reduce the loss of life and property damage through ongoing, formal, ongoing, public information campaigns that address property protection actions (flood proofing, elevation, anchoring mobile homes/propane tanks, electric and water system elevation, electric grounding, etc.) Improved awareness would also build understanding and public support for municipal mitigation actions to reduce potential infrastructure and liability costs.

5.5 Implementation and Monitoring of Mitigation Strategies

5.5.1. Public Involvement Following Plan Approval

After adoption, the town will continue to maintain web-presence of the mitigation plan with an opportunity for community input available on its website. Additionally, the town will hold an annual public meeting after performing the annual progress report for the mitigation plan to discuss achievements and the following year's implementation plan. At town meeting, the town will present mitigation information and provide the public an opportunity to increase

understanding and involvement with planning efforts. The Local Emergency Planning Commission (LEPC)will also host an annual mitigation plan presentation where response/state agencies, neighboring communities and other stakeholders can provide input. The town will also notify its neighboring municipalities of the availability of information for review and any significant risks and/or mitigation actions that have an impact on surrounding towns.

5.5.2. Project Lead and Monitoring Process

The Town Manager is the project lead and will work in conjunction with the Selectboard, town clerk, the Zoning and Floodplain Administrator and NVDA to complete the yearly progress report included in the plan. The town will create a mitigation action collection system that will be used as the source of future updates following the annual evaluation that will occur in conjunction with the progress report using the Plan Implementation Matrix provided below. While mitigation actions are, by default, often addressed at monthly Selectboard meetings, the town will schedule one meeting annually to formally assess the plan and adopt updates following the annual progress report and community meeting regarding the LHMP. Once the plan is approved by FEMA, the calendar will begin for annual review. The town will take the following implementation matrix and add actions to it each year, modifying tasks and/or needs as required so that the next LHMP update will be populated with the specific actions related to each mitigation strategy by year.

5.5.3 Plan Evaluation and Update Process

Formal integration into other community planning mechanisms since the last plan update have included the Municipal Plan related to flood resilience measures, achieving optimal ERAF rates, and the importance and rational of mitigation planning efforts. The Hardwick Municipal Plan also directly lists Hazard Mitigation Projects as defined in the 2017 LHMP and sets forth actions devoted to maintaining mitigation efforts as defined in the plan. This integration across the municipal plan and subsequent revisions to zoning bylaws, when appropriate to integrate, will continue in the future. Many of the action items from the 2017 plan have been accomplished due to situational awareness of town officials to pre-existing momentum during the plan development.

The Town Manager will lead the plan evaluation process as part of the annual progress report. Prior to town meeting and in preparation for the annual town report, a mitigation section will be included that provides an executive summary for the public that addresses the following topics:

- Status of recommended mitigation actions for the five-year planning period
- Identification of barriers or obstacles to successful implementation or completion of mitigation actions, along with possible solutions for overcoming risk
- Identification of a lead person to take ownership of, and champion the Plan if different from Town Manager
- An approach to evaluating future conditions (i.e., socio-economic, environmental, demographic, change in built environment etc.)
- Discussion of how changing conditions and opportunities could impact community resilience in the long term
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience

By engaging in the annual evaluation, the town will have a viable method for capturing the facets of efficacy and areas needing revision and improvement in its mitigation plan. The town is committed to "institutionalizing" mitigation into its normal operating procedures and with approval of this plan, embarks on the formal incorporation of mitigation actions and discussion, maintaining an awareness that involves not only the Selectboard, Town Clerk and Road Foreman but also the community at large, including the organizations represented by the current planning team. Along these lines, the town will maintain a contact list of the current planning team and make revisions as required, including the team on the evaluation process each year. Through this consistent attention resulting from the evaluation process, progress reports and communication in the annual town report, the town will achieve the consistency required to enhance resilience through planning, assessment and actions devoted to mitigation.

5.5.4. Plan Update Process

Although the plan will be reviewed, pending ongoing financial resources, in its entirety every five years the town may review and update its programs, initiatives and projects more often based on the above procedure as changing needs and priorities arise.

The Plan update will be led by the Town Manager. Depending on funding availability, the town may elect to acquire the assistance of NVDA and/or a consultant to update the plan following a declared disaster and/or the next five-year planning cycle. To assure that the Plan does not expire, the town will begin the update process within no less than 18 months of the current Plan's expiration date. Following a disaster and during the recovery phase, the town will use the experience to assess the current Plan's ability to address the impact of the most recent disaster and edit the plan accordingly. Using the annual progress reports and evaluation narratives as a guide, along with perceived changes in risk or vulnerabilities supported by data and/or observation, strategies will be captured in accordance with FEMA guidelines, which includes reconvening the planning team during the update process. The town will establish a "Mitigation File" that documents all evaluations and progress reports, along with actions, especially related to infrastructure improvement projects. While the progress reports are designed to capture the specific actions the town has accomplished related to implementation, keeping a narrative list with dates on all actions relatable to mitigation (e.g. school drills, LEOP updates, Fire Safety Awareness, meetings, etc.), will provide the town the bulk of information required in the update process.

5.5.5. Implementation Matrix for Annual Review of Progress

The following table is intended to aid municipal officials in implementing the mitigation actions for Hardwick and to facilitate the annual monitoring and progress reporting. Progress has been included as a guide to future updates. Each year, the town will reserve a Selectboard meeting to review and update the Implementation Matrix as means to establishing an accurate evaluation of the plan's efficacy and the information required for the succeeding update to the plan. The matrix includes each mitigation action for the project period, the timeline for accomplishment and the task leads. The town will update the matrix each year related to the full mitigation action items for each action category as they relate to progress status (completion or deletion from planning cycle initiatives) and rationale (new information, social, political and/or budgetary restrictions).

Table 5.5: Hazard Mitigation Action Implementation Tracking

Action	Responsible Entity (**Primary in Bold)**	Timeline	Specific Identified Tasks	Annual Progress
Improve road infrastructure and municipal systems protection programs	**Town Road Foreman**	Spring 2024 and each subsequent spring	Infrastructure Assessment for Storm Water Vulnerability	
	Town Road Foreman	Spring 2024 and as-needed related to weather patterns	Assessment for Fluvial Erosion, Landslide Vulnerability	
	Town Road Foreman	As needed during entire planning period	Culvert Upgrades	
	Town Road Foreman and associated municipal systems managers	Ongoing each fall and spring of planning period	Continued Monitoring of Vulnerable Infrastructure	
	Town Road Foreman	Spring 2024-Fall 2029 (each project will be selected based on capability and level of need within the planning period		
	Town Road Foreman	Winter 2024	Debris Management Plan	
	Zoning and Floodplain Administrator	Present-Fall 2024	6) Property Acquisition through FEMA (and other) Buy-out Program: 1. The town should assess repetitive and significantly damaged	

			property for eligibility in Buy-out programs to assist in mitigating future damages. 2. The town should convey the opportunity to owners of repetitive loss properties and/or those potentially eligible for acquisition in addition to educating property owners on best practices for mitigating future risk of property loss. 3. Utilize best practices for acquired property use and function in-line with town goals.	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Maintain and improve resilience to severe winter storms	**Road Foreman, LEPC**	Winter 2024 and each subsequent fall	Maintain Existing Shelter Capability	
	Road Foreman, LEPC	Winter 2024 and each subsequent fall	Reduce risk of power failure due to ice storms	
	Road Foreman, LEPC	Winter 2024-Summer 2029	Notification	
	Fire Chief, LEPC	Winter 2024-Fall 2029	Residential Programs	
	Town Road Foreman	Winter 2024 and each subsequent Fall in planning period	Monitor roads for safe and effective plowing	
	Emergency Management Director	Summer 2024	Increase awareness of ICS structure and recommended practices	
Action	Responsible	Timeline	Specific Identified Tasks	Annual Progress

	Entity			
Reduce impact of extreme cold durations	**Town Manager,** NVDA, School, local/regional assistance organizations.	Winter 2024 and ongoing each fall	Economic Resilience	
	Town EMD and Selectboard	Winter 2024 and ongoing as preparation for winter	Maintain Existing Shelter Capability	
	EMD, NVDA, School, local/regional assistance organizations.	Fall 2024	Notification and Education	
	Fire Chief LEPC	Fall 2024- Fall 2029	Assess Vulnerable Population	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce Impact of Extreme Heat	Town Manager	Summer 2023 and ongoing as required	<u>Economic Resilience</u>: • Consider assessing, if feasible, the economic consequences of both extreme cold and heat (with drought) and develop actions steps to best support the community and protect infrastructure/the environment. <u>Zoning and Permitting Review Considerations</u>: • Consider stronger ventilation and cooling standards for mixed use development and multi-unit structures with four or more units.	

			• Enhance and expand availability of publicly available cooling sites. Hardwick's cooling options will need to serve a range of needs for a diverse population. Some sites will need to be located indoors and operate extended hours. • Specific mitigation actions to consider: • Execute an operating agreement with one facility (gymnasium? Gateway?) to function as a dedicated cooling site that meets all of the minimum requirements, and at least two of the encouraged amenities in Table 1. • Promote use of the Vermont Department of Health Cooling Sites map and review the map every time the Local Emergency Management Plan is updated. • Establish procedures for ensuring that potable water is available for outdoor cooling sites during heat emergencies. • Work with local housing providers, social service agencies, and the regional planning commission to ensure that cooling options are considered when planning for	

			warming shelters for unhoused populations. • Improve cooling and ventilation of existing housing stock. Current statewide and regional efforts to weatherize and fuel switch provide an excellent opportunity to address cooling and ventilation as well. Organizations such as HEAT Squad and Northeast Employment Training Organization provide low- and no-cost services to the Hardwick's energy-burdened households. <u>Notification and Education</u> – Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational resources for homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and	

			avoid bursting through a yearly public service campaign. • Establish a local energy committee or appoint an energy coordinator to help Hardwick residents become more aware of weatherization and fuel-switching opportunities. • Expand on "neighbor-to-neighbor" networks. NEK residents are famously independent and self-reliant, and many individuals will not ask for help, even in more dire situations. The neighbor-to-neighbor efforts that were mobilized during the pandemic response, however, establish a valuable precedent for future emergency responses, including heat emergencies. • One statewide system that can be used in any community is the Citizens Assistance Registry for Emergencies, CARE (https://e911.vermont.gov/care). Anyone can register in CARE, and it is the responsibility of the local Emergency Management Director to request the CARE database for their municipality as needed. Registration in CARE is typically low, but promoting the use of it annually (such as Town Meeting Day) may help.	

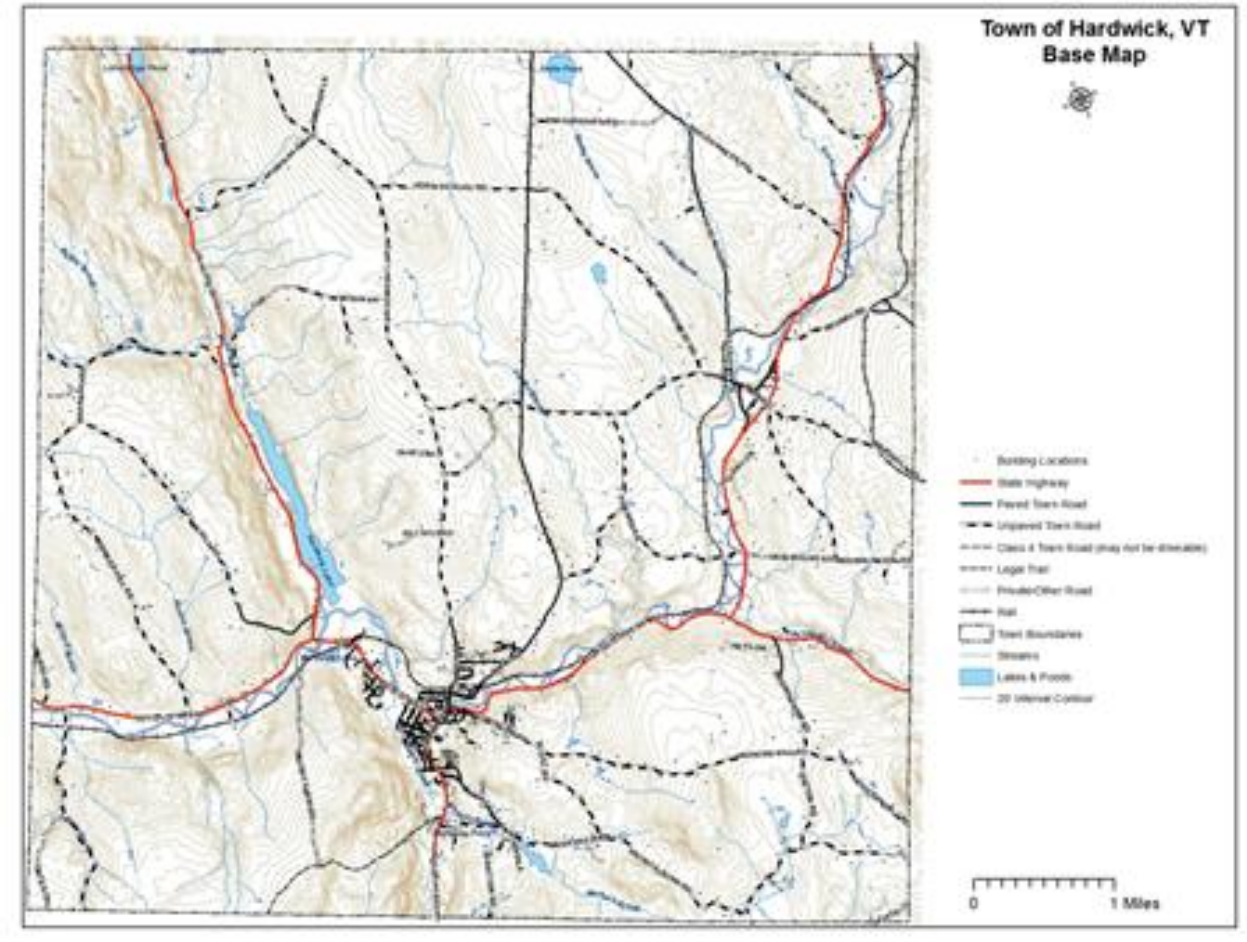
			• Specific mitigation action to consider: • Ensure that rental housing management staff, social service agencies, and visiting nurses have relevant and timely information on heat emergencies, including availability of cooling sites. • Encourage enrollment in CARE. Drought Planning: The town should consider what, if any, actions should be considered based off best practices related to drought mitigation, state guidance, and risk.	
Action	Responsible Entity	Timeline	Specific Identified Tasks	
Reduce risk and impact of a pandemic event	**Town Manager,** ACCD, VDH, NVDA, school	Summer 2024-Spring 2025 (as-required)	Work with facility leads on understanding risk factors and what can be done to mitigate and enhance training and skills for response. Explore ESSER funding for school.	
	Town Manager, ACCD, VDH, NVDA	Summer 2024-Spring 2025 (as-required)	Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability	
	Town Manager	Summer 2024-Spring 2025 (as-required)	Develop and maintain continuity of operations plans for critical positions	

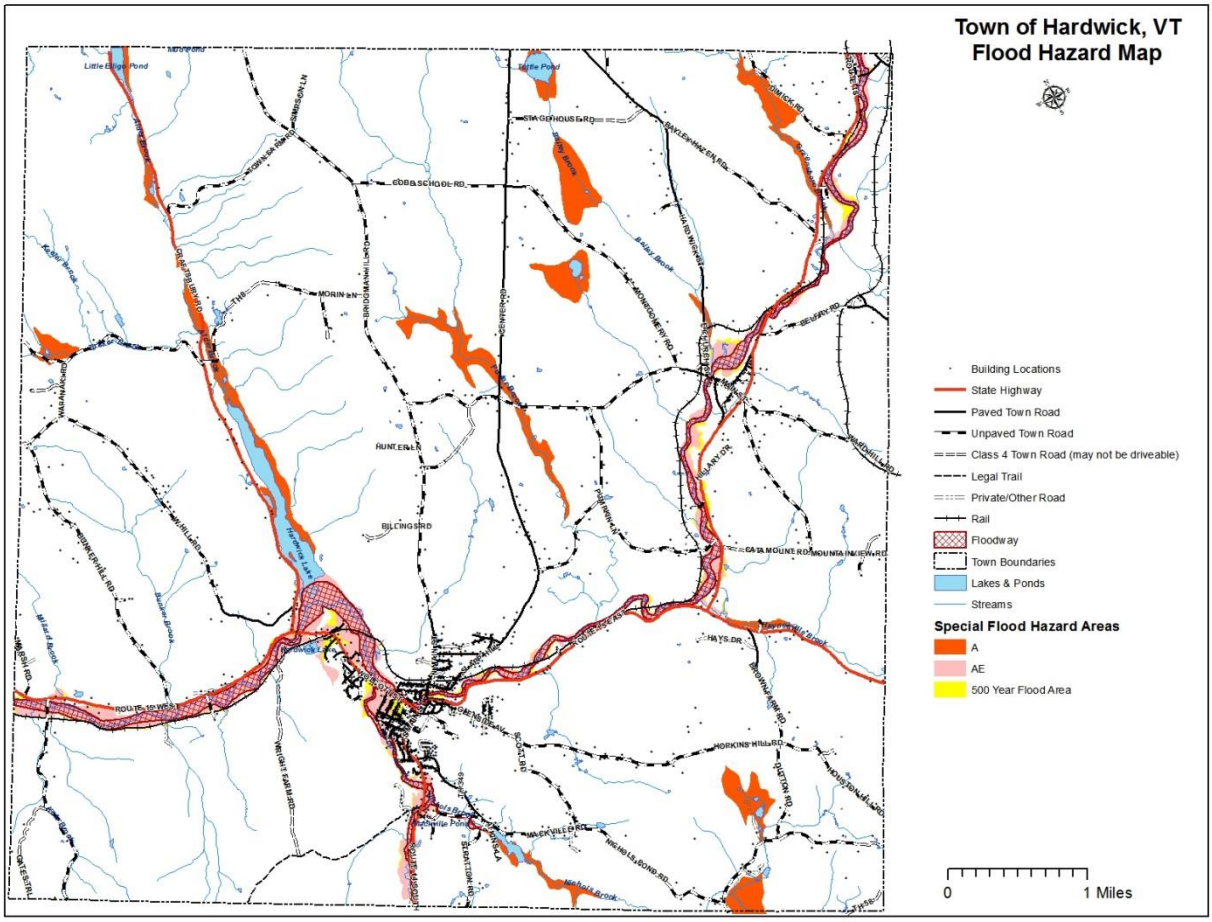
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Raise public awareness of hazards and hazard mitigation actions	Fire Chief, NVDA, , EMD, Zoning and Floodplain Administrator, LEPC	Winter 2025-Spring 2026	Hazard Resilience for Property Owners	
	Town Manager	As needed for residents and town	HMGP Awareness	
	Schools	Fall 2023- Fall 2026	School Programs	
	Clerks	Fall 2022 and ongoing as needed	Family Programs	
	Fire Chief	Spring 2023 and on-going as needed	Fire Prevention Programs a) Continue use of burn bans within the Hardwick State Forest for reducing wildfires during high-risk conditions b) Enhance public education of the risk of wildfires in the Hardwick State Forest and collaborate with state agencies (e.g., tourism, agriculture) on mixed-media sources to reach the largest audience most efficiently. c) Review planning, permitting, and zoning in and around the Hardwick State Forest to reduce risk. Consider controlling tree cover over new structures to reduce spread in the event of a structure fire. d) Explore opportunities through FEMA for Fire Assistance Grants and Post-fire assistance if needed.	

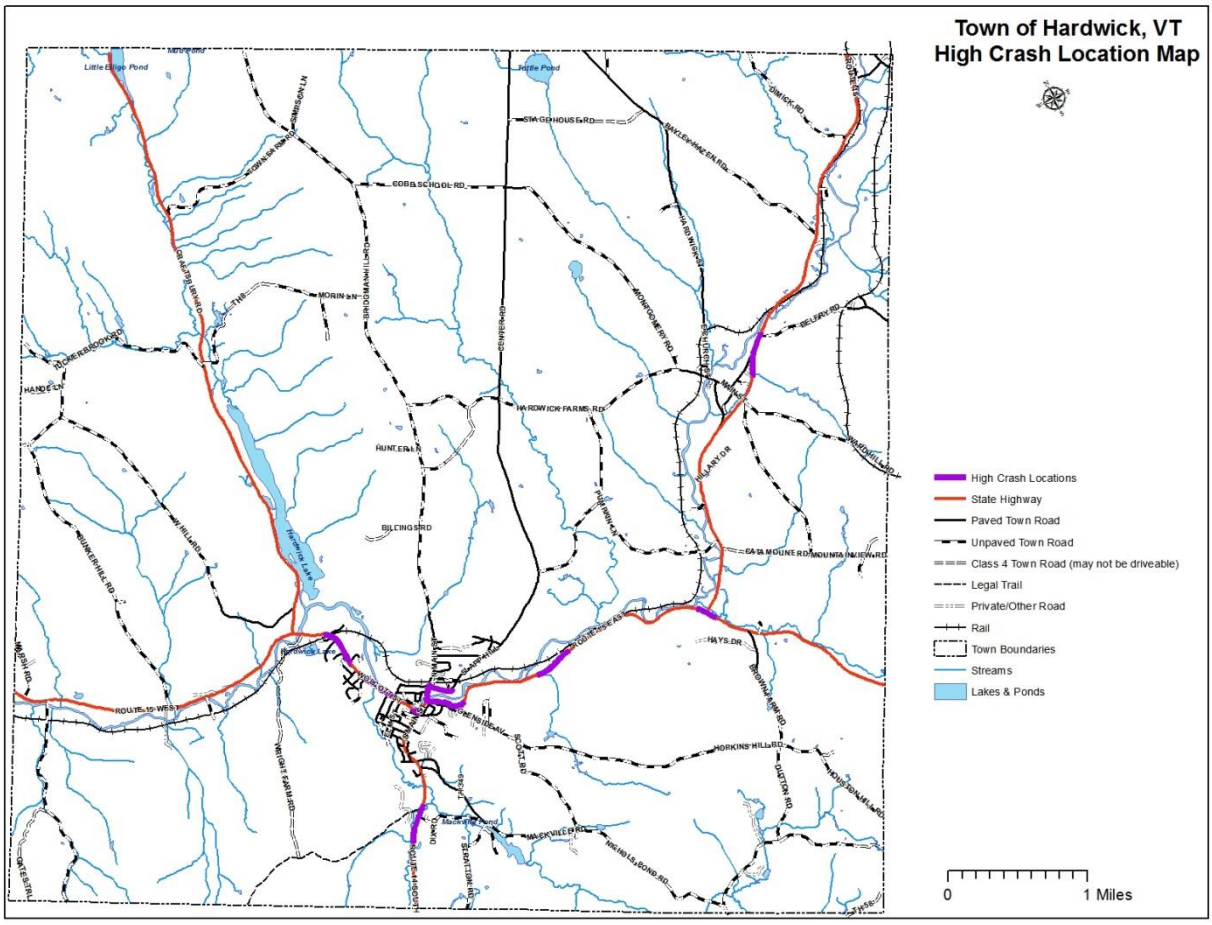
	Fire Chief	Summer 2024 on on-going as needed	Other Hazard Awareness Programs	

APPENDICES

Appendix A: Maps



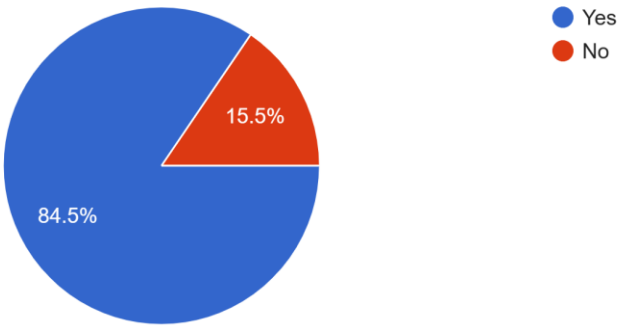

Town of Hardwick, VT
Flood Hazard Map
Building Locations
State Highway
Paved Town Road
Unpaved Town Road
Class 4 Town Road (may not be driveable)
Legal Trail
Private/Other Road
Rail
Floodway
Town Boundaries
Lakes & Ponds
Streams
Special Flood Hazard Areas
A
AE
500 Year Flood Area
0
1 Miles


Town of Hardwick, VT
High Crash Location Map
High Crash Locations
State Highway
Paved Town Road
Unpaved Town Road
Class 4 Town Road (may not be driveable)
Legal Trail
Private/Other Road
Rail
Town Boundaries
Streams
Lakes & Ponds
0
1 Miles

Appendix B: Community Outreach Survey Results

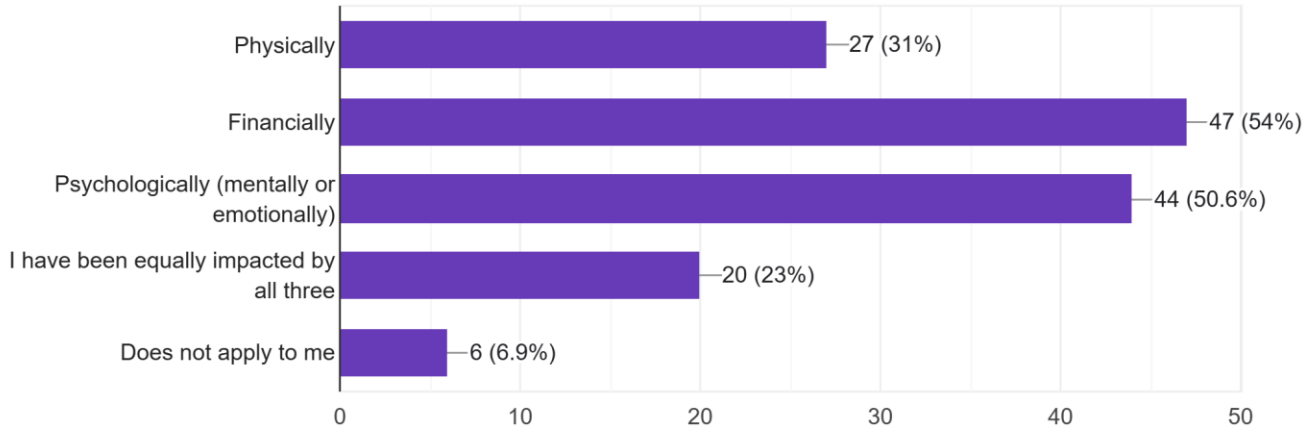
Have you ever been impacted physically, financially, or psychologically by a natural disaster in Hardwick?

97 responses



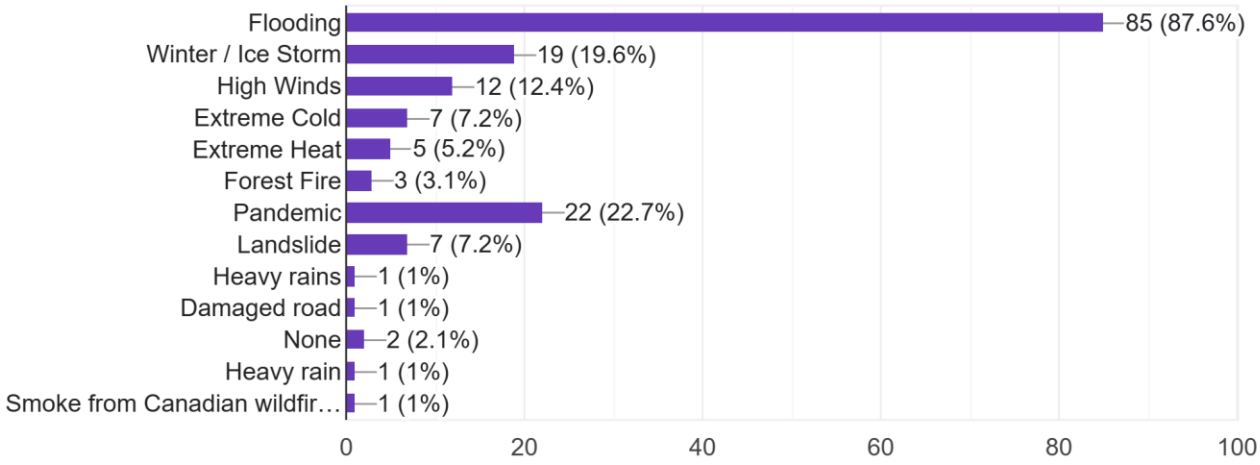
If you answered yes above, which best describes how natural disaster's have impacted you?

87 responses



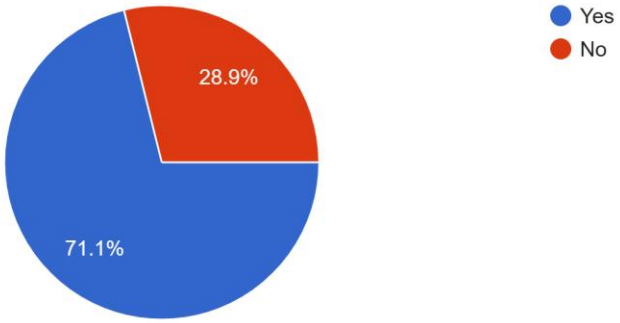
Which Hazard(s) was/were the cause of the disaster you experienced in Hardwick?

97 responses



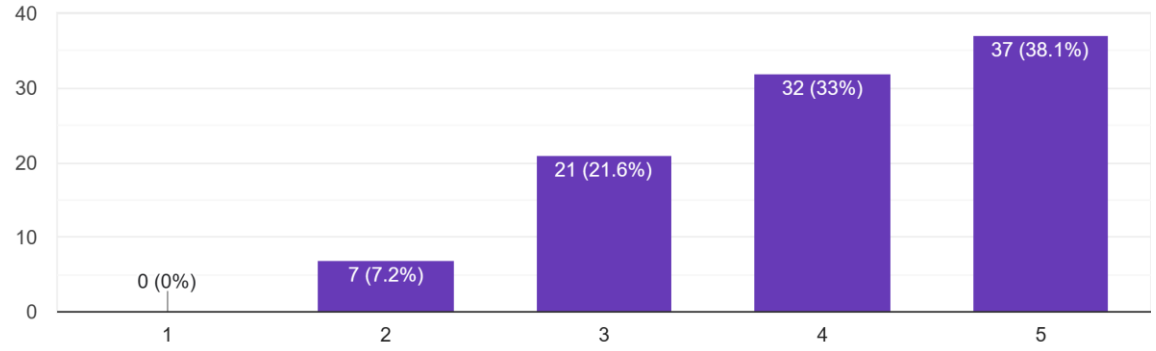
Has a road washout impacted your daily travels?

97 responses



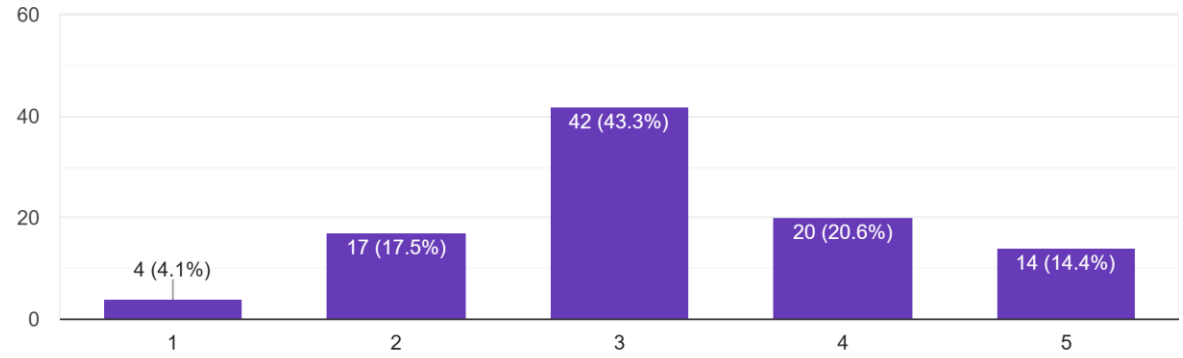
How concerned are you about flooding?

97 responses



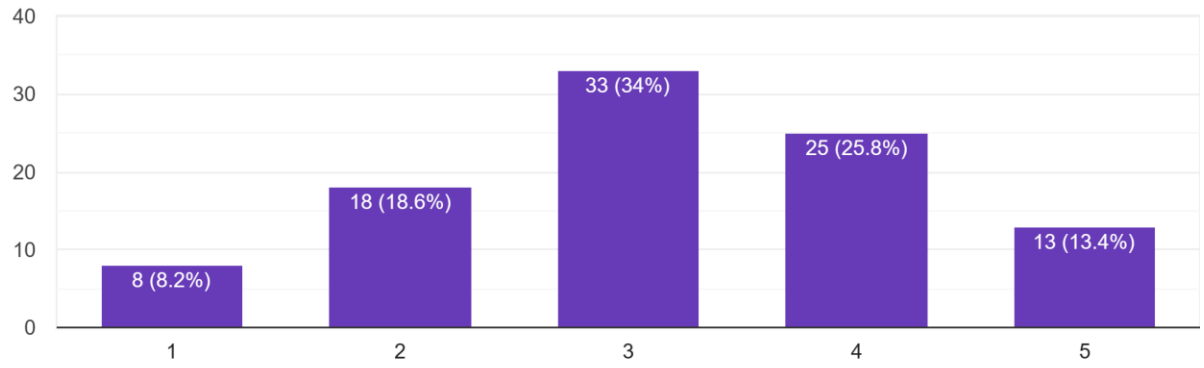
How concerned are you about winter / ice storms?

97 responses



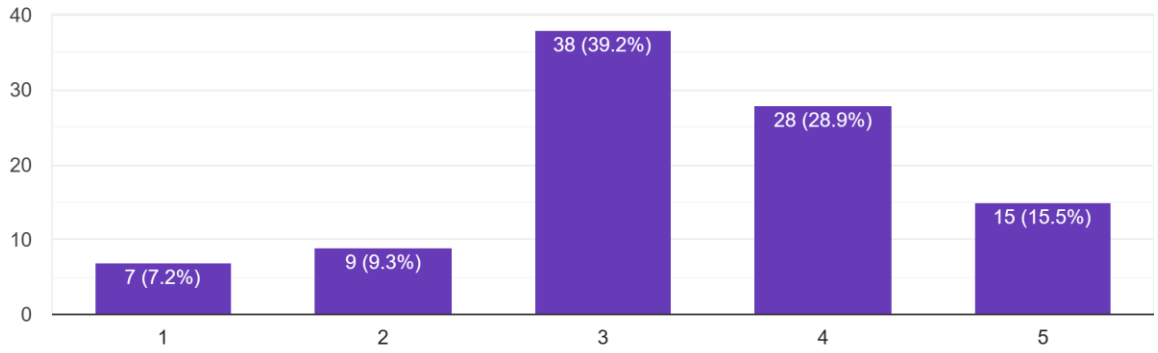
How concerned are you about high winds?

97 responses



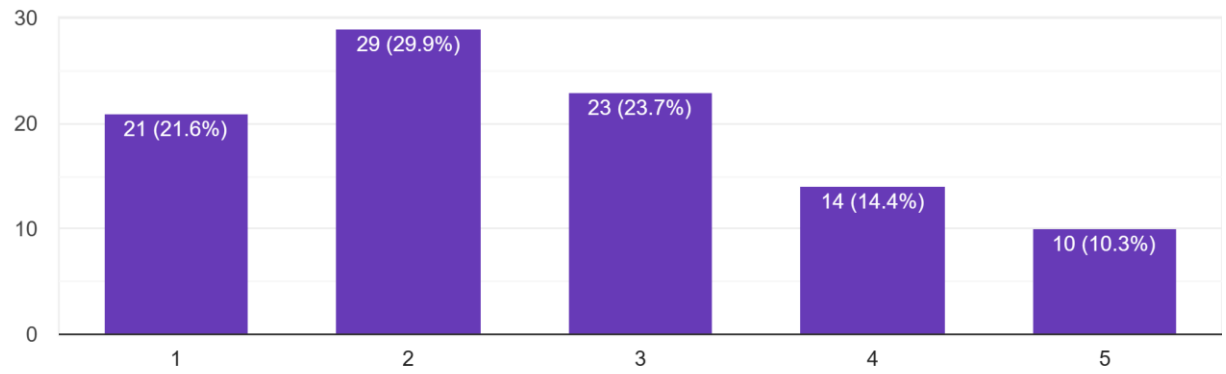
How concerned are you about extreme cold or heat?

97 responses



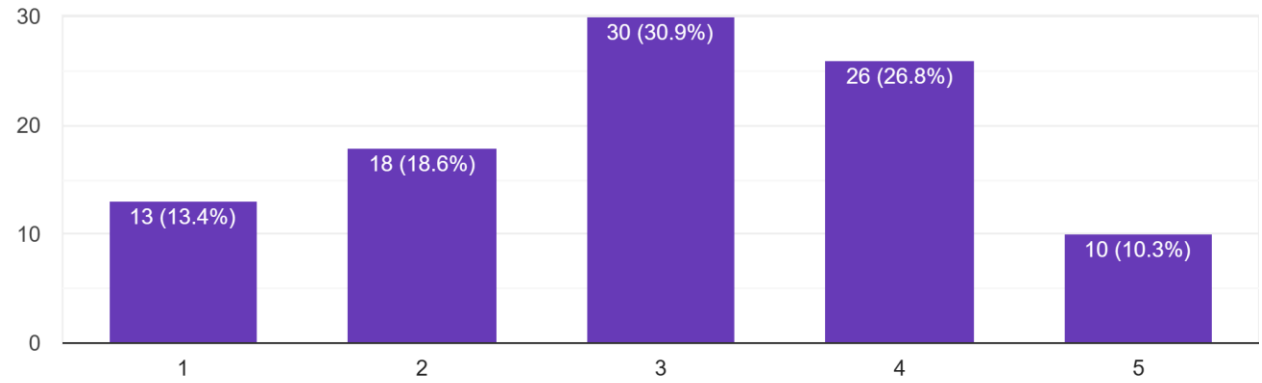
How concerned are you about wildfires?

97 responses



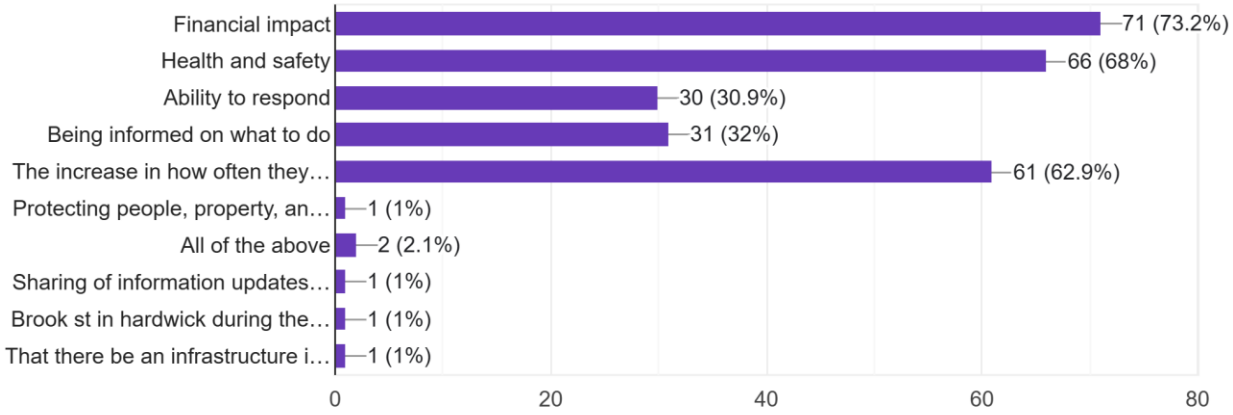
How concerned are you about another pandemic?

97 responses



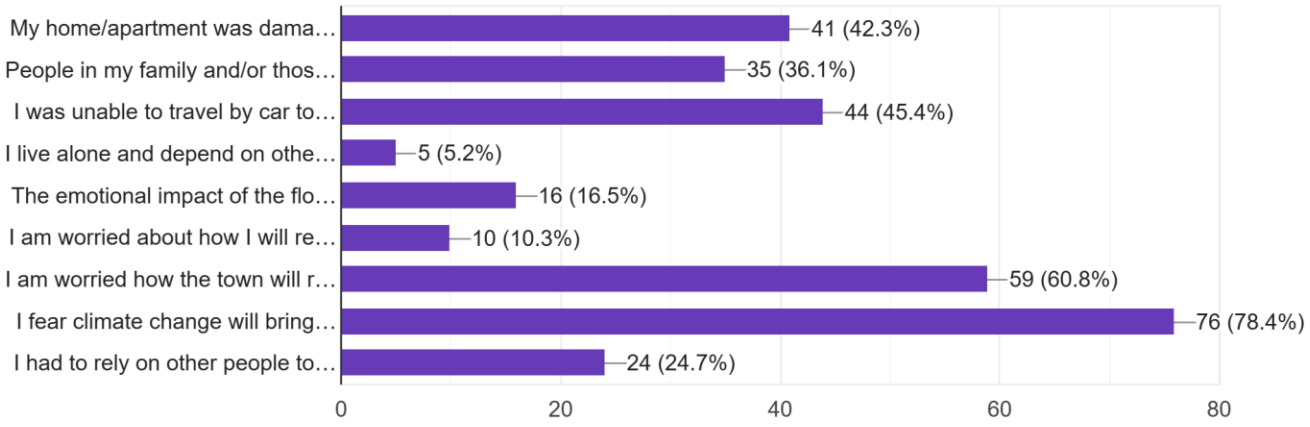
What concerns you the most about natural disasters in Hardwick?

97 responses



Which of following apply to you related to the most recent flooding event in Hardwick?

97 responses



Additional comments and concerns. 16 responses

the brook is too close to the house next time it will eat at my foundations i don't feel safe here

I'm on a bluff above the river....storms have been eroding the bank directly below my back porch to the point that my home is only feet away from dropping into the river. I am scared every time it rains. I live alone and afraid whenever it rains!

I depended on front porch forum mostly and wcax postings on Google/my phone. A lot of people were truly stressed, myself included. Communication got better as time went on. We need a town wide disaster communication plan , one that people can turn to immediately! Our town manager was great. We can do this!
Worried about the recovery of so so many of the small businesses and what will happen to Vermont's economy.....
As a member of Hardwick Rescue, the recent flooding and also during Irene, cut Hardwick off from both patients who needed transport and hospitals. It is of great concern to not be able to meet patient's needs at a time of emergency. Thus the ability to protect our roadways as much as possible during flooding is an important part of future planning. It is acknowledged that this is not an easy task with the miles of rural back roads in our area.
There needs to be a bigger culvert on Nichols Pond Rd. - it was either blocked, or insufficient, and broke through the road, causing a deluge of an unbelievable amount of water. It cause damage on my property and impacted others below badly, ultimately probably taking out Carey Rd.
Althought the direct damage was limited to our driveway, the extreme and extended humidity caused moisture to condense in our basement and cause extensive mold issues there and throughout our house. I would imagine this is the case for many others in old homes in the area as well. In addition, my husband was unable to go to work for around a week and we spend considerably more on gas when we lost direct access to Hardwick for errands and daily needs
I'm thinking that Jackson dam should be removed to mitigate flooding.
The impact of food insecurity rising
In the past the state used to dig out the river beds and used the gravel and fill for road construction. Fish moved to safety and returned to deeper and better living space. Also we have a great granite supply. Why is it we don't use large granite blocks to build our bridges and shore up our river banks where flood endangers them. This is just common sense. Granite would last well over a hundred years, so while it would be expensive initially, it would be almost permanent.
We lost our vehicle in the flooding and lack of public transportation options means we are isolated and I use my bicycle for groceries.
Brook st in hardwick during the last flooding was never but the corner on granite Street did get evacuated
While we were not directly impacted in any big way by the flood itself, we did experience some damage to stored items and washouts at the entrance to our lane. The bigger issue, for us, was watching others we care about suffer great losses (including our community, in the loss of: the Com Grdn @ Atkins & Frmer's Mrkt. for some weeks; friends' houses flooded or destroyed; and beloved farms having to suffer a loss of some of their best fields and crops). Despite the *heroic* efforts -- and results -- on the part of: the Neighbor-to-Neighbor group; Civic Standard; Town Manager/Clerk and Town Road Crew; the Food Pantry and CAE; and Red Cross/Hazen Management; and teams of volunteers from other towns, we are aware of the need to do better in *disaster preparedness* and *disaster resilience* -- as well as communicating the emergency/recovery plans to a broader spectrum of the community (in a variety of ways: social media, and flyers/white boards in central locations, etc. since some people did not have access to

electricity/phones, etc. as the events unfolded). It is clear that, with the climate emergency now upon us, this will be crucial going forward.
This devastation needs to be used as a opportunity/reason to look at the infrastructure of our town/community and prepare it for more of this type of weather extremes.....
Casey, I would be interested in serving on any disaster mitigation/resilience committee.
My flood damage was minor compared to others including family members. I plan some storm hardening for my home and backup heating as I believe that ice storms are also likely.

Appendix C: 2017 Mitigation Action Status Summary

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Status
Continue fluvial geomorphology assessments and develop strategies in response to identified risk.	VT DEC, NVDA, VT ANR	Spring 2019–Fall 2022	Fluvial Geomorphic Assessments	The town will work with DEC through coordinated meetings, workshops, and communication to increase understanding of current findings and develop an applicable framework to help guide decisions related to priority infrastructure work and vulnerability	Not Complete. Awaiting updated River Corridor and FEMA Floodplain maps
	NVDA, VT ANR	Fall 2018	Fluvial Erosion Hazard Mapping	Develop a fluvial erosion hazard map for the waterways, using the GIS extension known as SGAT (or Stream Geomorphic Assessment Tool) for assessed stream reaches. As assessments are completed, a map of all assessed waterways in the town will be created.	Not done and no longer pursuing due competing demands.
	Planning Commission and Selectboard, NVDA	Spring 2019	River Corridor Management Plans –	Using the River Corridor Maps, the town will develop an outreach strategy to residents/structures in or near the defined corridor. This communication should focus on flood resilience measures and opportunities. With the lack of repetitive loss properties in the town, the likelihood of viable HMGP acquisition projects is low but increasing awareness of this	Not done and will continue this work once new maps are acquired.

				program can serve the town well.	
	Hardwick Planning Commission	Summer 2018-Summer 2021	Fluvial Erosion Hazard Mitigation Implementation	The town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms, or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.	Complete. Flood resilience strategies, goals, and policies updated in Municipal Plan and Zoning
	Hardwick Planning Commission	Summer 2018	Administrative and Zoning Regulations:	Zoning administrator will work with town officials and residents to determine if a "Zero Development" policy in high flood/erosion risk areas is required in the town and progress accordingly.	Complete
Action	**Primary Responsible Entity**	**Timeline**	**Task**	**Brief Description**	**Progress**
Improve road infrastructure and municipal systems protection programs	Road Foreman, Commission	Winter 2017 – Winter 2022	Infrastructure Assessment for Storm Water Vulnerability	Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts, and other storm water management	Complete

				infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. The infrastructure will be evaluated regularly prior to replacement or upsizing of the existing infrastructure.	
	Road Foreman, Commission	Winter 2017 – Winter 2022	Continued Monitoring of Vulnerable Infrastructure	Monitor bridges and culvert locations that have erosion and scouring concerns and track	Complete
	Road Foreman	Winter 2017 – Winter 2022	Road Improvements and Landslide Protection	Within political and financial restraints, re-engineer certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects, numbered by priority (details included in Road Erosion Site Inventory) include: **Cobb School Road (800'), Bunker Hill Road (1200'), Browns Farm Rd. (700'), Ward Hill (600'): All of these locations will receive ditching and stone enhancement work and if required based on substantiated need, upgraded culverts. Stone size for ditching will be in line with AOT standards.** **Complete planning study to assess efficacy of installing duckbill gates on storm drains in Village along Cooper Brook near Bridge 43 and 66. Also assess efficacy and feasibility**	Complete

				of lowering elevation south of river and/or dredging. Develop procedure for ongoing lockdown of manholes during high-rain events **Assess efficacy and feasibility of installing and maintaining drop-down barricades for wastewater treatment facility. Assess and develop plan to protect structures in NFIP** **Increase capability of HED to mitigate outages through budgetary allotment, planning and consistent mitigation of risk variables.**	
	Road Foreman, Commission	Winter 2017 – Winter 2022	Documenting	Develop a methodology that serves to efficiently capture work and expenditures on sites and keep this information at the town office.	Complete
	Road Foreman, Commission	Winter 2017 – Winter 2022	Increase Awareness of Funding Opportunities	Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized through trainings and communication with the State Mitigation Office.	Complete
	Road Foreman, Commission	Winter 2017 – Winter 2022	ICS Training and Emergency Operations (SOP) Plan Development	Enhance knowledge of the principles of ICS and develop a Standard Operating Procedures that details the relationship, roles and responsibilities of the Highway Department and Road	Complete with latest EOP completed in 2020.

				Commission during major events.	
Maintain and improve resilience to severe winter storms	Selectboard, EMD	Winter 2017 – Winter 2022	Improve Existing Shelter Capability	Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.	Partially completed and work of community organizations is ongoing to support this initiative.
	Selectboard, HED	Winter 2017-Winter 2022	Reduce risk of power failure due to ice storms:	Enhance collaboration between town road foreman and electric company related to down-limbed induced power failure. Maintain function of generator	Complete
	Selectboard, HED,EMD, Shelter Lead	Fall 2018-Winter 2018	Notification	Develop a notification /communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)	Complete/CARE Registry promoted on Town site
	EMD, HED, NVDA	Winter 2017-Winter 2022	Residential Programs	Provide guidance and communication to residents on the structural and mechanical actions that can	Complete

				occur to reduce risk to severe winter storms (e.g. weather-proofing, anchoring, alternative heating sources, tree trimming, financial programs, etc.)	
	Road Foreman/Commission	Winter 2017- Winter 2022	Continue to monitor roads for safe and effective plowing: structure and recommended practices	Efficient snow removal is the foundation to winter storm (snow) events, assuring roads are plowable before winter remains an important facet of highway department functions	Complete
	Road Foreman/Commission	Winter 2017- Winter 2022	Increase awareness of ICS	The town can mitigate the effects of a severe winter by understanding how a large-scale storm is managed when the State EOC is operational. Additional awareness of local-level roles and responsibilities during statewide event is a mitigation action.	Complete
Reduce impact of extreme cold durations	Planning Commission, HED	Summer 2018- Winter 2022	Economic Resilience	Establish program for assistance in paying heating bills during crisis situations, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services.	Complete
	EMD, Shelter Leads, Selectboard	Summer 2018- Winter 2022	Maintain Existing Shelter Capability:	Maintain and improve capabilities of existing shelters. Notification	Partially Complete

				procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.	
	EMD, Fire and EMS Chiefs	Summer 2018-Winter 2022	Assess Vulnerable Population	Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.	Complete through promotion of CARE registry. Neighbor to Neighbor, Food Pantry, and The Civic Standard doing excellent work to support this.
	EMD, Fire and EMS Chiefs	Summer 2018-Winter 2022	Notification and Education	Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational resources for	Neighbor to Neighbor, Food Pantry, and The Civic Standard doing excellent work to support this.

				homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting through a yearly public service campaign.	
Increase resilience of mobile homes through accepted structural modifications and resident awareness of programs and opportunities	EMD, Hardwick Fire Chief, Selectboard	Fall 2018-Winter 2021	Collect recommendations from both UVM and ACCD programs devoted to MH resilience	Both entities have completed work that is accessible and free to towns	Not done and no longer considered a necessary action due to lack of need.
	EMD, Hardwick Fire Chief	Fall 2018-Winter 2021	Develop outreach mechanism that serves to address needs, resources and agencies that can assist the resident and/or owner of the MH. Develop and/or acquire informational brochure regarding accepted mitigation actions specific to mobile homes (e.g. anchoring home and fuel tanks, elevating electric and	See above	Complete. Neighbor to Neighbor, Food Pantry, and The Civic Standard doing excellent work to support this.

			furnaces, etc.) and distribute to residents in most economical way. UVM program and ACCD have the recommendations and information to use		
	Planning Commission	Fall 2018-Winter 2021	Work with NVDA to map all mobile homes in the town and use this map to assess flood risk, create risk ranking and gauge outreach accordingly	UVM program may be able to support work as well	Not done and no longer considered necessary due to anticipated updates to floodplain and river corridor maps.
Reduce risk and impact of hazardous materials incident	EMD, Facility leads, Hardwick Fire Chief, NVDA, Selectboard	Spring 2019-Fall 2020	Work with facility leads	Increasing understanding of risk factors and what can be done to mitigate and enhance training and skills for response to major highway accidents is advantageous	Not done and not pursuing due to competing demands and low benefit-cost.
	EMD, Facility leads, Hardwick Fire Chief, NVDA, Selectboard	Spring 2019-Fall 2020	Develop understanding of likely chemical characteristics and what area would be impacted under likely scenarios involving discharge/spill	Similar to above	Not done and not pursuing due to competing demands and low benefit-cost.
	EMD, Facility leads, Hardwick Fire Chief, NVDA, Selectboard	Spring 2019-Fall 2020	Explore using HMGP funding to increase awareness, knowledge, and collaboration a means to developing future mitigation actions	With competent management, this funding source can move understanding and coordination forward in a short amount of time	Not done but with DR4720 impact, the town will be seeking mitigation assistance during next planning cycle.
	EMD, Facility leads, Hardwick Fire Chief, NVDA, Selectboard	Spring 2019-Fall 2020	Explore using Homeland Security exercise planners to develop tabletop exercise based on likely scenarios	An excellent way to test response and free	Not done and not pursuing due to competing demands and low benefit-cost.
Raise public awareness of hazards, hazard mitigation and disaster preparedness.	Emergency Management Director; Hardwick Fire Chief	2018	Hazard Resilience for Property Owners-	Develop and maintain education materials to inform property owners on how to protect their homes and businesses through accepted hazard resilience	Complete

				actions (e.g. securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.).	
	Emergency Management Director; Hardwick Fire Chief	2018	HMGP Awareness:	Attend informational sessions on the HMGP funding opportunities for acquisition, elevation, and flood-proofing projects. Work with NVDA to develop an information brochure for residents.	Complete
	Emergency Management Director; Hardwick Fire Chief	2018	School Programs	Assure the school is structurally ready to handle natural hazard risks to the greatest extent possible. Continue school programs to raise student awareness of hazards, safety, preparedness, and prevention. Explore establishing the school emergency notification system as the primary methodology for all emergency notification procedures and build in the contact information accordingly.	Complete
	Emergency Management Director; Hardwick Fire Chief	2018	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety,	Complete

				preparedness, and prevention.	
	Emergency Management Director; Hardwick Fire Chief, School, Selectboard	2018	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness, and prevention.	Complete
	EMD, NVDA, LEPC		Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate as directed by the state department of health and its jurisdictional offices of local health	Complete
Reduce vulnerability to high wind events with accepted best practices	HED, Planning Commission	Winter 2017 –Winter 2022	Developing and maintaining a database to track community vulnerability to severe wind:	Use GIS to map areas that are at risk to the wind hazard associated with different non-hurricane conditions and identify concentrations of at-risk structures. Create a severe wind scenario to estimate potential loss of life and injuries, the types of potential damage, and existing vulnerabilities within a community to develop severe wind mitigation priorities.	Not done and not pursuing due to competing demands and low benefit-cost.
	HED, Planning Commission	Winter 2017 –Winter 2022	Establish standards for all utilities regarding tree pruning around line:	Incorporate inspection and management of hazardous trees into the drainage system maintenance process. Support and	Complete

				suggest the testing of power line holes to determine if they are rotting. Support the inspection of utility poles to ensure they meet specifications and are wind resistant. When feasible, support burying power lines to provide uninterrupted power after severe winds. Avoid use of aerial extensions to water, sewer, and gas lines when possible. Support use of designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.	
	HED, Planning Commission	Winter 2017 –Winter 2022	Public Outreach:	Ensure that school and hospital officials are aware of the best area of refuge in buildings and that their plans are viable in high wind mitigation events. Instruct property owners on how to properly install temporary window coverings before a storm. Support education to design professionals to include wind mitigation during building design/modification to an extent deemed necessary.	Not done and not pursuing due to competing demands and low benefit-cost.

Appendix D: Glossary of Terms and Acronyms

Base Flood Elevation (BFE) - the elevation of the water surface elevation resulting from a flood that has a one percent chance of equaling or exceeding that level in any given year. On the Flood Insurance Rate Map the elevation is usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the Flood Insurance Study report, or the average depth of the base flood, usually in feet, above the ground surface as defined in Vermont DEC Flood hazard Area and River Corridor Protection Procedures December 5, 2014.

Critical facilities -facilities that provide services or functions related to public health and safety during emergency response and recovery and facilities that must be protected to a higher standard to protect public health and safety.

Declaration - Presidential finding that a jurisdiction of the United States may receive Federal aid as a result of damages from a major disaster or emergency.

Emergency - Any occasion or instance for which, in the determination of the President, Federal assistance is needed to supplement State and Local efforts and capabilities to save lives and to protect property and public health and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. Defined in Title V of Public Law 93-288, as amended, Section 102(1); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Federal Emergency Management Agency (FEMA) - The lead Federal agency with responsibility for responding to Presidential emergencies and major disasters. FEMA's mission is to reduce loss of life and property and protect our Nation's critical infrastructure from all types of hazards through a comprehensive, risk-based, emergency management program of hazard mitigation, preparedness, response, and recovery.

Flood Insurance Rate Maps (FIRMS) - The official map of a community prepared by FEMA, showing base flood elevations along with the special flood hazard areas and the risk premium zones.

Flood Mitigation Assistance Program (FMA) - Provides pre-disaster grants to State and local governments for both planning and implementation of hazard mitigation strategies. Each State is awarded a minimum level of funding that may be increased depending upon the number of NFIP policies in force and repetitive claims paid. Grant funds are made available from NFIP insurance premiums, and therefore are only available to communities participating in the NFIP.

Fluvial Erosion Hazard (FEH) - those hazards related to the erosion or scouring of riverbeds and banks during high flow conditions of a river as defined in Vermont DEC Flood hazard Area and River Corridor Protection Procedures December 5, 2014.

Hazard – an emergency or disaster resulting from– (A) a natural disaster; or (B) an accidental or man-caused event. Defined in Title VI, Emergency Preparedness of Public Law 93-288, as amended, Sec. 602. Definitions (42 U.S.C. 5195a); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

Hazard Mitigation - Sustained actions taken to reduce or eliminate the long-term risk to people and property from hazards and their effects.

Hazard Mitigation Grant Program (HMGP) – a program authorized under Section 404 of the Stafford Act, 42 U.S.C. 5170c that provides funding for cost-effective hazard mitigation projects in conformance with the post-disaster hazard mitigation plan required under Section 409 of the Stafford Act.

Hazard Mitigation Plan - The plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in society that includes the actions needed to minimize future vulnerability to hazards.

Hazardous Materials (HazMat) – all petroleum and toxic, corrosive, or other chemicals and related sludge included in any of the following: (a) Any substance defined in CERCLA § 101(14); (b) Petroleum, including crude oil or any fraction thereof; or (c) Hazardous waste. Defined in Vermont statute Title 10, Chapter 159, Waste Management, Subchapter 001, section 6602 definitions. Note: “Hazardous material” does not include herbicides and pesticides when applied consistent with good practice conducted in conformity with federal, state, and local laws and regulations and according to manufacturers' instructions.

Hazardous waste - means any waste or combination of wastes of a solid, liquid, contained gaseous, or semi-solid form, including but not limited to those which are toxic, corrosive, ignitable, reactive, strong sensitizers, or which generate pressure through decomposition, heat or other means, which in the judgment of the Secretary may cause, or contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, taking into account the toxicity of such waste, its persistence and degradability in nature, and its potential for assimilation, or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other living organisms, or any matter which may have an unusually destructive effect on water quality if discharged to ground or surface waters of the state. All special nuclear, source, or by-product material, as defined by the Atomic Energy Act of 1954, as amended, codified in 42 U. S. C. § 2014, is specifically excluded from this definition. Defined in Vermont statute Title 10, Chapter 159, Waste Management, Subchapter 001, section 6602 definitions.

Invasive Species - The National Invasive Species Council defines an invasive species as one that is non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

Major Disaster - Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States that, in the determination of the President, causes damage of sufficient severity and magnitude to warrant major disaster assistance under the Stafford Act, above and beyond emergency services by the Federal Government, to supplement the efforts and available resources of States, local governments, and disaster relief organizations in alleviating the damage, loss, hardship, or suffering caused thereby defined under Public Law 93-288.

Mitigation - One of the four phases in emergency management. Preventing future emergencies or minimizing their effects. Includes any activities that prevent an emergency, reduce the chance of an emergency happening, or reduce the damaging effects of unavoidable emergencies. Example: Buying flood and fire insurance for your home is a mitigation activity. Mitigation activities take place before and after emergencies.

National Flood Insurance Program (NFIP) - Provides the availability of flood insurance in exchange for the adoption and enforcement of a minimum local floodplain management ordinance. The ordinance regulates new and substantially damaged or improved development in identified flood hazard areas.

Natural disaster - The term "natural disaster" means any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, or other catastrophe in any part of the United States which causes, or which may cause, substantial damage or injury to civilian property or persons. Defined in Title VI, Emergency Preparedness of Public Law 93-288, as amended, Sec. 602. Definitions (42 U.S.C. 5195a); The Robert T. Stafford Disaster Relief and Emergency Assistance Act.

NOAA's National Centers for Environmental Information (NCEI) – a consolidation of the former National Climatic Data Center, the National Geophysical Data Center, and the National Oceanographic Data Center. NCEI is responsible for preserving, monitoring, assessing, and providing public access to the Nation's comprehensive atmospheric, coastal, oceanic, and geophysical data.

Preparedness - One of the four phases in emergency management. Preparing to handle an emergency. Includes plans or preparations made to save lives and to help response and rescue operations. Example: Evacuation plans and stocking food and water are both examples of preparedness. Preparedness activities take place before an emergency occurs.

Recovery - One of the four phases in emergency management. Recovering from an emergency. Includes actions taken to return to a normal or an even safer situation following an emergency. Activities necessary to rebuild after a disaster. Recovery activities include rebuilding homes, businesses, and public facilities; clearing debris; repairing roads and bridges; and restoring water, sewer, and other essential services. Recovery includes getting financial assistance to help pay for the repairs. Recovery activities take place after an emergency.

Response- One of the four phases in emergency management. Responding safely to an emergency. Includes actions taken to save lives and prevent further property damage in an emergency situation. Response is putting your preparedness plans into action. Examples: Seeking shelter from a tornado or turning off gas valves in an earthquake are both response activities. Response activities take place during an emergency.

River corridor - the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition and for minimization of fluvial erosion hazards, as delineated by the Vermont Agency of Natural Resources in accordance with the ANR River Corridor Protection Procedures. 38 10 V.S.A. § 1422(12).

River corridor protection area - the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for riparian buffers. As delineated by the Vermont Agency of Natural Resources in accordance with the ANR River Corridor Protection Procedures. 38 10 V.S.A. § 1422(12).

Special flood hazard area - is synonymous with "flood hazard area" and "area of special flood hazard" (44 C.F.R. § 59.1) and is the floodplain within a community subject to a one percent or greater chance of flooding in any given year. This area is usually labeled Zone A, AO, AH, AE, or A1-30 in the most current flood insurance studies and on the maps published by FEMA.

Sustained action – to support and continue for an extended time or without interruption; to maintain, to keep in existence, to continue.

Vermont Agency of Commerce and Community Development (ACCD) – state agency with three main departments and a variety of programs to support economic and community development needs of Vermont. The three departments are: Department of Economic Development, Department of Housing and Community Development, and the Department of Tourism and Marketing.

Vermont Agency of Natural Resources (VT ANR) – state agency that promotes the sustainable use of Vermont's natural resources, protects, and improves the health of Vermont's peoples and ecosystems, and promotes sustainable outdoor recreation.

Vermont Agency of Transportation (VT AOT) – state agency that provides for the safe and efficient movement of people and goods by planning, developing, implementing, and managing a statewide transportation network - including roads, bridges, railroads, airports, park-and-rides, bicycle and pedestrian facilities, and public transportation facilities and services.

Vermont Department of Environmental Conservation (VT DEC) – a department in the state Agency of Natural Resources whose mission is to preserve, enhance, restore, and conserve Vermont's natural resources and protect human health for the benefit of present and future generations.

Vermont Emergency Management (VEM) – part of the Department of Public Safety, Division of Emergency Management and Homeland Security (DEMHS). VEM provides support and aid to Vermont's Local Emergency Management Directors, Local Emergency Planning Committees, Regional Planning Commissions, Community Emergency Response Teams, state agencies, and emergency response providers in an effort to ensure the state's resilience to disasters.

"Vermont addresses emergencies and disasters through two statutes. The Civil Defense Act created the state Emergency Management Division, gives the governor emergency powers, authorizes the rendering of mutual aid, and declares that all emergency management functions be coordinated with the federal government. The Internal Security and Public Safety Act provides for a declaration of a state of emergency and activation of an emergency disaster preparedness plan for the state and counties. Financial and other aid is provided by the state emergency relief and assistance fund, and through grants and loans from both federal and private sources. The governor is authorized to declare a state of emergency, and the state emergency board and local legislative boards may vote to terminate emergencies."

Appendix E: NtN DR4720 Service Synopsis

Hardwick Area Neighbor to Neighbor
August 2, 2023
Summary of flood related activity:

● The Jeudevine library staff, along with two NtN volunteers, fielded numerous email and phone requests for assistance. These two contact means were established when NtN was founded and continue to be active year round.
● Expanded our existing volunteer list to now include 120 potential volunteers.
● Repeatedly solicited volunteer assistance throughout the last two weeks, working collaboratively with the Civic Standard to mobilize and coordinate volunteers for on-site help.
● Assumed responsibility for the Supply Center (secure donations, greet and help direct supply center users, introduce NtN assistance opportunities) on July 14. This was located at the Senior Center. It was open 7:00AM-7:00PM and staffed for three 4 hour shifts daily, involving 18 different NtN volunteers. The Center closed at 5:00 PM on July 30. Volunteers were largely from Hardwick but also traveled from St J. Lyndonville and Waterford.
● Secured a $2,000 donation from The Prevot Family Foundation to fund the purchase of 6 dehumidifiers, which were immediately secured and disseminated to a wait list.
● Collaborated with the town to manage the disbursement of 15 additional dehumidifiers, now tracking this inventory (43 different transactions since 7/18).
● Currently managing the return/re-distribution of sump pumps and shop vacs
● One NtN volunteer organized a work day (July 26) with 22 youth and 4 adults, addressing basement, yard and barn flood damage at 5 Hardwick houses. They took 8 big truck beds, a dump truck and a large trailer full of things to the dumpsters.
● Organized a Financial Assistance Advocate initiative, spearheaded by Annie Houston. Annie has expertise in financial resources for flood victims. NtN will support her logistically to train and support 12 volunteers (already recruited) who will provide one-on-one advocacy for an individual or business pursuing flood funding (filling out applications, identifying sources as they emerge, assisting with documentation/report filing). This initiative will be launched in mid-August.
● Posted information about resources over social media.
Follow-up future efforts:
● Secured a $3,000 from the Flood Response and Recovery Fund (Vermont Community Foundation) to underwrite expenses for fall/winter NtN neighborhood gatherings with Opie, following the “Meet the New Town Manager” model established last year. This funding will also help offset expenses of establishing the Financial Assistance Advocate

initiative and any other means to assist the community rebuilding process in the coming months.

● Create a database of able bodied individuals willing to be hired to help out with physical labor tasks (while continuing to secure volunteers for a wide variety of services as well).

● Many volunteers have come forward with a wish to be more deeply involved in Hardwick Area Neighbor to Neighbor. The core committee will be renewing its efforts with this larger local volunteer base in the coming months.