

*Adopted by the Town of Northfield on October 10, 2023*

## **Town of Northfield, Vermont**



## **All-Hazards Mitigation Plan Update**

**Town of Northfield  
51 South Main Street  
Northfield, Vermont 05663  
(802) 485-6121  
Public Assistance Applicant #: 023-50275-00**

Prepared by:

Town of Northfield, Vermont

CERTIFICATE OF LOCAL ADOPTION

Northfield, Vermont

A Resolution of Northfield, Vermont Adopting  
the Update to the All-Hazards Mitigation Plan

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

WHEREAS, Northfield has prepared a multi-hazard mitigation plan, hereby known as the 2023 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

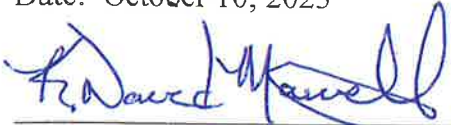
WHEREAS Northfield identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Northfield from the impacts of future hazards and disasters; and

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

NOW THEREFORE, BE IT RESOLVED BY NORTHFIELD VERMONT THAT:

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

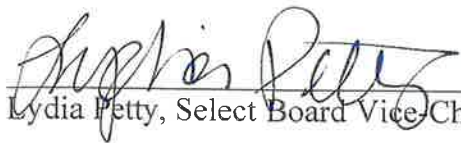
Date: October 10, 2023



K. David Maxwell, Select Board Chair



Merry Shernock, Select Board member

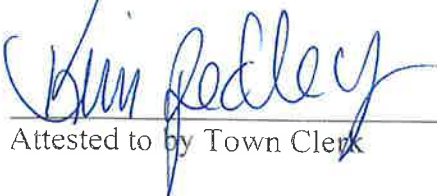


Lydia Petty, Select Board Vice-Chair

John B. Stevens, Select Board member



Charles L. Morse, Select Board member



Attested to by Town Clerk

## Executive Summary

In March 2023, the Town of Northfield began to develop this Local All-Hazard Mitigation Plan Update from the last approved plan from 2017. Following the historic flooding events of 2011, many communities were faced with needing an approved mitigation plan to allow for critical public assistance funding from FEMA. Northfield was one of these communities. The 2017 Northfield Local Hazard Mitigation Plan was an update of the 2011 plan and identified areas most vulnerable to the profiled hazards and defined proposed mitigation actions. Status of those actions are included in this plan update. The results of 2023 plan update are contained herein and represent the collaborative efforts of the newly formed Hazard Mitigation Planning Team and associated residents, towns 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 and surrounding municipalities, providing a formal opportunity to provide input and review relevant sections of the plan. Along these lines, the town has documented the planning process so that future updates can follow an efficient pattern in addition to capturing this important component as a means of establishing institutional memory. In realization that eligibility to receive federal hazard mitigation grants and optimize state-level reimburse or “match” dollars during a federally declared disaster is dependent on a federally approved plan, the town remains committed to sustaining its mitigation efforts and by developing this plan, will have a guide for action that will foster enhanced emphasis on mitigation in the years to come. There is now one legislative and managerial body in Northfield and any reference to “Village” and other distinct areas of town are for geographical reference only. The town realizes the importance of mitigation 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 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 Town Plan with specific municipal-level details on selected hazards.

**Section 3: Risk Assessment** discusses identified hazard areas in the town and reviews previously federally-declared disasters to identify what risks are likely in the future. This section presents a hazard risk assessment for the municipality, identifying the most significant and most likely hazards which merit mitigation activity. Building upon the identified hazards from 2011

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
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 in the most recent Town Plan that supports hazard mitigation 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 highway 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 damages 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, Select Board, and CVRPC and integrate the strategies into the existing town 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, 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 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 Planning Commission.

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## SECTION 1: INTRODUCTION AND PURPOSE

### 1.1 Purpose and Scope of this Plan

The purpose of this 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 Town Plan as well as efforts of CVRPC, 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 disaster resistant communities throughout Washington County.

### 1.2 Hazard Mitigation

The 2018 Vermont State All-Hazards 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 address their vulnerability more comprehensively. 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 with and/or benefits from the State’s 2018 Hazard Mitigation Plan and 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 Hazard Mitigation Grant Program (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 14<sup>th</sup>, 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 their 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, cultural, historical, 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.
- 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 CVRPC and will integrate the strategies into the existing Town 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 Town Plan Updates specific to flood resilience.

## **1.6 Community History and Background**

The Town of Northfield is the third most populous community in Central Vermont. It is located in the Southwestern quadrant of Washington County, approximately 10 and 13 miles from the cities of Montpelier and Barre, respectively. Northfield contains three population centers, considerable historic industrial development, and Norwich University. Norwich University is the nation's oldest private military college and contains approximately 2,000 Corps of Cadets and civilian students. The University is also home to the recently launched National Center for the Study of Counterterrorism and Cyber-Crime (NCatNU).

According to the 2020 U.S. Census, Northfield has a total population of 5918. This number includes the student population of Norwich University. The population has decreased 4.67% from the 2010 Census.

Northfield's Highway Department maintains 80 miles of roadway, including 45 bridges, 800 culverts, along with guard rails, signs and drainage and stormwater infrastructure. Highways are managed according to the adopted 2013 Vermont Road & Bridge Standards. The Town's major North-South thoroughfare is Vermont Route 12, which follows the course of the Dog River north of the Village. Vermont Route 12A intersects Vermont Route 12 below the Village and follows the Dog River south towards the Town of Roxbury. Further to the south Vermont Route 12 intersects Vermont Route 64, which provides connection to I-89 at Exit 5. Housing is widely dispersed both throughout the Town and within the Village, with approximately one-third of the

Town's population located within the Village. The Northfield Town Plan seeks to focus future development within the population centers of Northfield Village, Northfield Falls, and Northfield Center.

Since 2011 there has been Senior Housing development and expansion in the downtown/village area. New residential development has also occurred on Fairway Drive, with the building of three new homes. This area is outside of the existing population centers. The Town's commercial development is focused primarily within the Village, which is also a State Designated Village. The Village was designated as such to recognize this value, as well as the historic & cultural resources present there. Industrial activity is focused at the Nantanna Mill, just outside the village, and the Northfield Business Park.

The nature of commercial business activity in Northfield has changed significantly since 2011. Due both to changes in economic conditions, and for some businesses, losses incurred from Tropical Storm Irene and the COVID-19 pandemic resulted in complete shut down or relocation out of Northfield. These closures have resulted in the loss of many employees commuting daily into Northfield. All of the buildings and infrastructure supporting the businesses are still in place, however. Despite these losses, a few expansions or siting of new businesses have occurred since the last update. Potentially the most concerning change is the ability to attract and maintain employees across critical service organizations.

Land use patterns are reinforced by current zoning and flood hazard regulations. The changes in development described above both diminish and increase Northfield's vulnerability to hazards. The physical infrastructure remains in place and has no increased vulnerability due to location, but reduced maintenance and monitoring may create vulnerabilities. A smaller population is now in Northfield on a day-to-day basis, and the municipality has maintained all emergency response services, leaving the community's vulnerability unchanged to somewhat diminished. The expansion of business at the Nantanna Mill is located along the Dog River, and although it is out of the floodplain, much of it is vulnerable to fluvial erosion. The Nantanna Mill hosted three businesses during tropical storm Irene. The bakery and auto repair shop suffered extensive damage and were closed pending repairs. Wall/Goldfinger, though insurance made them whole as much as possible, could not get reinsured and had to move out of town.

Services provided by the Northfield municipality are overseen by a five (5) member volunteer Select Board. The volunteer Planning Commission is charged with developing the Municipal (Town) Plan, as well as the community's land use regulations. The Town employs approximately 30 staff members to carry out services to its residents.

In the Town, fire coverage is provided by the Northfield Fire Department which is made up of paid volunteers. Northfield is a member of the Capital Fire Mutual Aid System, which includes all the Towns in Washington County. The town has a Fire Warden and Assistant Fire Warden whose responsibilities include issuing burn permits and preventing wildfires. The Northfield Fire Department has an annual budget and Capital Improvement Plan.

Ambulance service is provided by the Northfield Ambulance Service and the Northfield Ambulance Volunteers, Inc. The two groups work in conjunction with each other to provide 24

hour Basic and Advanced level emergency medical care. In addition to servicing the Northfield community, the Ambulance Service also provides services to the communities of Roxbury and West Berlin. Northfield Ambulance also provides backup services to its surrounding communities upon request from authorized personnel. The Ambulance Service is housed in the Town Garage, which is located in the 0.2 percent annual chance floodplain of the Dog River. The Town would like to relocate this function to an area that is not in a flood hazard zone. Northfield Ambulance Service is owned and operated by the Town of Northfield, and Northfield Ambulance Volunteers Inc. is a 501(c)(3) nonprofit agency of membership that provides support services, fund raising, and community outreach for the Northfield Ambulance Service.

Police services are provided by the Northfield Police Department. The Department is staffed by a Chief of Police, 5 full-time officers, and 2 part-time officers. In addition to the Police Department, Norwich University provides private, on-campus security services. Vermont State Police and the Washington County Sheriff's Department are relied upon to provide supplementary support. The Municipality also has extensive emergency management vehicles and training. The Ambulance Service owns an all-terrain vehicle with toboggan for use in off trail rescues. The Municipality also owns a mass casualty incident trailer and mobile command post, which is offered for mutual aid use. Staff in the Fire and Police Department are also trained to use the Jaws of Life.

The Municipal Plan was adopted in 2020 and includes goals, policies, and tasks in regard to environmentally sensitive areas, water resources, earth resources, future land use, wastewater treatment, transportation, and public services. Northfield has implemented Land Use Regulations which include Subdivision and Zoning Bylaws. The land use regulations set out protections in town for water resource aquifers, wetlands, riparian zones and to manage stormwater, sediment, and erosion. The Zoning Regulations limit development on slopes greater than 25% and elevations greater than 1800 feet.

The Town's Floodplain Zoning Regulation has been in effect since April 2010 and is compliant for the jurisdiction's ongoing participation in the NFIP. Northfield has 54 NFIP policies and began participating in 1978. The flood hazard regulations include no new principal structures, storage, or fill in the floodplain or fluvial erosion hazard zone. Any new development requires project review from the Zoning Administrator (ZA), Zoning Board of Adjustments, and/or NFIP Coordinator at the Agency of Natural Resources in order to obtain a permit.

Enforcement actions are administered by the ZA. Notices of violations are mailed to the State NFIP Coordinator. If violations remain, the ZA shall submit a declaration to the Administrator of the NFIP requesting denial of flood insurance to the property.

Northfield is eligible under the Vermont Emergency Relief and Assistance Fund (ERAF) to receive state funding to match Federal Public Assistance funds after a federally declared disaster. Communities that take specific steps to reduce flood damage can increase the percentage of state funding they receive from 7.5% up to a maximum of 17.5%. At the time of this plan's development, Northfield has an ERAF rating of 17.5%. Northfield has taken the specific steps to reduce flood damage by 1) participating in the National Flood Insurance Program, 2) adopting standards that meet or exceed the current Vermont Roads and Bridge Standards 2013, 3)

adopting a Local Emergency Operations Plan which is renewed and adopted annually, 4) adopting a Local Hazard Mitigation Plan approved by FEMA, and 5) adopting Interim River Corridor protection standards. Northfield is one of numerous communities that adopted regulations for a subset of their watercourses (buffer setbacks, Phase 2 data-generated FEH overlays, or avoidance-based Flood Hazard Areas) prior to the ERAF Amendments that took effect on October 2014 and therefore have approved Interim River Corridor standards. In order to retain eligibility under the River Corridor Plan criteria of the ERAF and qualify for the maximum 17.5% rate, Northfield will need to update their interim river corridor standards to meet the Agency of Natural Resources (ANR) criteria within two years of ANR publishing a statewide river corridor map updated to include existing Phase 2 Stream Geomorphic Assessment (SGA) data. The data release, expected to occur at the end of 2016, has been delayed and the agency has not announced a new release date. The other option to qualify for the maximum ERAF rate is for Northfield to enroll in the NFIP Community Rating System (CRS) and adopt a bylaw that prohibits new structures in the Flood Hazard Area.

Information on ERAF Eligibility criteria – 17.5% State Share can be found at: <http://floodready.vermont.gov/sites/floodready/files/documents/ERAF17.5Criteria05282015.pdf> A copy of the criteria is an attachment to this plan.

Northfield’s Conservation Commission also promotes and implements natural resource protection measures which often wrap in hazard mitigation. This includes making recommendations regarding the local land use regulations, planting riparian buffers, and planning for management of the urban forest as well as the Town Forest. The Town Forest is adjacent to lands that support the municipal water supply reservoir and the old water supply lines run through parts of the forest.

## 1.7 Summary of Planning Process

The town contracted with OPH Consulting Services to update the plan. The Town Manager, Jeff Schulz, served as the primary point of contact during the update. The planning process was conducted over the course of March 2023 – June 2023. Existing documents were also researched and incorporated into the plan update. The following table presents the Planning Team members and their titles:

*Northfield Mitigation Planning Team Roster*

Name	Title and Organization
Jeff Schulz	Town Manager
James Russo	Utility Superintendent
Trent Tucker	Highway Foreman
Kim Pedley	Town Clerk
Peter J. DeMasi	Fire Chief

Name	Title and Organization
Pierre Gomez	Police Chief
Meggan McCusker	Chief, Northfield Ambulance
Mitch Osiecki	Zoning Administrator
Mary Ann Beaupre	Director, Northfield Senior Center
Ashley Hudson	Co-owner, Four Seasons Care Home
Danilla Nickerson.	Administrator, Mayo Healthcare
Tara Kulkarni	Associate Provost for Research and Chief Research Officer, Associate Professor, Civil and Environmental Engineering, Norwich University

The last approved plan for the town was in 2016. April 11, 2023, marked the kick-off meeting for the plan update at a normally scheduled Select Board meeting. Planning requirements were discussed with a list of next steps. Community comments and questions were captured in the minutes. An online community survey was developed and launched through the town’s website and social media pages on April 28<sup>th</sup>, 2023. The survey introduced the importance and informational needs of an LHMP and asked for specific concerns the resident and/or business owner had. The surveys are included in Appendix E and capture concerns of residents that include specific hazards and the respective impact of those hazards. As the April 11<sup>th</sup> kick-off meeting was a warned community meeting, the opportunity for all stakeholders to participate and provide feedback was announced and captured in the minutes along with the community survey, which is seen as the most efficient way for stakeholders to provide input. Specific to the plan feedback, stakeholders were informed at the June 27<sup>th</sup> warned meeting to contact the town clerk to review the plan and provide feedback. Agenda minutes, 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. The community survey is an anonymous feedback tool and any specificity to organizations and/or individuals is not available. Some key organizations, however, were contacted directly due to their work with vulnerable populations and/or magnitude in the town and asked to participate on the planning team. These included older adult service providers and Norwich University, respectively. As all planning team members were given updates on the planning process as well as draft sections of the plan to review and comment, those representing older adult service organizations were met with individually to best understand service capabilities and vulnerabilities related to profiled hazards. All neighboring towns were sent notification of the plan’s development via their town clerk and were given an opportunity to provide input through email and/or phone call to the Northfield town clerk/manager. These towns included Warren, Waitsfield, Moretown, Berlin, Williamstown, Roxbury, and Brookfield. 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

Northfield town staff, various state agencies 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)
- 2020-2028 Town Plan (provided current goals and regulations supporting mitigation, recent capital expenditures and infrastructure value helped to drive vulnerability assessment)
- 2018 Washington County Multi-Hazard Analysis Report (provided detail on hazard locations, risk, and vulnerability)
- 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, the specific risks, vulnerabilities, and mitigation strategies were developed and when applicable, broken down to the specific entity impacted. The following planning progress and requests for input during Select Board meetings are summarized below.

- *3/27/23: Planning Team formed.*
- *4/11/23: Kick-off meeting to discuss objectives, next steps and timelines. Members of the public were in attendance, comments and concerns captured in minutes.*

- 4/13/23: Individual meetings with facility leads representing vulnerable populations.
- 4/28/23: Community Survey launched online.
- 5/2/23: Draft sections I and II sent to planning team for review and comment.
- 5/16/23: Planning Team meeting to discuss status of 2017 mitigation action items and prospective infrastructure mitigation projects for the next planning cycle.
- 5/23/23: Planning update with community survey results, repetitive loss and NFIP claims at Select Board meeting. No questions received.
- 6/1/23: Draft sections III-IV sent to planning team for review and comment. No edits were required.
- 6/12/23: Draft Plan Submitted to VEM. All Neighboring towns sent notification that a draft copy was available starting 6/13/23 via the Town Clerk
- 6/13/23: Notification that draft plan is available for community review and comment made at Select Board meeting
- 6/27/23: Final meeting to review mitigation actions at warned Select Board meeting
- 7/27/23: Required edits received from VEM

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. 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 Select Board.

## SECTION 2: HAZARD IDENTIFICATION

For this update, the 2016 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 3-3). Hazards scoring lowest include drought, high winds, landslide, wildfires, earthquake, invasive species, and hail.

While there are commonalities of natural hazard risk across most of the state and county, awareness of historic events, financial burden, state, and city level assessments can support trajectory for the future mitigation actions. As indicated in the 2018 SHMP, the hazards of most concern across the state are in-line with the town of Northfield. Given that the most recent SHMP was before the COVID-19 pandemic, the town has included pandemic (infectious disease) as a hazard due to the magnitude of impact 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 feel 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.

**2016 Profiled Hazards:**

- Flash flood/flood/fluviial erosion
- Water Supply Contamination
- Railroad Accident
- Extreme Cold/Winter Storm/Ice Storm
- Hurricane/Tropical/Severe Thunderstorm

**2023 Updated Profiled Natural Hazards:**

- Severe Winter Storm/Ice
- Flooding/fluviial erosion
- Extreme Temperatures
- Infectious Disease

*Note: Railroad accident and water supply remain concerns for town but will not continue as profiled hazards. These vulnerabilities will be covered in Section 3*

**2.1 Hazards**

NOAA Storm data shows 197 severe weather events from 2012-January 2023 in Washington County. These events included winter storm, flooding/flash floods, lighting, high/strong wind, extreme cold, hail, thunderstorm/wind, and high heat. There have been 32 major disasters declared since 1998 and 5 Emergencies declared since 1977. Northfield was impacted by a fraction of these declarations. 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 the rural nature of the town, 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
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 (Washington County: Bold and "\*" denotes Town PA received)

Number	Year	Type
4621	2021	Severe Storm and Flooding
<b>*4532</b>	<b>2020</b>	<b>COVID-19</b>
4474	2020	Severe Storm and Flooding
4356	2018	Severe Storm and Flooding
<b>*4380</b>	<b>2018</b>	<b>Severe Storm and Flooding</b>
<b>4330</b>	<b>2017</b>	<b>Severe Storms and Flooding</b>
4207	2015	Severe Winter Storm
4232	2015	Severe Storms and Flooding
<b>*4178</b>	<b>2014</b>	<b>Severe Storms and Flooding</b>
<b>4163</b>	<b>2014</b>	<b>Severe Winter Storm</b>
<b>4140</b>	<b>2013</b>	<b>Severe Storms and Flooding</b>
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding
<b>*4022</b>	<b>2011</b>	<b>Tropical Storm Irene</b>
<b>*4001</b>	<b>2011</b>	<b>Severe Storms and Flooding</b>
1995	2011	Severe Storms and Flooding
1951	2010	Severe Storm
1816	2009	Severe Winter Storm
<b>*1790</b>	<b>2008</b>	<b>Severe Storms and Flooding</b>
<b>1784</b>	<b>2008</b>	<b>Severe Storms, Tornado and Flooding</b>
1778	2008	Severe Storms and Flooding
<b>*1715</b>	<b>2007</b>	<b>Severe Storm, Tornado and Flooding</b>
<b>1698</b>	<b>2007</b>	<b>Severe Storms and Flooding</b>
<b>*1559</b>	<b>2004</b>	<b>Severe Storms and Flooding</b>
1488	2003	Severe Storms and Flooding
<b>1428</b>	<b>2002</b>	<b>Severe Storms and Flooding</b>
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

### 2.1.1. An Introduction to Climate Change:

The Town is aware that climate change has the potential to affect the risks caused by many hazards in the future. Climate change poses challenges for the town including more intense storms, frequent heavy precipitation, heat waves and cold spells, extreme flooding, drought conditions, and generally more unstable weather patterns. These climate changes pose risks to both public and private property, as well as economic risks. Engaging the community in developing mitigation strategies that reduce the town's vulnerability to the impacts of climate

change and furthering the town's commitment to building a resilient community are an important function of this plan. The 2018 SHMP relays the following:

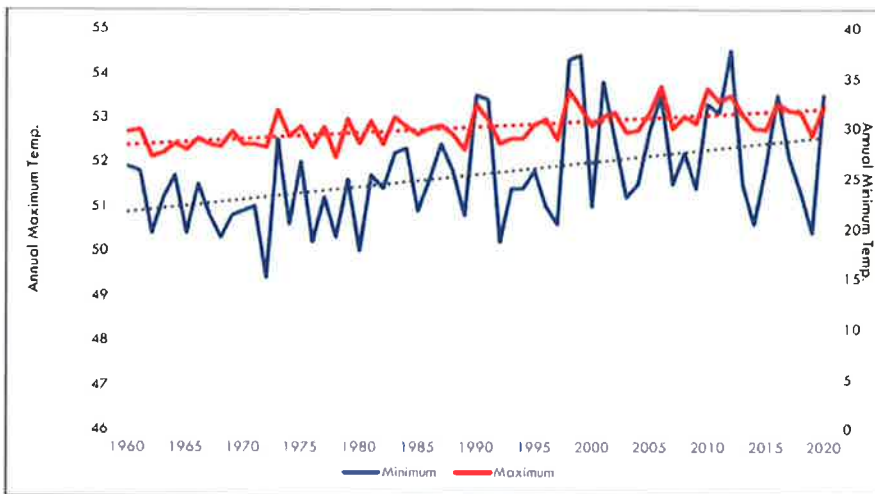
*“Over the past several decades, there has been a marked increase in the frequency and severity of weather-related disasters, both globally and nationally. Most notably, the Earth has experienced a 1°F rise in temperature, which has far-reaching impacts on weather patterns and ecosystems. This statistically 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<sup>6</sup>. 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 wildfire. 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. The 2022 NOAA National Centers of Environmental Information State Climate Summary concludes:

1. *Temperatures have risen about 3 degrees Fahrenheit since the beginning of the 20<sup>th</sup> Century in Vermont. 2010-2020 was the warmest 11-year period on record. As warming trends continue, the intensity of extreme winter cold is projected to decrease.*
2. *Average annual precipitation has increased almost 6 inches since 1960.*
3. *Extreme weather events (e.g., floods and severe storms) are having a stronger impact on Vermont and extreme rainfall is projected to become more frequent and intense while long-term droughts continue to pose challenges to water-dependent sectors.*

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



### 2.1.2 Profiled Hazards

History of Occurrences (within Northfield and Central Vermont from National Climactic Data Center (NCDC) Website and FEMA. Closest flood gauge is located in Berlin, VT.

Date	Event	Location	Extent
12/23/2022	Strong Wind	County Wide	Several observed wind gusts in

			the 45-55 mph range
10/30/2017	Strong Wind	County Wide	Numerous tree damage and power outages with measured wind gusts in the 40-50 mph range with a measured 58 mph at Barre-Montpelier airport in Berlin.
02/29/2016	Strong Wind	County Wide	Wind gusts of 35 to 45 MPH. Isolated to scattered tree limbs and power lines downed by wind.
10/07/2013	Strong Wind	Statewide	Reports of tree branches on utility lines in Washington County.
01/20/2013	Strong Wind	County Wide, Statewide	Winds in excess of 50 MPG. Numerous reports of tree or power line failures statewide. Estimated 10,000 without power statewide
10/29/2012	Hurricane/Superstorm Sandy	Statewide	15 to 30 MPH winds with frequent gusts in excess of 40 MPH. Scattered damage to trees. 35,000 residents statewide without power.
07/08/2020	Thunderstorm Wind	Northfield	Trees, lines and utility poles downed by thunderstorm winds.
7/4/2012	Thunderstorm Wind, Hail	Northfield, Statewide	50 knot winds. Dime size hail reported. 0.75" total. Several trees downed in Northfield.
8/28/2011 DR 4022	TS Irene	Statewide	~6" rain, Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet)
5/26/2011 DR 4001	Severe Storm, hail, flash flooding	Northfield, County Wide	1" hail, 3-5" of rain, 50 knot winds,
05/26/2011 DR 4001	Hail	Northfield	Dollar size hail reported. 1.5" total.
05/26/2011 DR 4001	Hail	Northfield Falls	Quarter size hail reported along Union Brook Road. 1" total.
7/21/2008	Severe storms, flooding	County Wide	Extent data unavailable for this event.
8/25/2007	Severe Storms	County Wide	55 knot wind gusts, 1" hail
7/9/2007 DR 1715	Severe Storms, hail, flooding	County Wide	1"-2.75" hail,
6/19/2006	Severe storms	County Wide	50 knot winds, downed trees and power lines
8/1/2005	Severe Storm	County Wide	1" hail, 55 knot winds
9/16/1999 DR 1307	Tropical Storm Floyd	Statewide	Tropical Storm,
6/27/1998	Severe Storms	County Wide	\$2M in damages, 3-6" rain across

DR 1228			county
5/29/1998	Severe Storms	County Wide	50 knot winds, heavy rains, downed trees and power lines
7/15/1997	Severe Storms	County Wide	2-4" of rain, Not a historical crest
8/4-6/1995	Severe storms, flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
DR 1063			
7/23/1990	Severe Storms, flash flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
DR 875			
8/4/1989	Severe Storms, Flooding	County Wide	Heavy rain, flooding – no NCDC/FEMA info
DR 840			
6/7/1982	Severe Storms	New England	14" of rain, \$276 M damages
8/5/1976	Hurricane Belle	Statewide	Gale force winds, 2 deaths,
DR 518			
7/3/1964	Hail	County Wide	1.5" hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

The impact of storms is usually flood related. See extent for flooding in the above flood section. The wind extent from storms is not well documented as there is no monitoring station in Northfield. Estimates for wind are gathered from county wide data off the NCDC website. An estimate of the worst anticipated wind extent based on past occurrences would be Category 1 force hurricane winds.

### ***Severe Winter Storm***

Since the last approved plan, there have been 26 winter storm events impacting the county (noaa.gov). According to the *2018 Vermont State All-Hazards 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.”*

Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to wires or trees, but in sufficient depth, can cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with

the surfaces coating the ground, tress, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. One of the major problems associated with ice storms is the loss of electrical power. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground. Other major problems include closed roads and restricted transportation.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Northfield. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. Northfield should plan and prepare for these emergencies. That planning and preparedness effort should include the identification of mass care facilities and necessary resources such as cots, blankets, food supplies and generators, as well as debris removal equipment and services. In addition, Northfield should develop debris management procedures (to include the identification of debris storage, processing and disposal sites) so that the tree and other storm related debris could be handled in the most expedient, efficient and environmentally safe manner possible.

Winter storm frequency and distribution varies from year to year depending on the climatological patterns but snowfall in the town is significantly higher than the national average. County-wide, the winter of 2010-2011 was the third snowiest on record with a total of 124.3 inches. The record of 145.4 inches was set in 1970-1971. The most recent extreme event was between March 14-15, 2017, a major nor'easter developed off the North Carolina/Virginia coast during the early morning hours of March 14th and intensified as it moved north-northeast across southeast New England during the night into central Maine by the morning of March 15th. Snow developed across Vermont by mid-morning on the 14th and intensified to at least 1 to 3 inches per hour for several hours during the late afternoon and overnight hours before gradually diminishing late on the 15th. There were numerous sites that witnessed 4 to 5 inches per hour snowfall rates for more than one hour. In addition, blizzard to near blizzard conditions developed around the time of the heaviest snowfall and lasted for 3-4 hours within several miles of Lake Champlain and some higher exposed terrain as well. While totals for Northfield are not available, neighboring towns received up to 24". Numerous schools, businesses and local government offices closed for March 14th and 15th with numerous vehicle accidents and stranded vehicles. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase in snowfall totals and cold temperature duration, the town realizes that further consideration is required. A major disaster declaration for severe winter storm was made on 2/3/2015 for nearly all counties in Vermont, Washington County included. 3.95 million dollars in public assistance was obtained but Northfield did not have any PA for this event.

The National Oceanic and Atmospheric Administration (NOAA) Weather Predictions Center is in the process of developing a new prediction tool, the Winter Storm Severity Index (WSSI)<sup>1</sup>, to provide an indication of the level of winter event severity and impacts (Table 28, p. 84 SHMP). The WSSI does not depict official warnings or exact event timing but provides severity level

over a given period. The WSSI is broken down into six components that are individually weighted based on the WSSI categories and then summarized into overall severity:

- *Snow Amount: to depict severity due to total amount of snow or rate of snowfall accumulation. (Adjustments are made based on climatology and urban areas, e.g. 4" of snow in Atlanta is more severe than 4" in Minneapolis.)*
- *Snow Load: to depict severity due to total weight of snow on trees and power lines.*
- *Blowing Snow: to depict severity mainly to transportation due to blowing and drifting snow.*
- *Ice Accumulation: to depict severity of transportation and downed trees/powerlines due to the accumulated ice in combination with wind.*
- *Ground Blizzard: to depict severity to mainly transportation of ground blizzards that develop due to a pre-existing snowpack and strong winds.*
- *Flash Freeze: to depict severity primarily to transportation of situations where temperatures rapidly fall below freezing during precipitation.*

The Town has seen damage from declared snow disasters in the past, primarily dealing with debris removal from downed trees. In any Vermont community, this potential exists every winter. While there is no record of snowfall for Northfield, the 2018 SHMP gives historic snowfall totals by county. 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 (2018 SHMP).

### ***Ice Storm***

Major Ice Storms occurred in January 1998 and again in January 2014. While Northfield was not profoundly affected by the ice storm of 1998, ice jams frequently back up water on Winooski River and can cause flooding. One of the problems with weather related storms is the loss of power. Power outages are frequent during storms with high winds causing the trees to fall on power lines. The power was out for 5 days for all of CVPS/GMP customers and significant mature tree growth on the western Border range (Scragg Mountain) was devastated leading to a heavy timber harvest for clean-up.

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, steadily 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. Northfield received less than .5" of ice. On December 13th, 2013, another ice storm hit portions of Washington County, resulting in the greatest disruption of electric service since 1998 at 96 hours for some customers regionally but the greatest impact for residents in Northfield was 16 hours on February 16<sup>th</sup>, 2013. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. 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 ([www.wrh.noaa.gov/map/?wfo=sto](http://www.wrh.noaa.gov/map/?wfo=sto)).

### ***Extreme Cold***

Since the last approved plan, there were two extreme cold events, both occurring in mid-January of 2022. Minimum temperatures on the morning of the 11th (Tuesday) were 10 to 20 below zero with winds creating wind chills in the mid-20s to lower 30s below zero range. Daytime highs only reached near zero with still sub-zero wind chills. Lows Tuesday night fell below zero early then rose overnight but combined with south winds of 10 to 20 mph still created wind chills in the 15 to 20 below zero range. On the 14<sup>th</sup>, dangerously cold wind chills of 25 to 40 below zero were observed across the region with actual air temperatures of 10 to 20 below zero Friday evening through midday Saturday. Overnight minimum temperatures Saturday night-Sunday morning were 15 to 25 below zero with calm/light winds. The 2018 SHMP states:

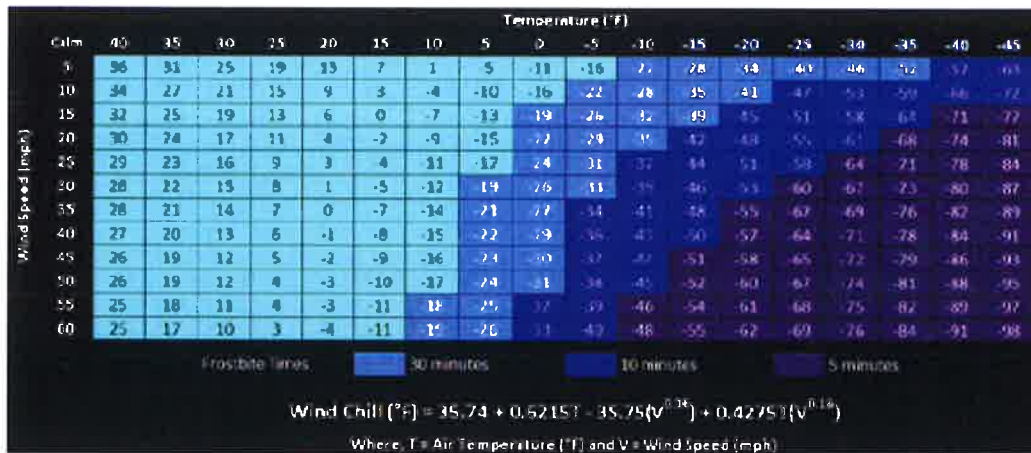
*Extreme cold temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. burst pipes from ice expansion and power failure). What constitutes “extreme cold” can vary across different areas of the 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 (Figure 44). 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 arctic 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.*

*2018 SHMP*

Recent extremes in cold temperatures are a concern and impact the entire city 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. From February 1st-28th, 2015, a persistent deep cold trough settled across the northeast United States from late January through early March. Many locations did not witness temperatures above freezing for 25 to 45 consecutive days from mid-January through early March. In February, many areas recorded 15 to 20+ days below zero and on several days, dangerously cold wind chills of 30 below zero or colder occurred. The average departure was 13 to 17 degrees below normal.

It was a record cold February for nearby Montpelier and Northfield certainly felt the cold extremes as well. 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 socio-economic (ability to purchase heating fuel) factors.

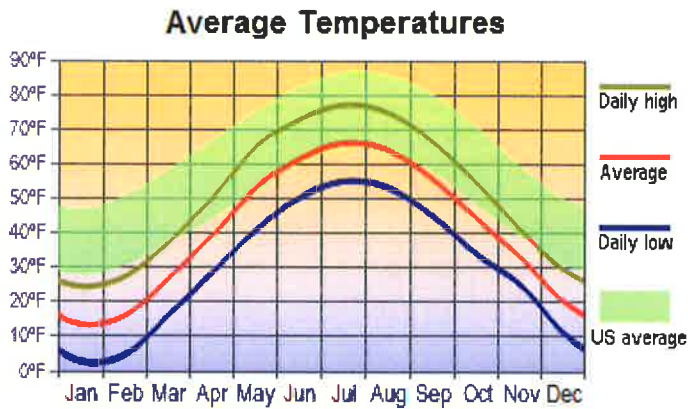
The NOAA Wind Chill Chart identifies those temperatures and associated wind speeds that may cause frostbite if skin is exposed to the air over a certain period of time:



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*
- *Frost Advisory: Areas of frost are expected or occurring, posing a threat to sensitive vegetation*

Table 2-4: Northfield Temperature Ranges vs. National Average



## 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:

Since the last approved plan, there have been six flash floods and two floods in the county, none of which impacted the town (noaa.gov). The town has significant infrastructure risk to flooding events. The 2017 Northeast States Emergency Consortium Multi-Hazard Analysis lists the following buildings in the HAZUS-MH modeled 500-year flood scenario:

Commercial	Educational	Gov./Emer	Industrial	Recreational	Religious	Residential	Transportation	Utility	Other
54	2	7	2	5	4	363	8	8	19

The 2018 SHMP states:

*“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 indicates that greater than 75% of flood damages in Vermont, measured in dollars, is 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.”*

Flooding/flash flooding/fluvial erosion is Northfield’s most commonly recurring hazard. Flooding is the overflowing of rivers, streams, drains and lakes due to excessive rain, rapid snow melt or ice. Flash flooding is a rapidly occurring flood event usually from excessive rain. Fluvial erosion is the process of natural stream channel adjustments. Fluvial erosion causes erosion of sediment in some areas, while causing aggradation of sediment in others. Fluvial erosion processes occur more quickly and severely during flood events. Flooding of land adjoining the normal course of a stream or river has been a natural occurrence since the beginning of time. If these floodplain areas were left in their natural state, floods would not cause significant damage. Development has increased the potential for flooding because rainfall that used to soak into the ground or take several days to reach a body of water now quickly runs off streets, parking lots and rooftops and through human-made channels and pipes.

The most significant historic floods occurred in August 2011, November 1927, September 1938, and June 1973. The National Weather Service, Burlington Office, predicts the following impacts at various flood stages of the Dog River:

- *17 ft: Devastating flooding throughout the Dog River valley. Route 12 will be inundated with road damage and bridge washouts. Low structures along the Dog River will be inundated. Flooding will be comparable to Irene in 2011.*
- *9 ft: Water will cover low spots of Route 12 between Northfield Falls and Montpelier, and Browns Mill Road in Berlin. Fields and farmland along the Dog River will flood.*
- *8 ft: There will be widespread field flooding along the Dog River between Northfield Falls and Montpelier. Water will approach Route 12 in the town of Berlin.*

Source: <http://water.weather.gov/ahps2/hydrograph.php?wfo=btv&gage=nffv1>

History of Occurrences (within Northfield and Central Vermont from National Climactic Data Center Website, FEMA Declared Disaster (DR) List and the flood gauge located at Northfield Falls. This gauge is approximately 2.5 miles downstream from Northfield Village, on the Dog River):

Date	Event	Location	Extent - flood stage is 8 ft
2018 DR 4380	Severe Storm and Flooding	Countywide	Extent data not available for this event.
2017 DR 4330	Severe Storm and Flooding	Countywide	Extent data not available for this event.
2014 DR 4178	Severe Storms and Flooding	Countywide	Extent data not available for this event.
2013 DR 4140	Severe Storms & Flooding	Countywide	Dog River, Northfield Falls Flood Gauge at 7.34 ft
2011 DR 4022	Tropical Storm Irene	Northfield, Statewide	Dog River, Northfield Falls Flood Gauge at 17.26 ft
2011 DR 4001	Flash Flood	Countywide	3-5” of rain

2011 DR 1995 & 4043	Severe Storms & Flooding	Countywide	Extent data not available for this event.
2010	Flood	Northfield	7.14 ft, 1.5-2 inches of rain across central Vermont, Dog River left its banks and partially covered Route 12 between Northfield and Berlin
2010	Flood	Northfield	The Dog River left its banks in Northfield, flooding portions of Water Street
2008 DR 1790	Flash Flood	County Wide	2-5" of rain
2007 DR 1715	Flash Flood	County wide	3-6" of rain in 2 hrs
2006	Flood	Northfield	8.50 ft, nearly 3" rain in Northfield, minor flooding along Route 12 in Northfield
2002	Flood	County wide, Northfield	7.67 ft, 1-3" of rain countywide
2000	Flood	County Wide	3" of rain countywide
2000	Flash Flood	Countywide	6.52 ft
1999 DR 1307	Tropical Storm Floyd	County Wide	4.97 ft, 5-7" rain county wide,
1998 DR 1228	Flash Flood	Northfield, County Wide	6.66 ft, 3-6" rain countywide,
1997 DR 1184	Flash Flood	County Wide	2-4" of rain
1996 DR 1101	Flood; ice jam	County Wide	7.41 ft
1992 DR 938	Flooding, Heavy Rain, Ice Jams	Statewide	Extent data not available for this event.
1989 DR 840	Severe Storms, Flooding	Statewide	10.16 ft
1987			9.84 ft
1976	Flood	County Wide, Northfield	8.56 ft
1973	Flash Flood	Northfield, Countywide	11.57 ft
1938	Flood, Hurricane	County Wide, Northfield	11.53 ft
1927	Flood	County Wide, Northfield	Winooski River-Montpelier gauge downstream at 27.10 ft (flood stage = 15 ft)

The Dog River Corridor Plan is a valuable tool to help restore the river's health and prevent future flooding impacts. It is used to inform the community of bridges, culverts and other structures that could be upgraded to mitigate damage. The Northfield Project and Strategy Recommendation Summary Table from the Dog River Corridor Plan is attached for reference and consideration for future mitigation projects. The Hazard Analysis Map identifies the Special

Flood Hazard Area and Statewide River Corridor and depicts the number and types of structures that are located within those hazard areas. More specific community assets vulnerable to flooding are the wastewater facility, Ambulance Facility, and Town Garage. These facilities are located in the 500-year floodplain (0.2 percent annual chance flood). The Fire Station, as well as other government buildings, are outside the designated floodplain, but near the river. Other facilities identified in the Local Emergency Operations Plan as in flood hazard areas include – Mayo Nursing Home and Tucker’s Trailer Park. Tropical Storm Irene destroyed one home in Tucker’s Trailer Park. Of these, the community has identified the Ambulance Facility as the most important community asset to address with its limited mitigation resources. It should be noted, the Northfield Food Shelf is also operated out of this building. The ability to access the Ambulance Facility during a flood event has immediate impacts on life safety for residents of Northfield. Other vulnerable entities independent of the municipality have been working on their own, and sometimes in collaboration with the Town, to improve preparation and mitigation for future flooding events. No new commercial or residential developments are planned in the floodplain/fluvial erosion hazard zone. Flood hazard/FEH bylaws prohibit development of new principal structures in flood prone and FEH zones. Bridges and roads are particularly susceptible to damage in the event of a flash flood. The Areas of Local Concern Map identifies four vulnerable bridges that have a rating of “Scour Critical”: Pleasant Street Bridge and West Hill Road Bridge over Union Brook and two Route 12A bridges over the Dog River and Sunny Brook. Water Street, Jarvis Lane, Lovers Lane, and the Route 12A Trailer Park are susceptible as well.

### ***Flood Vulnerability***

All of the planning area has the potential to be affected by flooding. 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 melting, flash flooding and urban flooding. Flooding has also been known to occur because 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 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. While that plan is concerned with all of Vermont, the information on flooding is all relevant in that:

*“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...*

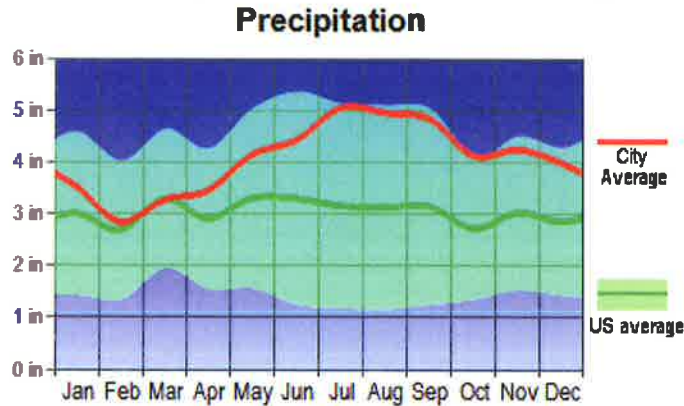
*...Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant 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 flood plains. 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."*

Vermont experienced major floods long before Federal disaster assistance became available. The most destructive recorded event was in November of 1927. In the month before the flood, rains in excess of 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 widespread damage across the state and the residual rains of Hurricane Belle in 1976 resulted in substantial federal disaster assistance in Vermont.

As previous events have made clear, areas beyond the NFIP designated 100-year floodplain may be particularly vulnerable to these types of hazards. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to historical channel management activities, floodplain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities, within and beyond the NFIP floodplain.

Table 2-7: Northfield Precipitation vs. U.S. Average



### ***Inundation and Floodplains***

The state has further identified and classified roads at risk of erosion. Regarding flood inundation issues, the 2018 Vermont State All-Hazards Mitigation Plan states:

*Inundation flooding is the rise of riverine or lake water levels, while fluvial erosion is streambed and streambank erosion associated with physical adjustment of stream channel dimensions (width and depth). Both inundation flooding and fluvial erosion occur naturally in stable, meandering rivers and typically occur as a result of any of the following, alone or in conjunction:*

- *Rainfall: Significant precipitation from rainstorm, thunderstorm, or hurricane/tropical storm. Flash flooding can occur when a large amount of precipitation occurs over a short period of time.*
- *Snowmelt: Melted runoff due to rapidly warming temperatures, often exacerbated by heavy rainfall. The quantity of water in the snowpack is based on snow depth and density.*
- *Ice Jams: A riverine back-up when flow is blocked by ice accumulation. Often due to warming temperatures and heavy rain, this causes snow to melt rapidly and frozen rivers to swell.*

*Inundation and fluvial erosion may both increase in rate and intensity as a result of human alterations to a river, floodplain, or watershed. For instance, when a dam fails there may be significant, rapid inundation which can occur without warning. Public and private structures and infrastructure become vulnerable when they are located on lands susceptible to inundation and fluvial erosion.*

#### *Riverine Inundation Flooding:*

*The land area where inundation flooding occurs is known as the floodplain. During high water events, water flows out of the riverbank and spreads out across its floodplain. FEMA defines the portion of the floodplain inundated by the 1% annual chance flood as the Special Flood Hazard*



*Area (SFHA); the area where the National Flood Insurance Program (NFIP) floodplain management regulations must be enforced and where the mandatory purchase of flood insurance applies for federally secured loans.*

*Inundation flooding on larger rivers and streams typically occurs slowly, over an extended period of time but can spread out over a large area of land. Due to the slower onset of inundation flooding on larger rivers, there is time for emergency management planning (e.g. evacuations, electricity shut-off considerations, etc.) to take place. Though the inundation floodwaters are slower to hit, they often take time to recede as well, and exposure to water for an extended period of time can result in significant property damage. U.S. Geological Survey's (USGS) National Water Information System monitors real-time streamflow gaging stations in Vermont.*

### ***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 All-Hazards 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 riverbed 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 FloodReady3 and Vermont Natural Resources Atlas websites.*

The Vermont Agency of Transportation (VTTrans) 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 VTTrans 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. Erosion of stream banks was a concern but is less-so now. A FEMA study has shown very little increase in velocities resulting from over-bank events which are infrequent and have subsequently not caused channel migration.

### ***Extreme Heat***

While there were no events during the last planning period, there is a consensus that this hazard is likely to increase in frequency. 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 has resulted in some concern. 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<sup>2</sup> . 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.” 2018 SHMP

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

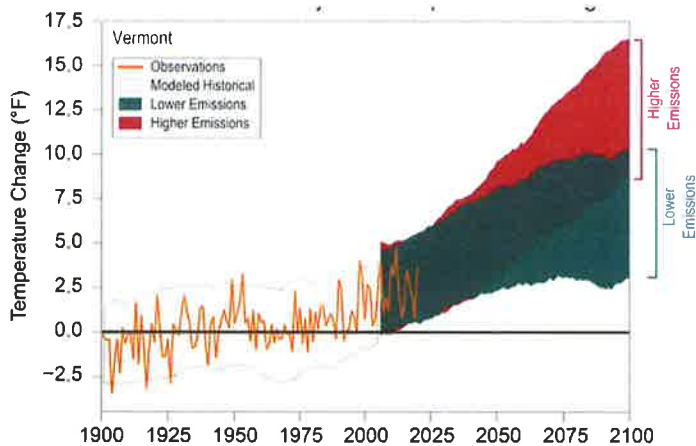
- *Excessive Heat Outlook: A period of excessive heat is possible within the next 3 to 5 days.*
- *Heat Advisory – Take Action: A period of excessive heat is expected. The combination of hot temperatures and high humidity will create a situation in which heat related illnesses are possible. Heat Advisories 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.<sup>1</sup>

*Table 2-7: Observed and Historical Temperature Change Scale*

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<sup>1</sup> 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.



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 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 snowpack across the region to be largely below normal or even non-existent by mid-March. In Vermont, temperatures climbed into the 70s 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 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***

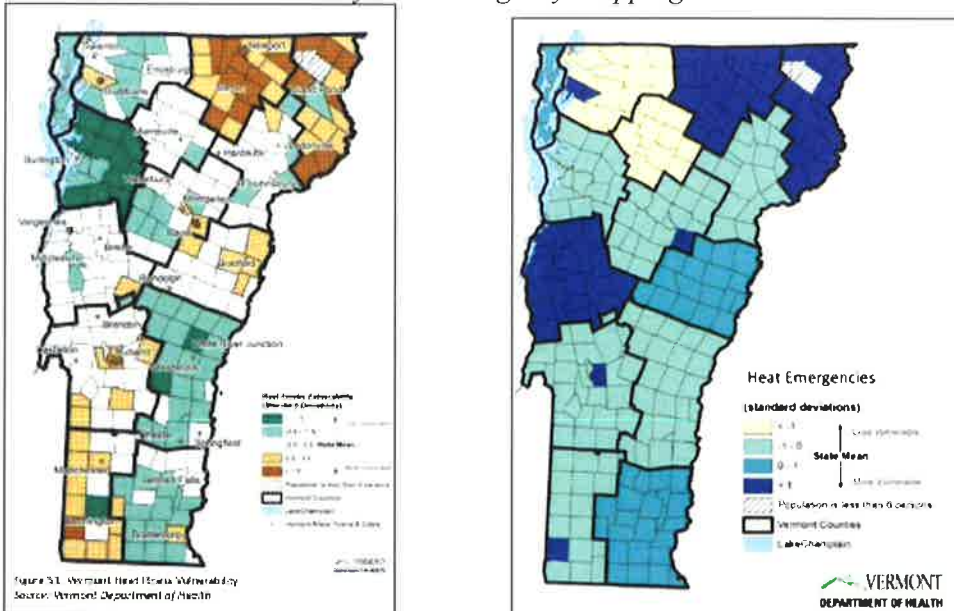
Heat is most likely to pose the greatest risk to human health in July, which is typically the hottest month of the year. In July of 1911, Northfield had a 12-day average of 90.75°F. The summer of 1949 was also very hot, with 25 days above 90°F. It is important to note here, however, that hot weather 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 21st 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 city residents, environmental characteristics, the ability of city 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](http://www.healthvermont.gov/environment/climate).

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 indicates 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 on 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 United States 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 United States 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 was 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
<b>Average daily high heat index* (°F), Burlington Airport</b>	68°	75°	83°	81°	72°
<b>Heat-related ED visits, statewide total, per month (2009-2019)</b>	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 Northfield. 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 2-8a: 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*
<b>Less than 80°</b>	97	0.2	2	742	12.9
<b>80° - 89°</b>	46	1	2	778	13.3
<b>90° - 94°</b>	6	3	2	789	14.1
<b>95° or hotter</b>	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 U.S. 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 that 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 are included below:

1. Vector-borne disease:

Data suggests 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 increase 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. The rise in average annual temperature and increased occurrence of prolonged hot weather events will also have impacts on infrastructure, the environment and the economy in Vermont.

2. 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.

3. 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, making them more vulnerable to pest invasion and disease.



Planning Considerations:

Community cooling sites can be an essential resource for community members that 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](http://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

People are reluctant to leave their homes in a heat emergency. 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 microorganisms, 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 bioterrorism.*

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 United States 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 is 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 have been approved for major disaster declarations to assist with additional needs identified under the nationwide emergency declaration for COVID-19. Additionally, 32 tribes are working directly with FEMA under the emergency declaration. FEMA announced that federal emergency aid has 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.

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 a 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>

On May 5<sup>th</sup>, 2023, The World Health Organization lifted the Public Health Emergency of International Concern (PHEIC) for COVID-19. As stated by Director General Tedros Adhanom Ghebreyesus, "COVID-19 has been so much more than a health crisis, disrupting economies, travel, shattering businesses and plunging millions into poverty." Being prepared for a future event is critical for states and communities and the town will depend on guidance and recommendations coming down from national and state sources during the next planning period.

## **Profiled Natural Hazard Summary**

The natural hazards impacting Vermont communities are, for the most part, homogenous. Each town and city in the Green Mountain State is called to assess their capabilities in mitigating the ongoing relationship we all share with mother nature when that relationship becomes a difficult one. The data and information presented above, combined with the knowledge of living and experiencing life in our town, serves as the foundation of that assessment which is required to define achievable and viable mitigation strategies that can serve to protect both the safety and financial investments of the town and its residents.

## **SECTION 3: RISK ASSESSMENT**

### **3.1 Designated Hazard Areas**

#### *3.1.1. Flood Hazard Areas*

Northfield lies in the heart of the Dog River valley, which is defined by the Northfield Range to the west and the Irish Hills to the east, both of which have elevations above 2,400 ft. The most significant body of water within the Town is the Dog River, which flows northward along Vermont Route 12 and through Northfield's three population centers, eventually terminating at the Winooski River in Montpelier. Its tributaries include Cox Brook, Union Brook, Stony Brook, Felcher Brook, Bull Run, Sunny Brook and Robinson Brook.

The entire Dog River watershed drains 97.5 square miles. Cox Brook drains 11 square miles, although only a small portion of this drainage area is in Northfield. Union Brook drains 5.79 square miles, all of which is in Northfield. The peak discharge of the Dog River just downstream of Union Brook is 8,580 cubic feet per second, during the 1 percent chance annual flood (100-year flood).

According to the National Flood Insurance Program, many properties within the Town are located within the designated 100-year floodplain. Northfield, in fact, is in the top 8% of communities in Vermont with many structures in the Special Flood Hazard Area. Based on the results of overlaying the FIRM flood maps with the location of the E911 structures, there are 402 properties (parcels) and 100 structures in the 100-year floodplain. By using median property values from the Northfield grand list, a very general sense of risk of loss can be calculated for 325 parcels that have both land and structures. Many of the structures on these parcels, however, are not in the floodplain. The total value for these properties is \$51,447,500, and the value of the land only is \$3,080,000. As many of the structures represented in the land and structure value are not in the floodplain, this gives only a very broad sense of the value at risk in the Special Flood Hazard Area.

There is one documented repetitive loss property in Northfield. It is a residential structure in the Water Street area in Northfield’s village. The other 2 repetitive loss structures on record have been acquired and demolished by the municipality through FEMA Hazard Mitigation grants since the last FEMA database update. The table below lists available records on repetitive loss structures, as confirmed with the State Floodplain Manager. Although state databases indicate 6 losses, only the 3 properties are affected, with 2 losses each. Information on which specific properties have been mitigated is not published to protect the privacy of the homeowners.

*Table 3.0: NFIP Status Summary*

Insured	Total Building Payment	Total Contents Payment	Losses	Total Paid	Average Payment
YES	52,280.01	0.00	2	52,280.01	26,140.01
YES	59,592.25	0.00	2	59,592.25	29,796.13
YES	179,245.37	0.00	2	179,245.37	89,622.69

As previous events have made clear, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to these types of hazards. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to historical channel management activities, floodplain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities, within and beyond the NFIP floodplain.

The Statewide River Corridor hazard area in Northfield includes even more parcels and structures than the Special Flood Hazard Area (100-year floodplain). This hazard area is similar to the fluvial erosion hazard (FEH) area regulated by the town, but also includes a couple other tributaries to the Dog River, a 50-foot buffer on the FEH boundary, and a 50-foot buffer on small streams draining less than 2 square miles. Therefore, there may be more properties at risk than are currently regulated by the town. In Northfield, there are 496 parcels and 202 E911 structures in the Statewide River Corridor hazard area. 413 of the parcels with both land and structures are

valued at \$65,377,900, and the land only at \$3,320,000. Again, many of the structures represented in this value are not actually located in the Statewide River Corridor.

A corridor plan for the Dog River was developed by VT Agency of Natural Resources in 2009. The plan assesses the Dog River until its convergence with the Winooski River in Montpelier. The stretch of river in Northfield was rated in “fair” condition; however, the river is undergoing “high” to “extreme” bank adjustments and fluvial erosion. The fluvial erosion hazard map of Northfield is located as an attachment. The high rates of adjustment and erosion can be attributed to several factors – straightening of the river channel, development encroachments, high levels of stormwater runoff, historic gravel mining and dredging activities, undersized culverts and bridges, and lack of riparian buffers greater than 25 feet. The Dog River Corridor Plan is a valuable tool to help restore the river’s health and prevent future flooding impacts. It is used to inform the community of bridges, culverts and other structures that could be upgraded to mitigate damage. The Northfield Project and Strategy Recommendation Summary Table from the Dog River Corridor Plan is attached for reference and consideration for future mitigation projects. More specific community assets vulnerable to flooding are the wastewater facility, Ambulance Facility, and Town Garage. These facilities are in the 500-year floodplain (0.2 percent annual chance flood). The Fire Station, as well as other government buildings, are outside the designated floodplain, but near the river. Other facilities identified in the Local Emergency Operations Plan as in flood hazard areas include – Mayo Nursing Home and Tucker’s Trailer Park. Tropical Storm Irene destroyed one home in Tucker’s Trailer Park.

### 3.1.2. Fluvial Erosion Hazard Areas

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. 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 is 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.

*Table 3-1: Repetitive Loss Properties*

Area/Type	Repetitive Losses	BCX Claims	Polices	LOMCS	FIRM
Northfield Town/ residential	9 (1 current w/in SFHA)	2	53 (45 current w/in SFHA)	16	9/27/85

Source: FEMA Repetitive Loss/BCX Claims. NOTE: BCX claims are ones located out of the SFHA. The numbers are historic and not reflective of current status.

### 3.2 Non-designated Hazard Areas

#### 3.2.1. Ice Storm Damage

On December 13th, 2013, another ice storm hit portions of Washington County, resulting in the greatest disruption of electric service since 1998. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. 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. (1998 data: <https://www.fema.gov/disaster/1201>)

#### 3.2.2. 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 are maintained very well by the electric service providers and the Vermont Agency of Transportation works to keep limbs trimmed on state highways. As with many Vermont communities characterized by natural terrain, the issue of downed trees creating power loss and property damage is more common compared to urban areas. Historically, these instances are short in duration 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 Northfield has had a history of flooding, losses to public infrastructure have intensified in recent years. 2011 resulted in the greatest financial impact resulting from a natural hazard (flooding). The town has been fortunate that its buildings and residential property have remained unaffected by recent disasters.

*Table 3-2: Flood-related Public Assistance Summary: 2017-Current:*

Disaster Number	Date	Hazard	Location	Projects	Federal Share
4207	02/03/2015	Severe Storm(s)	NORTHFIELD (TOWN OF)	1	\$3,331.25
4140	08/02/2013	Flood	NORTHFIELD (TOWN OF)	5	\$62,014.48

4140	08/02/2013	Flood	NORTHFIELD, VILLAGE OF	1	\$3,650.89
4022	09/01/2011	Hurricane	NORTHFIELD (TOWN OF)	43	\$1,612,349.11
4022	09/01/2011	Hurricane	NORTHFIELD, VILLAGE OF	5	\$75,456.03
4001	07/08/2011	Severe Storm(s)	NORTHFIELD (TOWN OF)	27	\$207,709.60
4001	07/08/2011	Severe Storm(s)	NORTHFIELD, VILLAGE OF	4	\$10,311.45
1790	09/12/2008	Severe Storm(s)	NORTHFIELD (TOWN OF)	5	\$28,202.31
1715	08/03/2007	Severe Storm(s)	NORTHFIELD (TOWN OF)	8	\$39,588.57

Sources: FEMA

Non-declared disasters 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 the residents' ability to pay. 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 the town since 2011 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 declarations.

**3.4 Future Events**

Although estimating the risk of future events is far from an exact science, using available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis can help frame future mitigation actions. This analysis assigns numerical values to a hazard's affected area, expected consequences, and probability, supporting 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. While there are some differences in risk associated with each jurisdiction, there is a single estimation matrix and when appropriate, subsequent narratives will describe the differences in risk. 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

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

- Severe Winter/Ice Storm (32)
- Flooding (44)
- Extreme Cold (24)
- Extreme Heat (16)

Flooding remains the most likely event to incur the most cost for the town based on historical analysis and disaster declaration-related funding since 2004 has all been a result of severe rainstorms. Given the magnitude of damage to such few areas during DR 4001, the realization that a major flooding event can result in major expense is evident, lending support that that flooding is likely to have a significant impact over a smaller area while a severe winter storm tends to affect the entire town. As with most Vermont towns, there is almost an inherent resilience to winter weather events because they are expected. However, as severity increases and consequences mount (e.g., power outage, road closures, etc.), the risk for health and safety also increases. High wind and lightning events happen and have the potential to disrupt functionality of the town, but the town is not at any increased risk in comparison to other areas of the state, but the sum area impacted, and probability of occurrence raise these two events in the hazard analysis methodology.



Table 3-3 Natural hazards risk estimation matrix

Northfield Hazard & Risk Analysis: NATURAL HAZARDS	Drought	Flooding	High Winds	Riprap Erosion	Landslide	Extreme Heat	Infectious Disease	Wildfire	Winter Storm	Ice Storm	Extreme Cold	Earthquake	Invasive Species	Hail
	<b>Area Impacted</b> 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	1	1	3	3	2	1	1
<b>Consequences</b>														
<b>Health &amp; Safety Consequences</b> Key: 0 = No health and safety impact 1 = Few injuries or illnesses 2 = Few fatalities or illnesses 3 = Numerous fatalities	1	1	1	0	0	1	2	1	1	1	1	1	0	1
<b>Property Damage</b> 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	2	1	1	0	0	0	1	1	1	1	1	0	1
<b>Environmental Damage</b> 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	2	1	0	0	1	0	2	1	1	1	1	2	1
<b>Economic Disruption</b> 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	1	1	1	3	1	2	2	1	1	1	1
<b>Sum of Area &amp; Consequence Scores</b>	7	11	5	3	2	4	6	6	8	5	6	5	4	5
<b>Probability of Occurrence</b> 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	1	4	2	2	1	4	2	1	4	2	4	1	1	2
<b>TOTAL RISK RATING</b> Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence	7	44	10	6	2	16	12	6	32	10	24	5	4	10

## SECTION 4: VULNERABILITY ASSESSMENT

Vulnerability refers to the potential impact of a specific loss related to an identified risk. 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 deferred required maintenance expected of highway-related machinery. The town is significantly vulnerable to loss during a disaster. All town-owned buildings are collectively assessed at \$25,844,800 with an additional \$2,951,400 in total land value. The Municipal Building is valued at \$1,176,100 with land at \$32,845. Fire equipment is valued at \$2,010,000. The town garage at 31 Dog River Dr. is valued at \$1,596,700 with land at \$33,700. The water facility is valued at \$1,073,100 with land at \$150,100.

For this section of the plan, prior history and worst-case scenarios were assessed. The primary vulnerability for the town is transportation-related infrastructure damage due to flooding. Due to railroad operations and municipal water, there are additional vulnerabilities that exist somewhat independent of natural hazards. Arguably, these concerns can be influenced by natural events in some cases. The following narrative discusses these two distinct vulnerabilities for the town:

### **Water Supply Contamination**

The Source Protection Plan for the Northfield Water Supply, updated in 2013, outlines multiple hazards to the system, some of which are natural hazards and others which are man-made. The primary concern to the municipality is contamination from failed individual on-site sewage disposal systems. The municipality has conducted planning and design for extension of the municipal wastewater system that would reduce the number of on-site sewage disposal systems, and therefore the likelihood of this man-made concern.

Flooding and fluvial erosion are special natural hazards that are of concern to the municipality regarding the municipal water supply. Two of the well heads are located both in the 100-year flood plain (1 percent annual chance) and in the River Corridor, or Fluvial Erosion Hazard Area (FEH). The other, northernmost well-head coincides with the boundary of the 500-year floodplain (0.2 percent annual chance), as well as the River Corridor (or FEH area) boundary. Many of the primary and secondary groundwater recharge areas for these wells are located in the 100-year floodplain and River Corridor as well.

During Tropical Storm Irene in August 2011, one of the water supply wells sustained bacterial contamination. The well was taken offline for a few days while the contamination was treated, and then brought back online. Municipal drinking water supplies were not directly affected during this incident, as the reservoirs and additional wells provided sufficient supplies for those

days. The municipality nevertheless would like to plan for the potential threat that a repeat of this flooding scenario poses to the water supply.

Erosion of the riverbanks along the well field also occurred during Tropical Storm Irene, although this did not cause damage to the well-heads or impact the water supply. The riverbank was repaired within a few weeks of the event. As the well-heads are so close to or inside of the fluvial erosion hazard area and River Corridor, the threat of erosion over time is also a risk for the municipality to consider.

Another important characteristic of Northfield’s wastewater system is that it is a combined system, meaning storm water also enters the system. When heavy flooding occurs, the treatment system becomes overwhelmed and releases some untreated sewage into the Dog River. Although the Northfield wellhead protection area is upstream from the treatment facility, the overflow from the facility could have environmental and health impacts on downstream users and water supplies. The municipality is working with the Agency of Natural Resources as well as CVRPC to separate and treat stormwater flows to prevent this hazard. Since 2011, most of the combined flows have been addressed and therefore those remaining are not a priority for this hazard mitigation plan.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Water Supply Contamination	Well head protection areas	Med	Municipal Wells	Moderate	\$2 million

**Railroad Accident**

The Central Vermont Railroad runs through Northfield from north to south along the valley floor, following Route 12 and Route 12A. The tracks pass through the center of Northfield Village, directly adjacent to several businesses and in proximity to residences as well. There are several major road and trail crossings in the town. This stretch of railroad is a consistent steep downgrade from south to north, causing trains to “brake” through Northfield going towards Berlin. Rail activity includes both Amtrak passenger service from Boston to Burlington and cargo transport, to and from Canada. Cargo transport includes a variety of freight including hazardous materials including oil and propane.

There have been several occurrences of railroad accidents in Northfield. A historic collision occurred in August of 1910 when two freight trains collided causing two oil tanks on the train to explode. Seven railroad employees were killed. The accident happened on a sharp turn, where an accident of similar nature had occurred two years prior. Damages were estimated to be \$50,000. In February 2009, a woman on a snowmobile collided with an Amtrak train on Fairground Road. The snowmobile was damaged; however, no one was hurt. On October 5, 2015, the Amtrak Vermonter Train 55 derailed after hitting a rockslide lying on the tracks in Northfield near Bull Run Road and Vermont Route 12A. The rockslide is said to have occurred naturally in the early morning hours. Five cars left the track including the engine and coach car which went into the brook below the track. Four passengers and three crew members sustained non-life-threatening injuries in the accident.

Hazard	Location	Likelihood	Vulnerability	Extent	Risk
Railroad Accident	Area behind sewage treatment plant/ambulance facility, road/trail crossings	Medium	Cars, pedestrians, water system	Severe if large crash	Unknown cost to loss of life or severe health hazards due to chemical release; environmental degradation

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 ( $< 2$  in last five years) of an event with an 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., elderly) is subjective because there is no historical data to rank vulnerability to the health and safety of Northfield residents, workers or travelers.

#### 4.1 Vulnerability Narrative by Profiled Hazard

##### **Severe winter/ice storm: Moderate**

**Summary:** 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 severe winter storm are more vulnerable to cold-related injury and/or snow related accidents. However, 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. 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 city 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 regarding 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 take on. Issues, such as tax revenue reductions from failure to pay on a large scale to how a major storm event, could compromise pandemic response (e.g., sheltering operations and resource allocation).

**Flooding (including fluvial erosion/inundation): High**

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 flooding and 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 Northfield. 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. With approximately 132 mobile homes located within one of the 7 mobile home parks in Northfield, there is some elevated risk to these structures by nature of their construction and, often times, location.

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. (Source: *A Risk-Based Flood-Planning Strategy for Vermont’s Roadway Network, 2015*). In 2015, the Agency of Commerce and Community Development (ACCD) completed the Vermont Economic Resiliency Initiative (VERI) Report. The report was developed to help Vermont communities better manage their flood risk and included an analysis that defined the top 32 communities where flooding risk is high, based on economic activity, at-risk infrastructure, and at-risk non-residential buildings (*2018 State Hazard Mitigation Plan*). Below is the town’s data from this report. In short, Northfield is an area with higher-than-average economic activity and flood risk.

*Table 4-0: Vermont Economic Resiliency Initiative (VERI) Report Findings for Northfield*

Total Economic Score out of Top 89	Total Infrastructure Vulnerability Score out of Top 75	Non-residential structures in corridors
59	28	40 (21 <sup>st</sup> highest)

## 4.2 Infrastructure

Flooding is the highest risk profiled hazard and town infrastructure has high vulnerability to damage during major flood events. The information presented below summarizes town infrastructure and high vulnerability areas.

### 4.2.1. Town Highways

Northfield's Highway Department maintains 80 miles of roadway, including 45 bridges, 800 culverts, along with guard rails, signs and drainage and stormwater. The Highway Department budget is overseen by the Select Board. The Town may, at the discretion of the Select Board, accept new roads into its care only when constructed according to town standards approved April 5, 2001.

Different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to being washed out in a flood or heavy storm, while traffic incidents are more likely to occur on large, arterial roads.

### 4.2.2. Bridges, Culverts, and Dams

The Town of Northfield's Road Commissioner has done a thorough job of maintaining an inventory of the town's road infrastructure on Vermont's online bridge and culvert inventory tool ([www.vtculverts.org](http://www.vtculverts.org)). The Highway Department continues to assess all culverts and bridges with proposed replacement and rehabilitation to be scheduled with the Vermont Department of Transportation. Due to the funding structure, municipalities must participate in the regional Transportation Advisory Committee (TAC) to be placed on the priority list, which is reviewed yearly, in order to obtain funding from the bridge and culvert program. The Road Commissioner is currently active in this program. Stormwater-related improvements will be required on town roads to comply with Municipal Roads General Permit requirements, which took effect in 2018 with at least 15% of non-compliant segments upgraded to meet standards by 2021-22 and full compliance by 2036.

#### Bridges:

There are six long bridges (>20 feet) on state highways in Northfield: two on Route 12 and four on Route 12A. According to VTrans inspection reports as of 2018, five of these bridges are in fair or good condition with only minor repairs needed. There are 23 long bridges (>20 feet) and 17 short bridges (6-20 feet) on town roads in Northfield. VTrans bridge inspection reports indicate that at least seven of the long bridges needed major rehabilitation as of 2018. According to culvert inventory data, there were also 89 culverts in urgent or critical condition and 116 in poor condition.

The North Main Street bridge over the Dog River in the center of downtown needs extensive rehabilitation or replacement and repair is slated to begin in 2025. Regionally, the vulnerability of bridges to flood damage became evident from the damage seen to Vermont bridges in the 2011 Tropical Storm Irene. Successfully mitigating scour-related problems associated with bridges depends on the ability to reliably estimate scour potential, design effective scour prevention and countermeasures, design safe and economical foundation elements accounting for scour potential, and design reliable and economically feasible monitoring systems. (*Scour Damage to Vermont Bridges and Scour Monitoring: UVM Transportation Research Center Report 15-002 June 10, 2015*).

#### Culverts:

The Town maintains a culvert inventory that assesses 717 culverts. Of these, seven are in critical condition (Dole Hill Rd, Gib Lane, W. Hill Rd., Tamarack Rd., Union Brook Rd., Aseltine Rd., Onion River Rd.). 106 are in poor condition, 17 are in unknown condition, and 100 have been closed. This data guides the town's culvert maintenance and replacement plan.

#### **Critical Facilities**

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. However, there is no evidence to suggest that any critical facility is highly vulnerable during any hazard event despite some being located in the floodplain.

#### 4.2.3. Water, Wastewater and Electric Power Service

The Northfield Electric Department (NED) provides electricity to approximately 1,900 Northfield customers and serves portions of West Berlin and Moretown. The remaining portions of Northfield are served by Green Mountain Power and the Washington Electric Cooperative. The Northfield Electric Department does not produce its own electricity. NED is a member of Vermont Public Power Supply Authority (VPPSA) and has a Master Supply Agreement with VPPSA, which buys and sells wholesale power. The Town of Northfield owns the electric department but relies on GMP for all service work regarding line and meter maintenance. Northfield Village, Northfield Falls, and Northfield Center are served by a municipal water supply dependent upon wells adjacent to Vermont Route 12A and the Dog River. The Northfield municipal water system serves approximately 4,000 residents and all system users at Norwich University, as well. Water is pumped from a well field south of the village at approximately 400,000 gallons of water per day, through approximately 25 miles of water mains. The Town of Northfield owns thirty (30) acres around the wells, and this offers a considerable amount of protection to the source. Two reservoir locations provide a backup supply. One location has two 250,000-gallon tanks and the other is a 1,000,000-gallon concrete reservoir. This storage provides about three days of emergency supply. The wells and their recharge areas are managed under a Source Protection Plan approved by the Vermont Agency of Natural Resources. The Source Protection Plan was updated in June 2013. Community members outside of the areas

served by the municipal water system depend upon groundwater for their domestic water supply and industrial uses.

The Municipality’s wastewater treatment facility services the entire Village and Northfield Center, including Norwich University. It includes the collection and treatment of waste and also provides a significant amount of stormwater collection and treatment. The wastewater system is regulated by the State of Vermont. Residents outside of the sewer service area are responsible for disposal of their wastewater through on-site sewage disposal systems regulated by the State of Vermont, Agency of Natural Resources.

A Water & Wastewater Commission was established in July 2015 to advise the Town Select Board on utility matters. The Commission has three members, two of whom are elected to three-year terms by registered Northfield voters who are customers of the Water and/or Sewer Department. The third member is appointed annually by the Town Selectmen. The Commission meets on a regular basis.

### 4.3 Estimating Potential Losses in Designated Hazard Areas

There are 108 buildings in town located within the Special Flood Hazard Area. 21 (19%) of these buildings are in the floodway. 40 of these are mobile homes, including most of the homes in the 32-lot Tucker Mobile Home Park on Fairgrounds Road. An additional 54 structures are located in the 500-year floodplain, including the town’s wastewater facility, ambulance station and town garage. There are 17 miles of roads located within mapped river corridors or 50 feet of small streams, 13 miles of which are maintained town roads. Even during a flooding event similar to the worst experienced in the last 10 years, there would be substantial damage to buildings or residential housing that exceeded 1%. However, given the magnitude of damage to town bridges, the potential for costs exceeding \$300,000 dollars to repair exists because it has happened in the last 20 years. However, the repairs and upgraded resilience of these locations associated with these prior expenses greatly reduces the potential for a recurrence and the disaster funding history supports this.

*Table 4-1: Town of Northfield Natural Hazard Risk and Vulnerability Summary*

Hazard	Vulnerability	Extent (Storm Data from most severe event)	Impact (economic/health and safety consequence)	Probability
<b>Flood</b>	Roads, Bridges, Senior Living Center, Sewer Facility, Fire Station, Town Garage  Water St, Dogwood Rd, Dog River Dr, Lovers Ln, Route 12 A	The greatest 24-hour rainfall record for the immediate region occurred in late October 31st, 2019, at 3”. The greatest level of precipitation in any month occurred in August 2011 at 11”	The two 2011 flooding events resulted in the most damage for the town.	High



	Trailer Park, Along Cox Brook, Union Brook, Jarvis Lane			
<b>Fluvial Erosion</b>	Roads and property adjacent to streams/rivers	Road scouring results from drainage issues. Erosion occurs at shoreline but poses little risk. No detailed data was available for fluvial erosion damage in town in terms of numbers of acres lost during each event.	No current data on erosion	Low
<b>Extreme Cold/ Snow/Ice Storm</b>	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.	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.	High

<b>Infectious Disease</b>	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
<b>Extreme heat/drought</b>	The entire planning area is vulnerable in both human/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 Northfield from July 20 through July 26. The maximum temperature reached 89°F on July 21st and July 24.	High

#### 4.4 Proposed Land Use and Development Trends Related to Mitigation

*Northfield's development is focused in Northfield Village and Northfield Falls – along the Route 12 and rail corridor in the Dog River valley. Forested hillsides and ridgelines dominate the landscape in most areas of town. Small pockets of active or former agricultural fields and pastures are scattered throughout town with larger concentrations off Union Brook Road, Bean Road and West Hill Road. The town's basic land use pattern has been in place for more than 100 years and changes to that pattern have been incremental. Since the 1960s, commercial and industrial development has occurred along Route 12 between Northfield Village and Northfield Falls and to a lesser degree south of the village along the state highway corridors. Downtown commercial activity has experienced cycles of contraction and growth. Once organized around mills and industry, Northfield Village and Northfield Falls have become predominately residential villages with many residents commuting out of Northfield. Recent years have seen*

*some commercial and industrial growth, including the expansion of Cabot Hosiery into the former Nantanna Mill. (2020 Northfield Town Plan).*

Northfield Village and Northfield Falls are exposed to flood and erosion risks that will become more extreme in future decades as a result of climate change. Future land use and development decisions need to respond appropriately to those hazards to minimize future damage or loss. Flood resilience needs to be considered in the upland areas as well to ensure that land development does not contribute to downstream flooding. Maintaining or establishing riparian buffers along streams for their flood attenuation, stream bank stabilization, water quality and wildlife habitat benefits are goals of the Town Plan with the concept of using land within the floodplain and river corridor along the Dog River in and between Northfield Village and Northfield Falls as public parks connected by a multi-use path or greenway. Effective flood maps are used by the town to support flood hazard area regulations and are assessed for necessary changes as part of the NFIP continued compliance. The Zoning Administrator is the compliance officer for the town's participation in the NFIP.

#### *4.3.1. Land Use Goals*

- Revitalize the villages and guide most growth into the areas designated for commercial, industrial, institutional, mixed-use and village residential uses on the Future Land Use Map.
- Extend and improve municipal infrastructure and private utilities (water, sewer, stormwater, fiber, etc.) as necessary to accommodate the planned land use pattern and densities in the areas designated for commercial, industrial, institutional, mixed-use and village residential uses on the Future Land Use Map.
- Revitalize Northfield's downtown business district and other existing commercial/industrial areas in and between the villages to improve aesthetics, access and economic competitiveness.
- Preserve and enhance the historic character, pattern and scale of the built environment in Northfield Village and Northfield Falls.
- Construct, improve and maintain safe pedestrian and bicycle routes in and between Northfield Village and Northfield Falls that connect downtown, schools, parks and recreation areas, community facilities, stores and services, major employers and neighborhoods.
- Celebrate Norwich University – a major landowner, employer and defining landmark – and establish a stronger partnership between the university and the community.
- Preserve rural character, open space and working lands in the areas of town beyond the villages. Prevent adverse environmental impacts resulting from irresponsible land use and development practices.
- Maintain a balanced tax base and a fair PILOT (payment in lieu of taxes) from Norwich University in order to generate the revenue necessary to provide municipal services without overburdening residential property owners.

#### *4.3.2. Land Use Strategies*

- Maintain the lands within and between Northfield Village and Northfield Falls as the principal location for community growth and development including ongoing downtown

revitalization efforts, residential infill and mixed-use redevelopment that is compatible with the historic scale and character of the villages.

- Recognize Norwich University as a driver of Northfield’s economy and its ability to shape the community’s current and future character.
- Guide development to land already or intended to be served by infrastructure (roads, water, sewer, electricity, communications), capable of accommodating development based on site conditions such as slope and soils, and not subject to natural constraints such as floodplains, wetlands or other significant environmental factors.
- Avoid further extension of roads and services into remote areas and minimizing fragmentation of priority forest block.
- Protect and improve water quality, and reduce flood hazards, by maintaining or establishing riparian buffers along streams and rivers throughout town.

#### *4.3.4 Utilities, Facilities, and Services Goals*

- Provide the utilities, facilities, and services necessary to support existing and future residential, commercial, industrial and institutional uses in accordance with the goals, objectives, policies, recommendations and actions of this plan.
- Have full cell phone coverage and affordable access to reliable, high-speed internet throughout town.
- Keep most municipal buildings and facilities located in Northfield Village and maintain its role as the civic center of the community.
- Meet the town’s obligations under Vermont’s Clean Water Act (Act 64).
- Eliminate combined sewer overflows from the municipal wastewater system

#### *4.3.5 Future Development and Housing*

The town welcomes future development and the following summarized increases in development since the last approved plan. In 2022, 84 development permits were issued with the majority being for “Other Accessory Structures (39), “Homes, Apartments, Accessory Dwellings (12), and “Additions” (9). The newly planned Northfield Apartment Complex on North Main Street is the most significant development, providing a minimum of 30 residential units in the town. Additional flood risk for this property is considered minimal. With the conversion from a 1-acre to 10-acre Act 250 zoning regulation, approval for building on less than 10-acres will be an easier process moving forward.

The Town plans to create a master plan to better connect Northfield’s villages to each other, Norwich University and their recreational centers by enhancing the streetscape and improving the water quality of the Dog River. The Better Connections program, a nationally recognized grant program from the Agency of Transportation (AOT) and Agency of Commerce and Community Development (ACCD), awarded Northfield project funds to increase transportation options, improve water quality, support public health and strengthen economic vitality in downtowns and the village center.

## 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 since 2011. 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. It is because of this that the town views this update as the new standard in their mitigation planning efforts. In addition to new development, substantial improvements to existing structures are required to meet elevation requirements and floodproofing measures (when applicable to NFIP policy requirements). This plan update allows for a continuation of the systematic documentation of mitigation efforts in the next planning cycle. The implementation matrix captures specific progress in certain areas but more importantly, gives the town a guide from which all future action and updates can be based on.

### 5.1 Town Goals and Policies that support Hazard Mitigation

#### 5.1.1. *Capital Improvement Goals*

- a. Provide services and facilities deemed necessary for the orderly and rational development of the Town.
- b. Assure that the Highway Department has enough funding to fulfill the goals of the following year and in adjunct, increase awareness of eligibility requirements for infrastructure projects under the Hazard Mitigation Grant Program (HMGP).
- c. Continue to meet or exceed the VTrans Road and Bridge standards. Participate in regional road foreman trainings and Transportation Advisory Committee meetings to stay abreast of flood resilience measures for the Town's roads and bridges.
- d. Continue to update the Town's transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool ([vtculverts.org](http://vtculverts.org)).
- e. Replace undersized and failing culverts.

#### 5.1.2. *Housing Goals*

- a. Diversify the housing stock and offer quality housing choices so that households across age and income ranges will be able to live in Northfield.
- b. Maintain or improve the affordability of the housing stock for households earning the prevailing wages in Northfield and surrounding communities.
- c. Maintain or improve housing quality and neighborhood stability in Northfield Village and Northfield Falls

### 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 the CVRPC to increase awareness, enhance planning and engage in exercises that address needs in the community.

### 5.1.4. Regulatory Devices Goals

- a. State permitting and Vermont's Act 250
- b. The Town should plan a financial future that invests the current surplus of tipping fees<sup>2</sup> to produce perpetual investment income for the Town.
- 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 any farm-related development in town.
- e. Continue to work with Montpelier, Barre City, Central Vermont Regional Planning Commission and VTrans to complete the Central Vermont Regional Bike Path in Northfield

### 5.1.6 Natural Resources

- a. Ensure that the existing health ordinance is enforced to maintain protection of both surface and groundwater supplies.
- b. The town should work with the CVRPC 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.
- c. In line with the VTrans mission statement regarding climate change, the town remains committed to:
  - Identifying, protecting, and preserving important natural features of Northfield's landscape that help define the community's identity and sense of place.
  - Preserving and enhancing the historic character, pattern and scale of the built environment in Northfield Village and Northfield Falls.
  - Preserving rural character, open space and working lands in the areas of town beyond the villages.
  - Ensuring that conserved lands and/or lands under long-term stewardship encompass a diversity of landforms.
  - Protecting priority forest blocks and other habitat is necessary for native animal and plant species to thrive and meet all their survival requirements.
  - Preventing adverse environmental impacts resulting from irresponsible land.
  - Ensuring that there are viable alternative routes around vulnerable infrastructure such as bridges and roadways.

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<sup>2</sup> A tipping fee is a fee paid by anyone who disposes waste in a landfill that is based on the weight of waste per ton. This fee can be passed down to waste generator from landfill through fees or taxes

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

- 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/htm/rv_floodhazard.htm) [http://www.watershedmanagement.vt.gov/rivers/docs/rv\\_RiverCorridorEasementGuide.pdf](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 downcutting 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](http://www.watershedmanagement.vt.gov/permits/htm/pm_streamcrossing.htm)

#### 5.1.7. 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
- 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.

#### 5.1.8. Transportation Goals

a. Maintain a safe and efficient multi-modal transportation system that is capable of supporting the land use, resource protection and economic development goals, objectives, policies and recommendations.

- b. Provide transportation facilities and services that will allow people to travel into, out of and within Northfield by means other than private motor vehicles (rail, transit, biking, carpooling).

#### *5.1.9.1. Energy Goals*

- a. Increase the percentage of trips made in Northfield by means other than single-occupancy vehicles (transit, rail, van or carpools, biking, walking, etc.) and by means that do not require fossil fuels (all-electric vehicles or transit, walking or biking, etc.).
- b. Increase the amount of renewable energy being produced in Northfield to move toward meeting the state's Act 174 targets for the town in a manner that is consistent with the goals, objectives and policies of this plan.
- c. Reduce energy use in Northfield through conservation and efficiency measures to move toward meeting the state's Act 174 targets for the town, which will also have the benefit of reducing greenhouse gas emissions and lowering energy costs for households and businesses.

## **5.2 Existing Town of Northfield Capabilities 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 Select Board has successfully pursued funding to address needs. With recent work including the new bridge on Stony Brook Road, major repair of the Slaughterhouse Road Covered Bridge, and a significant stormwater mitigation project that will result in a near-elimination of combined sewer overflows, the town continued to move forward with the impending Main Street Bridge replacement in 2025. With nearly 2 million dollars in American Rescue Plan Act (ARPA) funds devoted to increasing broadband service to underserved areas in town and miles of road rebuilding in addition to regular maintenance, the town feels confident as it enters into the next planning period and is dedicated to continuing its mitigation efforts.

Additional funding relationships are established and ongoing with Better Back Roads, Structures Grants and FEMA. 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 seek local, state and federal funds to address the sites identified as priorities. The town has also adopted municipal road and bridge standards that meet or exceed the most recent standards and has an approved and annually adopted Local Emergency Operations Plan and Town Plan.

The town participates in the NFIP and has Zoning Regulations that reflect its commitment to mitigating flood risk. Prior to the issuance of any zoning permit the Zoning Administrator shall first satisfy himself that the subject of the application is in conformance with this bylaw. Any proposed use or structure in the flood hazard area must meet all the standards and criteria for



development in the zoning district where it is located, after which it must meet the requirements of these flood hazard area regulations. The Planning and Zoning Department reviews all plans before any permits are issued. The Department reviews plans to determine compliance with the Town Plan and requires applicants developing in the floodplain to submit a Vermont DEC project review sheet. In addition, upon receipt of a complete application for a substantial improvement or new construction the Zoning Administrator submits a copy of the application and supporting information to the State National Flood Insurance Program (NFIP) Coordinator at the Vermont Agency of Natural Resources, in accordance with 24 VSA § 4424. A permit may be issued only following receipt of comments from the Agency, or the expiration of 30 days from the date the application was mailed to the Agency, whichever is sooner. Substantial Damage (SD) assessments have not been required and the town Zoning Administrator would manage SD if and when required but would rely on state partners to assist if required before adequate training provisions were completed.

*Table 5-1: Existing Town Capabilities that Support Hazard Mitigation*

Type of Existing Protection	Description /Details/Comments	Key Points
<b>Emergency Response</b>		
Police Services	Northfield Municipal Police, Norwich University provides private, on-campus security services. Vermont State Police and the Washington County Sheriff's Department are relied upon to provide supplementary support.	Chief retiring in May 2023.
Fire Services	The Northfield Volunteer Fire Department provides fire protection and emergency response from a primary fire station located adjacent to the elementary school and a secondary station in Riverton.	The Northfield Fire Department has an annual budget and Capital Improvement Plan. Recruiting and retention of staff is ongoing struggle.
EMS Services	Northfield Ambulance Service and the Northfield Ambulance Volunteers, Inc	The Ambulance Service is housed in the Town Garage, which is located in the 0.2 percent annual chance floodplain of the Dog River.
<b>Other Municipal Services</b>		
Highway Services	Town Highway Department	Maintains 80 miles of roadway, including 45 bridges, 800 culverts, along with guard rails, signs and drainage and stormwater infrastructure. Highways are managed according to the most recent Vermont Road & Bridge Standards.
Highway personnel	4 FTE/2-3 PT field personnel	None currently

Northfield Electric Department (NED)	Provides electricity to approximately 1,900 Northfield customers and serves portions of West Berlin and Moretown. The remaining portions of Northfield are served by Green Mountain Power and the Washington Electric Cooperative.	The Town of Northfield owns the electric department but relies on GMP for all service work regarding line and meter maintenance.
Water Department	Northfield Village, Northfield Falls, and Northfield Center are served by a municipal water supply dependent upon wells adjacent to Vermont Route 12A and the Dog River. The Northfield municipal water system serves approximately 4,000 residents and all system users at Norwich University, as well. Wastewater treatment facility services the entire Village and Northfield Center, including Norwich University. It includes the collection and treatment of waste and also provides a significant amount of stormwater collection and treatment	Two reservoir locations provide a backup supply. One location has two 250,000-gallon tanks and the other is a 1,000,000 gallon concrete reservoir. This storage provides about three days of emergency supply.
Planning and Zoning personnel	Town positions filled	None currently
Residential Building Code / Inspection	2019 Land Use and Development Regulations in use	The town does not, nor does it plan to have building codes in the future. Zoning regulations, current and applied governance related to structures is adequate and effective.
<b>Emergency Plans</b>		
Local Emergency Operations Plan (LEOP)	2023	Assure sheltering plans and contact information is up to date and vulnerable populations are addressed.
School Emergency/Evacuation Plan(s)	2022	Increased collaboration (with town staff, school, LEPC, CVRPC), knowledge of roles and drills
Municipal HAZMAT Plan	None	Continue working/planning relationships with Waste USA/Airport

Shelter, Primary	Northfield School	Working with ARC's Shelter Initiative and have obtained certification, training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.
Replacement Power, backup generator	Acquired	Stay proactive with state and FEMA regarding town interests.
<b>Municipal Plans</b>		
Town / Municipal Comprehensive Plan	2020-2028	Update done
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	2016	The Town's Floodplain Zoning Regulation has been in effect since April 2010 and is compliant for the jurisdiction's ongoing participation in the NFIP. Northfield has 54 NFIP policies and began participating in 1978. The flood hazard regulations include no new principal structures, storage, or fill in the floodplain or fluvial erosion hazard zone. Any new development requires project review from the Zoning Administrator, Zoning Board of Adjustments, and/or NFIP Coordinator at the Agency of Natural Resources in order to obtain a permit.
Land Use and Development Regulations	2016	Northfield has implemented Land Use Regulations which include Subdivision and Zoning Bylaws. The land use regulations set out protections in town for water resource aquifers, wetlands, riparian zones and to manage stormwater, sediment and erosion. The Zoning Regulations limit development on slopes greater than 25% and elevations greater than 1800 feet.
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Active Participation and in good standing with NFIP. Managed by David Barlow, Zoning Admin.	Zoning board of appeals and Administrator
Certificate of Compliance with Road and Bridge Standards	2018	<a href="https://vtculverts.org/map">https://vtculverts.org/map</a> <a href="https://vtculverts.org/bridges#list">https://vtculverts.org/bridges#list</a> Strive to coordinate lists and keep up to date

### 5.3 Town of Northfield All-Hazards Mitigation Goals

*5.3.1. Flood Resilience Goals:*

- a. Mitigate potential flood and erosion hazards and increase the community's resilience to flooding and other disasters.
- b. Avoid increased flood and erosion hazards resulting from irresponsible land use and development practices.
- c. Improve or maintain natural riparian functions along streams and rivers in Northfield to prevent or minimize future flood and fluvial erosion hazards.
- d. Educate property owners about flood and erosion hazards and encourage more to purchase flood insurance.
- e. Reduce the number of buildings in the floodway in Northfield through means such as buyouts.
- f. Increase the amount of public or conserved land within flood and fluvial erosion hazard areas in order to provide flood storage, stabilize streambanks and protect water quality.

*5.2.2. Flood Resilience Strategies:*

- a. Identify and protect natural flood protection assets, including floodplains, river corridors, other lands adjacent to streams, wetlands, and upland forested cover.
- b. Adopt flood hazard regulations that at a minimum, protect property from known risks.
- c. Review and evaluate statewide river corridor information when it becomes available.
- d. Consider adopting regulations that will protect erosion prone areas for additional development and encroachment
- e. Maintain and regularly update the Local Emergency Operations Plan.
- f. Continue to meet the VTrans Road and Bridge standards. Participate in regional Road Foreman trainings and Transportation Advisory Committee meetings to stay abreast of flood resilience measures for the Town's roads and bridges.
- g. Continue to update the Town's transportation infrastructure information in the Vermont online Bridge and Culvert Inventory Tool
- h. Upgrade undersized and failing culverts.
- i. Keep Hazard Mitigation Plan updated every 5 years.
- j. Assure all emergency shelters are adequate and equipped with a generator.

The following goals were developed by the planning team, vetted during a warned community meeting and approved 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.
- Develop a 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 Joint Planning Commission, Select Board and CVRPC and integrate the strategies into the existing town plan as annexes until the next formal update occurs, where a section devoted to mitigation planning will be integrated into the plan.
- Develop a 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 Joint 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 to enhance community resilience in a wholistic manner.

#### **Mitigation Action Groups:**

The following mitigation action categories form the basis of the town's future mitigation actions. For each mitigation action to follow, an indication of group will be given with the abbreviations listed below:

(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 Town 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. With comprehensive 10-year Capital Equipment and Improvement Plans starting in 2022, the town has considered future needs and the financial considerations required to meet these needs. 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 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. However, the town can 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.

#### *5.4.2 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. Progress in Mitigation Efforts

The table below provides status updates on the mitigation actions specific to infrastructure projects listed in the last approved plan. Actions from the previous plan not addressed below have been determined to be low priorities for the city. A low priority action from 2005 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.

*Table 5-2: Summary of Progress*

<b><i>Hazards Mitigated</i></b>	<b><i>Mitigation Action</i></b>	<b><i>2023 Status</i></b>
<i>Flooding, Localized Flooding</i>	<i>Stormwater Treatment installation (bio-retention) between Wall St. Bridge &amp; Union St. and collection system upgrade in Union St. catchment area</i>	<i>Complete</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<p><i>During the Town Plan update, conduct appropriate analysis and public outreach to determine if the community wants to augment its Floodplain Zoning Regulation to maintain its 17.5% ERAF state contribution rate, by updating the bylaw to meet ANR criteria. Criteria include (but are not limited too):</i></p> <ul style="list-style-type: none"> <li><i>adopt small streams setback to be regulated as River Corridor for streams draining &lt;2 sq. mi. Setback must be minimum 50' from top of bank.</i></li> </ul>	<i>Assessed but not adopted. Town may consider adopting following DR4720 recovery.</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>If the community elects to bring Floodplain Regulation into conformance with ANR Criteria, make and adopt necessary revisions.</i>	<i>Not completed and not electing to do this due to competing demands and higher priorities.</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>Evaluate flood and fluvial erosion mitigation and risk management measures for both the municipal water supply well-heads and well-fields as part of the next Source Protection Plan update.</i>	<i>Completed</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>Propose bond at the March 2017 Town Meeting for construction of new ambulance facility out of the floodplain and in a safer location near or attached to the Police/Fire Station</i>	<i>Complete and planning ongoing</i>

<b>Hazards Mitigated</b>	<b>Mitigation Action</b>	<b>2023 Status</b>
<i>Flood/Flash Flood/Fluvial Erosion: Flooding in Village &amp; Northfield Falls</i>	<i>Develop project scope(s) of work for flood modeling between Cross Bros. Dam and the Dog River Drive Facilities to define potential project components, their products, and their uses.</i>	<i>Incomplete and no longer considered a priority due to low risk.</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>Implement designs to restore floodplain parallel to Water St. to reduce flooding in the Water Street neighborhood. This action provides mitigation benefits for the one documented repetitive loss structure in Northfield.</i>	<i>Complete</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>Floodplain restoration downstream of Union Brook, following completion of Water Street restoration project</i>	<i>Complete</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<p><i>Bring in outside technical assistance to help Municipal Emergency Responders and Mayo Health &amp; Senior Rehab expand their evacuation &amp; (potentially) All Hazards Planning to possibly include:</i></p> <ul style="list-style-type: none"> <li><i>• conducting a mock evacuation exercise</i></li> <li><i>• work w/Mayo's licensing agency to ensure all plans meet agency requirements and best practices</i></li> <li><i>• work with hospitals that Mayo might evac. too, to determine capacity and best procedures</i></li> <li><i>• Coordinate with Red Cross Southern District to support Norwich's process of determining if Armory can support special needs sheltering, or other potential shelter sites</i></li> <li><i>• Assist Mayo with obtaining sample evacuation plans or other guidance from the Dept. of Public Safety</i></li> </ul>	<i>Complete</i>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<p><i>Based on the positive results of the CRS Quick Check, conduct further investigation to inform the decision of the community of whether or not to seek and maintain lower CRS classification. This will include:</i></p> <ul style="list-style-type: none"> <li><i>• Learn from Central Vermont communities already enrolled</i></li> <li><i>• Project as best as possible what the reduction in premium would be for the typical policy holder were the community to successfully reduce its</i></li> </ul>	<i>Not complete and not pursuing at this time due to competing demands and benefit-cost is considered low.</i>



<b>Hazards Mitigated</b>	<b>Mitigation Action</b>	<b>2023 Status</b>
	<p><i>classification</i></p> <ul style="list-style-type: none"> <li>• <i>Project the number of hours required for CRS application and verification</i></li> <li>• <i>Project the ongoing annual administrative burden of hours and resources for maintaining the credited activities (particularly new ones taken on), record-keeping &amp; reporting and yearly recertification</i></li> </ul>	
<i>Flood/Flash Flood/Fluvial Erosion &amp; Hurricane/Tropical/Severe Thunderstorm</i>	<i>Request that AOT enlarge the culvert that crosses under Rt. 12 at intersection of Gould Rd.</i>	<i>Not complete on not necessary</i>
<i>Railroad Accident</i>	<i>Participate in next Rail Car Incident Response Course (AWR 147) offered by State Fire Academy or Division of Emergency Management and Homeland Security</i>	<i>Complete</i>
<i>Extreme Cold/Winter Storm/Ice Storm</i>	<i>Identify contractors in the LEOP that Northfield or emergency response partners/agencies can call upon for assistance with debris clearing and removal during an event. Develop and maintain "Resource Appendix B5 Local Support Function"</i>	<i>Not complete and not pursuing</i>
<i>Extreme Cold/Winter Storm/Ice Storm</i>	<i>Incorporate Siting, permitting and designating a local disaster debris disposal facility along with designation and permitting of a new facility for yard waste and tree debris, to ensure proper disposal and a lower cost vs. hauling out of town</i>	<i>Not Complete and not pursuing</i>
<i>All Flooding, &amp; Water Supply Contamination</i>	<p><i>Invite closer collaboration &amp; offer municipal &amp;/or financial support for the work of the Friends of the Winooski River on river, watershed science &amp; flood risk education, well-field protection, stormwater management, and riverbank restoration &amp; beautification</i></p> <ul style="list-style-type: none"> <li>• <i>Select Board public support of FWR work on Dog River Park</i></li> </ul>	<i>Complete</i>

<b>Hazards Mitigated</b>	<b>Mitigation Action</b>	<b>2023 Status</b>
<i>Flood/Flash Flood/Fluvial Erosion</i>	<i>Take steps to grow the collaborative relationship between Norwich Physical Education, Geology, Engineering &amp; Architecture professors and the community to further flood resilience and sustainability awareness</i>	<i>Partially complete in addition of Norwich Staff to planning team for this update. Relationship building and collaboration will continue/</i>
<i>Earthquake (only to be pursued if Brownfields redevelopment advances to this stage).</i>	<i>Determine if earthquake retrofitting would be feasible during Brownfields redevelopment of the Mayo Block or Northfield Savings Bank Block</i>	<i>Not complete no longer considered necessary</i>

### 5.4.3. Specific Mitigation Actions

With emphasis on nature-based solutions (i.e., “green-engineering), several specific actions described below fall into the nature-based solution category. 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.

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.

Below, each of the seven actions listed above are explained below regarding progress, project leads and partner agencies and specific action steps:

**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**

**Lead Responsible Entity:** Town of Northfield, Road Forman

Potential Partner Entities: Vermont Agency of Natural Resources; Vermont Agency of Transportation; CVRPC, VEM, FEMA and the Agency of Commerce and Community Development

Timeframe: 2023 – 2028

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. In 2015, the University of Vermont released Scour research and opportunities for scour sensors. Maintenance and improvement of municipal water, sewer and electric power supply systems are established and ongoing will continue to function as a means of protection. Emergency generators at pump station water facility.

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. The infrastructure will be evaluated regularly prior to replacement or upsizing of the existing infrastructure.

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 city 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 will be identified and prioritized during the planning period through municipal coordination situational awareness.

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.

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

**Group: SP, PP, PEA**

Primary Responsible Entities: Town of Northfield, Select Board, Planning Commission and Emergency Management Director

Potential Partner Entities: Northfield Fire Chief

Timeframe: 2023 – 2028

Funding Requirements and Sources: VEM 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. All designated shelters have a backup power. 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 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 generators.
- 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 infectious disease event**

**Group: PEA, PP, SP**

Risk or Hazard Addressed: Risk to infrastructure, environment and residents

Lead Responsible Entities: Town of Northfield, ACCD, VDH

Timeframe: 2023-2028

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**

Primary Responsible Entities: Northfield Planning Commission, CVRPC, Emergency Planning services, VDH

Potential Partner Entities: Fire Chief, American Red Cross, Vermont's Medical Reserve Corps (MRC)

Timeframe: 2023 – 2028

Funding Requirements and Sources: Existing programs, contingent on available resources and funding.

Specific Identified Tasks:

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.

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. Northfield'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 Northfield’s energy-burdened households.

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 Northfield residents become more aware of weatherization and fuel-switching opportunities (NBS)
- Expand on “neighbor-to-neighbor” networks. Vermont 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 city 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 city, 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: Northfield, Fire Chief, VDH, CVRPC.

Timeframe: 2023 – 2028

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. Town Meeting Day can serve as an annual update and outreach opportunity as well.

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.
- 4) 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.
- 5) 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.

### *5.4.3. 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?
- 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?



Table 5-4.3: Northfield Action Evaluation and Prioritization Matrix

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

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. Also, most proposed FEMA HMGP mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

## 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 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's Select Board is the project lead and will work in conjunction with the Town Clerk and CVRPC 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 Select Board 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*

The town's Select Board Chair 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 Select Board
- 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

Formal integration into other community planning mechanisms since the last plan update has included the Town Plan related to flood resilience measures, achieving optimal ERAF rates, and the importance and rational of mitigation planning efforts. The Town 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 town plan and subsequent revisions to zoning regulations, 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.

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 Select Board, 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*

The Plan update will be led by the Select Board Chair. Depending on funding availability, the town may elect to acquire the assistance of CVRPC 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 six 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 Northfield Town 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 Planning Commission meeting to review and update the Implementation Matrix as a means to establishing an accurate evaluation of the plan's efficacy and the information required for the succeeding update to the plan. The town will fill in the implementation matrix specific to work accomplished relevant to the actions outlined, especially as it pertains to outreach, municipal system actions and road improvement projects.

Table 5-5 Implementation Matrix for Annual Review

Action	Responsible Entity (Bolded entity denotes primary responsibility)	Timeline	Specific Identified Tasks	Annual Progress
Improve road infrastructure and municipal systems protection programs	<b>Town Road Foreman, Planning Commission (PC)</b>	Spring 2023 and each subsequent spring	Infrastructure Assessment for Storm Water Vulnerability	
	Town Road Foreman	Spring 2023 and as-needed related to weather patterns	Assessment for Fluvial Erosion, Landslide Vulnerability	
	Town Road Foreman	As needed during entire planning period	Culvert Upgrades	
	<b>Town Road Foreman</b> and associated municipal systems managers	Ongoing each fall and spring of planning period	Continued Monitoring of Vulnerable Infrastructure	
	Town Road Foreman	Spring 2023-Fall 2028 (each project will be selected based on capability and level of need)	Future Project List TBA	

		within the planning period		
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Maintain and improve resilience to severe winter storms	<b>Road Foreman,</b> PC	Fall 2023 and each subsequent fall	Maintain Existing Shelter Capability	
	<b>Road Foreman,</b> PC	Fall 2023 and each subsequent fall	Reduce risk of power failure due to ice storms	
	<b>Road Foreman,</b> PC	Winter 2023-Summer 2028	Notification	
	PC and <b>Fire Chief</b>	Winter 2023-Fall 2028	Residential Programs	
	Town Road Foreman	Fall 2023 and each subsequent Fall in planning period	Monitor roads for safe and effective plowing	
	<b>Emergency Management Director</b>	Fall 2023-Winter 2028	Increase awareness of ICS structure and recommended practices	
Action	Responsible Entity	Timeline	Specific Identified Tasks	Annual Progress
Reduce impact of extreme cold durations	<b>PC Chair,</b> CVRPC, School, local/regional assistance organizations.	Winter 2023 and ongoing each fall	Economic Resilience	
	<b>Town EMD</b> and	Fall 2023 and	Maintain Existing Shelter Capability	

	Select Board	ongoing as preparation for winter		
	<b>EMD, CVRPC, School, local/regional assistance organizations.</b> <b>Fire Chief, PC,</b>	Fall 2023 and ongoing as preparation for winter	Notification and Education	
	<b>Fire Chief, PC,</b>	Fall 2023- Fall 2023	Assess Vulnerable Population	
<b>Action</b>	<b>Responsible Entity</b>	<b>Timeline</b>	<b>Specific Identified Tasks</b>	<b>Annual Progress</b>
Reduce Impact of Extreme Heat	PC	Summer 2023 and ongoing as required	<p><b>Economic Resilience:</b></p> <ul style="list-style-type: none"> <li>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.</li> </ul> <p><u>Zoning and Permitting Review Considerations:</u></p> <ul style="list-style-type: none"> <li>Consider stronger ventilation and cooling standards for mixed use development and multi-unit structures with four or more units.</li> <li>Enhance and expand availability of publicly available cooling sites. Northfield’s cooling options will need to serve a range of</li> </ul>	

	<p>needs for a diverse population. Some sites will need to be located indoors and operate for extended hours.</p> <ul style="list-style-type: none"> <li>• Specific mitigation actions to consider:</li> <li>• 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.</li> <li>• Promote use of the Vermont Department of Health Cooling Sites map and review the map every time the Local Emergency Management Plan is updated.</li> <li>• Establish procedures for ensuring that potable water is available for outdoor cooling sites during heat emergencies.</li> <li>• 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.</li> <li>• Improve cooling and ventilation</li> </ul>			
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	<p>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 Northfield's energy-burdened households.</p>		
	<p><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</p>		



			<p>service campaign.</p> <ul style="list-style-type: none"> <li>• Establish a local energy committee or appoint an energy coordinator to help Northfield residents become more aware of weatherization and fuel-switching opportunities.</li> <li>• Expand on “neighbor-to-neighbor” networks. Vermont 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.</li> <li>• One statewide system that can be used in any community is the Citizens Assistance Registry for Emergencies, CARE (<a href="https://e911.vermont.gov/care">https://e911.vermont.gov/care</a>). 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</li> </ul>	
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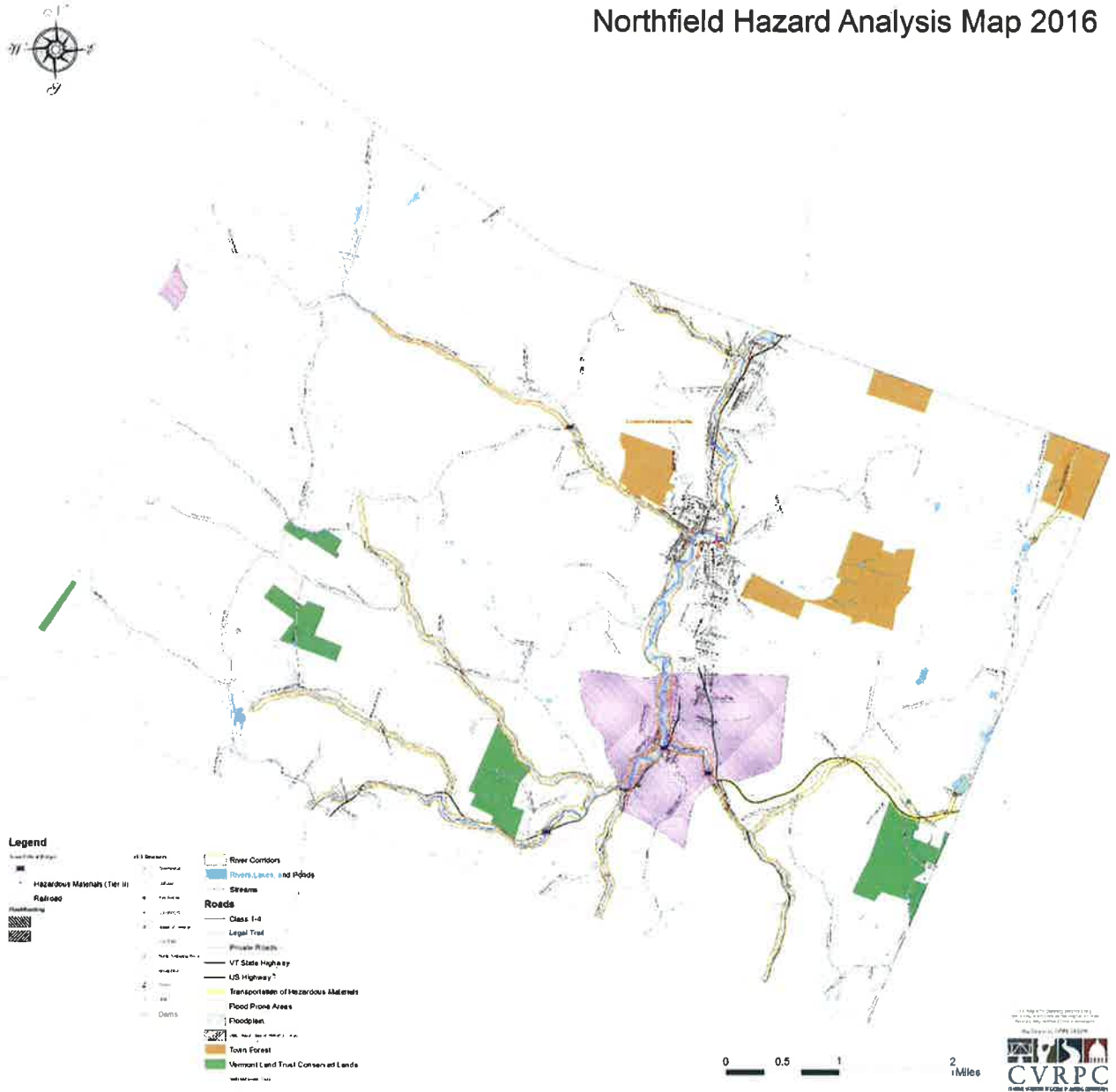
				(such as Town Meeting Day) may help. <ul style="list-style-type: none"> <li>• Specific mitigation action to consider:</li> <li>• Ensure that rental housing management staff, social service agencies, and visiting nurses have relevant and timely information on heat emergencies, including availability of cooling sites.</li> <li>• Encourage enrollment in CARE.</li> </ul> <p><u>Drought Planning:</u> The city should consider what, if any, actions should be considered based off best practices related to <u>drought mitigation</u>, state guidance, and risk.</p>	
<b>Action</b>	<b>Responsible Entity</b>	<b>Timeline</b>	<b>Specific Identified Tasks</b>		
Reduce risk and impact of a infectious disease event	PC, ACCD, VDH, CVRPC, school	Summer 2023-Spring 2023 (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.		
	PC, ACCD, VDH, CVRPC	Summer 2023-Spring 2023 (as-required)	Enhance awareness and planning for COVID-19-related mandates, communication, isolation and quarantine logistics for residents, municipal operations and maintaining economic stability		

	PC	Summer 2023- Spring 2023 (as- required)	Develop and maintain continuity of operations plans for critical positions	
<b>Action</b>	<b>Responsible Entity</b>	<b>Timeline</b>	<b>Specific Identified Tasks</b>	<b>Annual Progress</b>
Raise public awareness of hazards and hazard mitigation actions	Fire Chief, CVRPC, PC, EMD	Winter 2023- Spring 2024	Hazard Resilience for Property Owners	
	PC	As needed for residents and town	HMGP Awareness	
	Schools	Fall 2023- Fall 2026	School Programs	
	PC, Clerks	Fall 2022 and ongoing as needed	Family Programs	
	Fire Chief	Spring 2023 and on-going as needed	Fire Prevention Programs	
	Fire Chief	Summer 2023 on on-going as needed	Other Hazard Awareness Programs	

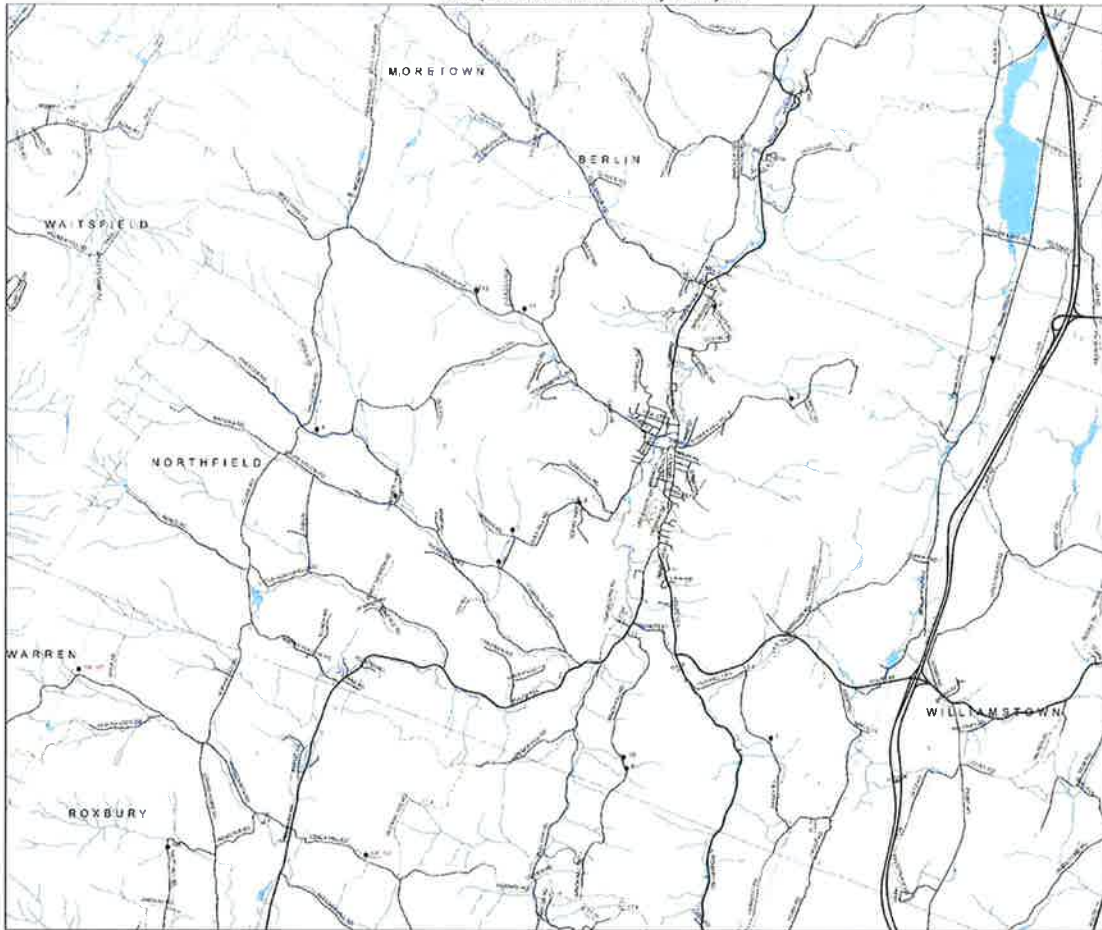
# APPENDICES

## Appendix A: Town Maps

### Northfield Hazard Analysis Map 2016



CVRPC Transportation Vulnerability Analysis



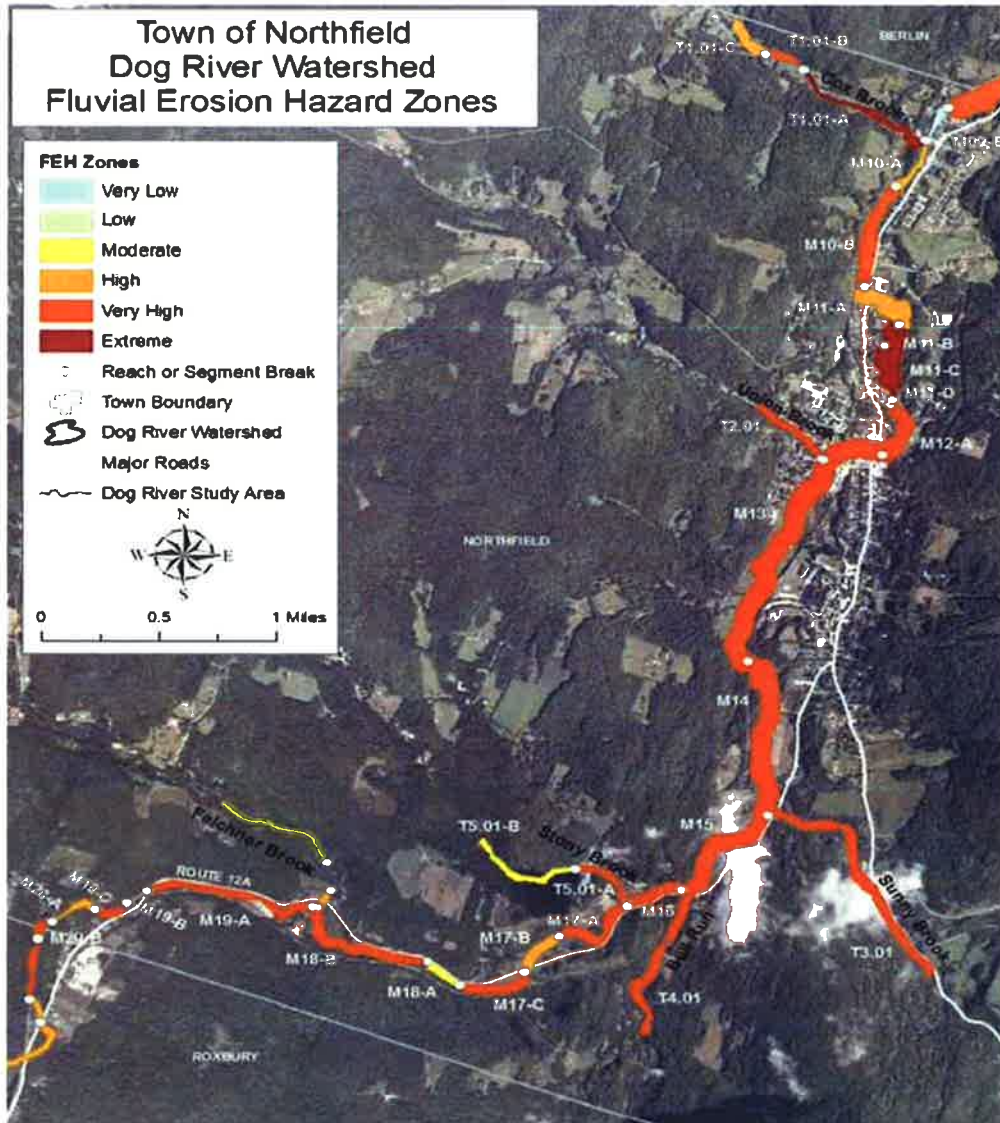
**Legend**

- GPS Sites for Potential Flood Resiliency Improvements
- Install Cross Culverts
- Forest Roads and Private
- Class 1-3
- Class 4
- VT State, US and Interstate
- Legal Trail and Discontinued

CLASS	STATUS	STATUS
1	Substandard	OK, NOT OK, NOK
2	Substandard	OK, NOK
3	Substandard	OK, NOK
4	Substandard	OK, NOK
5	Substandard	OK, NOK
6	Substandard	OK, NOK
7	Substandard	OK, NOK
8	Substandard	OK, NOK
9	Substandard	OK, NOK
10	Substandard	OK, NOK
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42	Substandard	OK, NOK
43	Substandard	OK, NOK
44	Substandard	OK, NOK
45	Substandard	OK, NOK
46	Substandard	OK, NOK
47	Substandard	OK, NOK
48	Substandard	OK, NOK
49	Substandard	OK, NOK
50	Substandard	OK, NOK



This map is for planning purposes only. Data is only as accurate as the original sources. This map may contain errors and is provided as is.

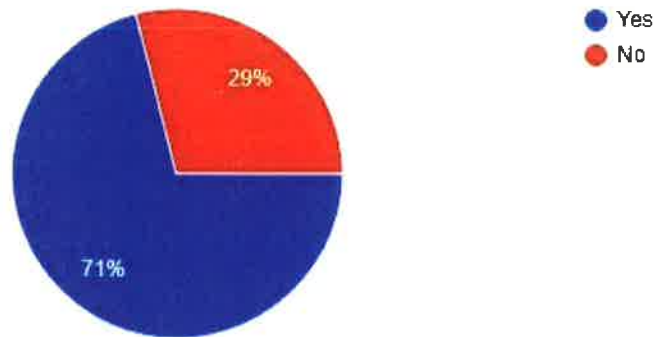


**Figure 7.2. Draft Fluvial Erosion Hazard Zone Map for the Town of Northfield - Dog River watershed**

Appendix B: Community Outreach Survey Results

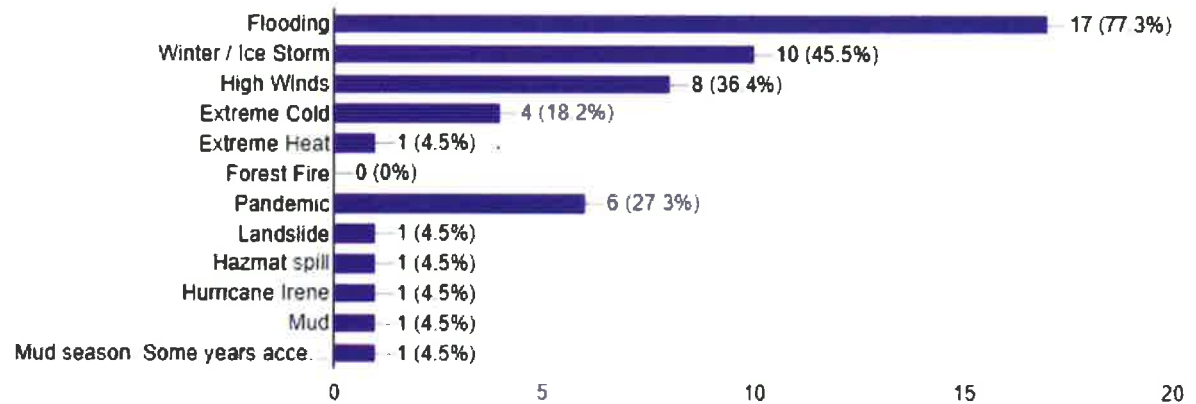
Have you ever been impacted physically, financially, or psychologically by a natural disaster in Northfield?

31 responses



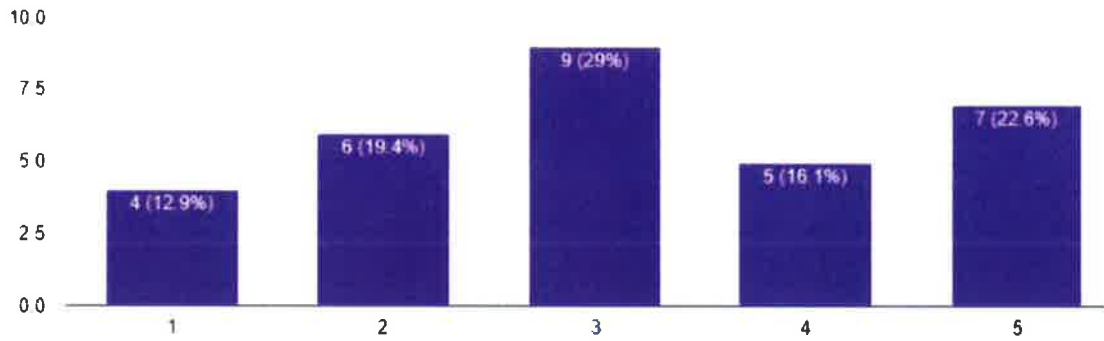
Which Hazard(s) was the cause of the disaster you experienced in Northfield?

22 responses



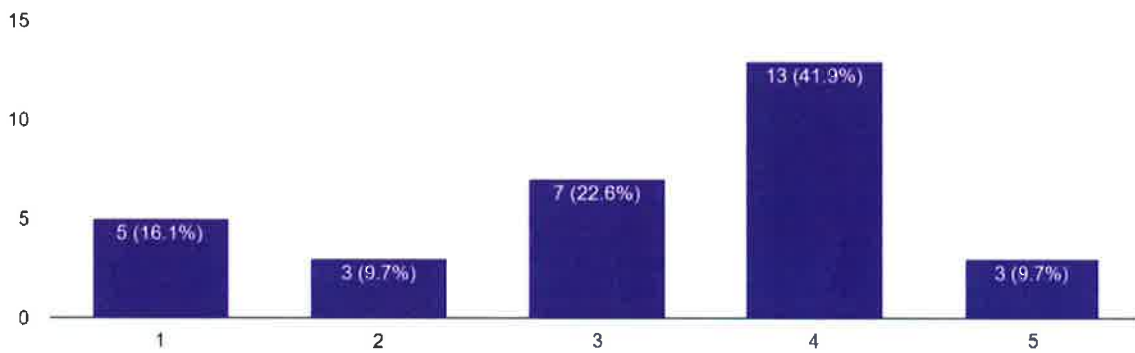
### How concerned are you about flooding?

31 responses



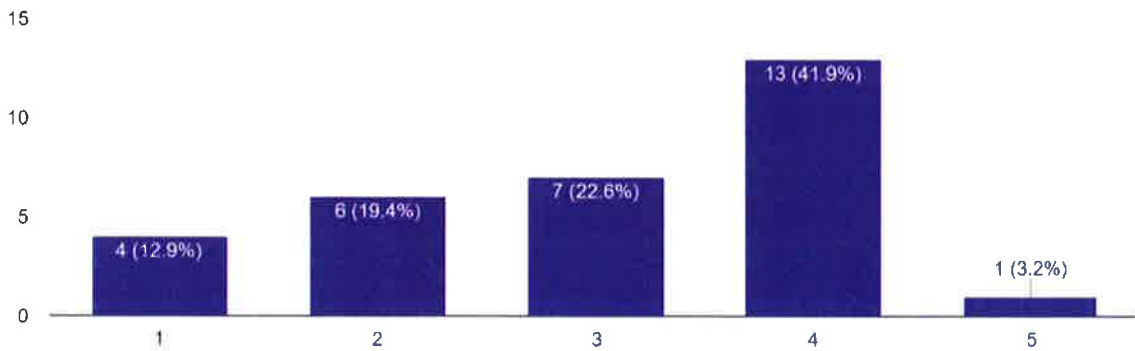
### How concerned are you about winter / ice storms?

31 responses



### How concerned are you about high winds?

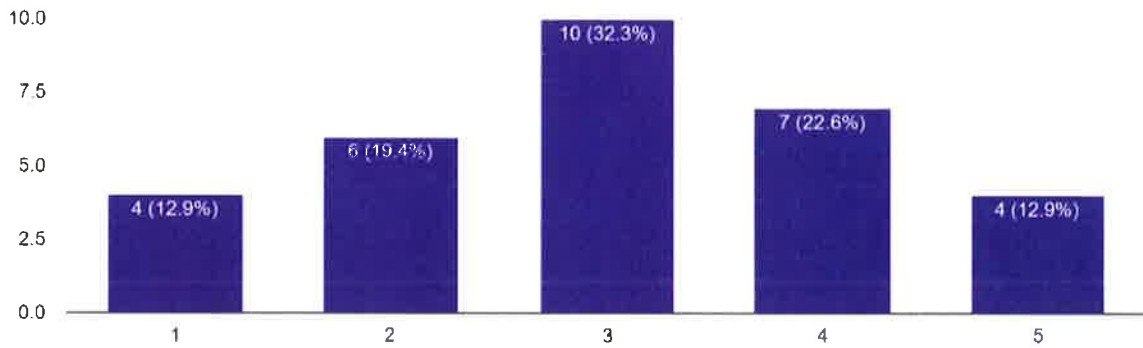
31 responses





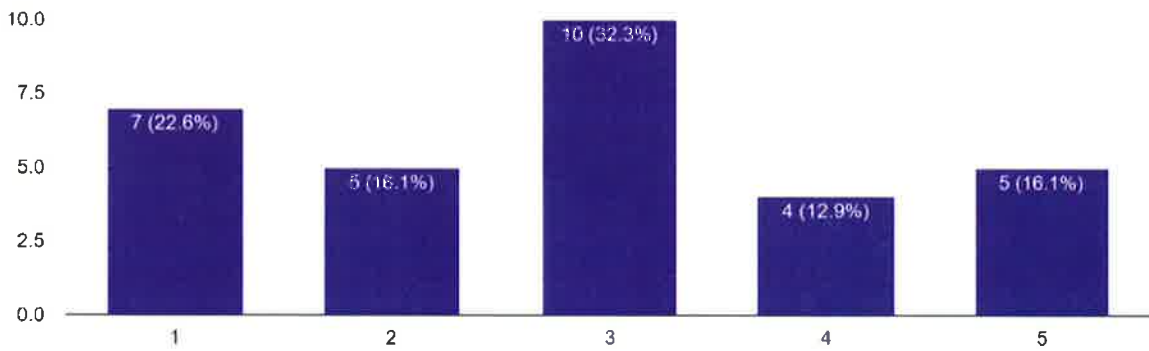
How concerned are you about extreme cold or heat?

31 responses



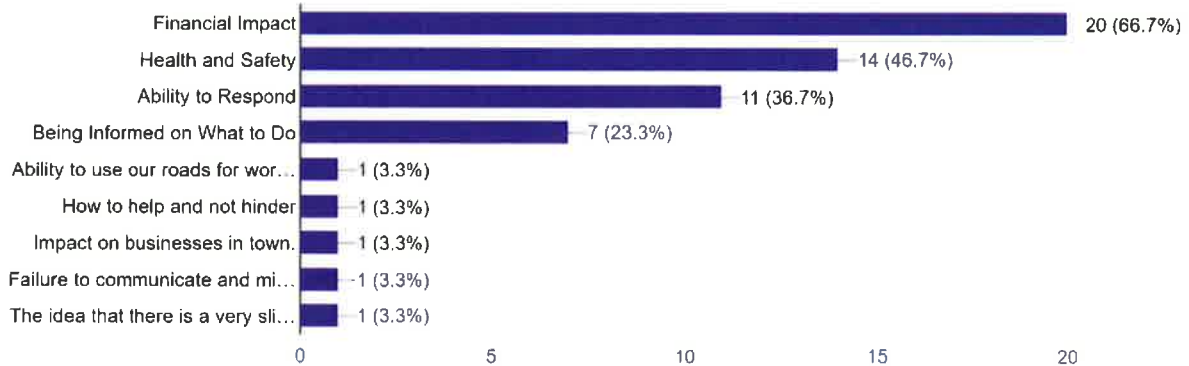
How concerned are you about another pandemic?

31 responses



What concerns you the most about natural disasters in Northfield?

30 responses



## Appendix C: Glossary of Terms and Acronyms

The following terms and acronyms are defined as used in this plan.

**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.

**Central Vermont Regional Planning Commission (CVRPC)** – an organization serving the 23 communities in Central Vermont including all of Washington County and the three towns of Orange, Williamstown, and Washington in Orange County. The mission of the CVRPC is to assist member municipalities in providing effective local government and to work cooperatively with them to address regional issues. The CVRPC works with area non-profits, other regional organizations, State and Federal agencies, and the general public. The CVRPC implements a variety of projects and programs tailored to local and regional needs, and also completes projects of statewide importance and interest.

**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 and 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.”