

*Adopted by the Town of Berlin on*

June 2, 2020

## **Town of Berlin**



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

**Town of Berlin  
108 Shed Road Berlin, Vermont 05602  
(802) 223-4405  
Public Assistance Applicant #: 023-05650-00**

Prepared by:

Town of Berlin, Vermont

CERTIFICATE OF LOCAL ADOPTION

Town of Berlin, Vermont

A Resolution Adopting the All-Hazards Mitigation Plan Update

WHEREAS, the Town of Berlin has worked with its residents and stakeholders to identify its hazards and vulnerabilities, analyze past and potential future losses due to natural and human-caused hazards, and identify strategies for mitigating future losses; and ...

WHEREAS, the Town of Berlin All-Hazards Mitigation Plan contains recommendations, potential actions and future projects to mitigate damage from disasters in Berlin; and

WHEREAS, the Town of Berlin and the respective officials will pursue implementation of the strategy and follow the maintenance process described in this plan to assure that the plan stays up to date and compliant; and...

WHEREAS, a meeting was held by the Town of Berlin Selectboard to formally approve and adopt the Town of Berlin All Hazards Mitigation Plan.

NOW, THEREFORE BE IT RESOLVED that the Town of Berlin adopts this All-Hazards Mitigation Plan for the town.

June 1, 2020

Date

Florence C. Smith

Selectman

[Signature]

Selectman

[Signature]

Selectman

Selectman

Selectman

[Signature]  
Selectboard Chair

Rosemary Mase  
Attested to by Town Clerk

## Executive Summary

In April 2019, the Town of Berlin began to develop this Local All-Hazard Mitigation Plan Update from the last approved plan from November 2011. 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. Berlin was one of these communities. The Berlin Local Mitigation Plan was originally adopted by the Town as an Annex to the Central Vermont Regional Pre-Disaster Mitigation Plan in November 2005 and received FEMA final approval in January 2006. The 2011 update was a standalone town PDM Plan. The 2011 plan identified areas most vulnerable to the profiled hazards and defined proposed mitigation actions. Updates on those actions are included in this plan update. The results of 2019 planning process 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 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. 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 previous 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 are introduced in the grid below:

*2020 Profiled Hazards (with Hazard Impact rating from 2018 State Plan “(x)” and Regional Planning Commission “[x]”)*

Severe winter/Ice storm (4/3) [3/4]	Extreme Cold (7) [5]	Flooding/Erosion (2/1) [1/2]
High Wind (5) [6]		

**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 support 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, Selectboard 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: Improve road infrastructure and municipal systems protection programs**
- Action #2: Improve resilience to severe winter storms**
- Action #3: Reduce impact of extreme cold durations**
- Action #4: Raise public awareness of hazards and hazard mitigation actions**
- Action #5: Continue fluvial geomorphology assessments in collaboration with DEC/VTrans and develop strategies and regulatory actions in response to identified concerns**
- Action 6: Improve resilience to high wind event**

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. 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 more comprehensively address their vulnerability. Though hazards themselves cannot be eliminated, Vermonters can reduce our vulnerability to hazards by improving our understanding of both the natural hazards we face and their potential impacts.*

*The 2018 Vermont State Hazard Mitigation Plan (SHMP) presents the hazard impacts most likely to affect Vermont and a mitigation strategy to reduce or eliminate our most significant vulnerabilities.”*

Hazard mitigation strategies and measures can reduce or eliminate the frequency of a specific hazard, lessen the impact of a hazard, modify standards and structures to adapt to a hazard, or limit development in identified hazardous areas. This plan aligns and/or benefits from the State’s 2018 Hazard Mitigation Plan and as part of the Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency, many state agencies and local organizations have an 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 both villages and their residents:

- 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 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 multi-jurisdictional municipal comprehensive plan as described in 24 VSA, Section 4403(5). This mechanism will be developed by the Planning Commission, Selectboard 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 municipal 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

## **1.6 Community History and Background**

The Town of Berlin is located in the center of Washington County. It is surrounded by eight municipalities, including the urbanized areas of Montpelier and Barre City. According to the 2010 US Census, Berlin has a total population of 2,887. Approximately 25% of Berlin's workforce is employed within the Town, with the remaining 75% working outside of the community. The Town's major thoroughfare, Interstate 89, travels from the Town's southeastern border to its northern border with Montpelier. Two Interstate exits are located entirely within the Town, with a third just beyond its northern border. Other significant roads include Vermont 63 and Vermont 62 (both of which connect the Interstate to the eastern part of the County), US Route 302 (Barre-Montpelier Road, which follows the Stevens Branch and serves as the major connector for Barre City and Montpelier), and Vermont 12 (which follows the Dog River and serves as the major connector between Montpelier and Northfield). Housing within the Town is widely dispersed. Residential growth through the Town continues to be of lower densities and scattered. While the resident population may not be exploding, there is some evidence that the employment population (and correspondingly, the commercial/service infrastructure/square footage) is. Traffic studies are being performed around the mall, hospital and Route 62 intersection to address growing traffic and accident concerns. Current zoning regulations focus non-residential development and high-density residential development within this region, essentially along US Route 302 and extending westerly to Interstate 89. Berlin contains the Region's only State airport, E.F. Knapp Airport, only hospital, Central Vermont Medical Center, and only indoor mall, Berlin Mall. Zoning regulations encourage growth to stay in the northeast quadrant area, while allowing low density rural residential growth in the remainder of the town. Development in the flood hazard overlay area is highly restricted.

In Berlin, electricity is provided by Green Mountain Power to those residents who are situated along the major transportation corridors of US 302, Vermont 62, and Vermont 12. Washington Electric Cooperative primarily serves residents that are located in the hills and along the back roads. Development along US Route 302 and the Central Vermont Medical Center segment of the Plateau Area are served by an existing water system. Community members outside of these two areas depend on ground water for domestic water supply and industrial uses.

The Berlin Volunteer Fire Department provides fire protection to the Town from two stations: Riverton (located in the western half of the Town long Vermont Route 12) and the Berlin Corners area. Berlin is also a member of the Capital Fire Mutual Aid System which includes all of the Towns in Washington County and some surrounding communities. Ambulance service is provided by the Town of Barre Emergency Management Services. Police service is provided by the Berlin Police Department which has an eight-officer force. Vermont State Police are relied upon to provide supplemental support and the Washington County Sheriff's Department provides additional speed control on major routes.

The Town Plan includes goals and objectives in regard to flood plains, steep slope development, transportation, and public services. The Zoning Regulations include a stream protection section which has instituted a vegetated buffer strip of 75 feet from all streams and rivers and 50 feet from any wetland.

Revisions to this plan update have been made to reflect changes in development. Namely, the mitigation projects related to both declared disasters of 2011 have drastically reduced flood vulnerability for the town. A detailed listing of projects is included in this update. Mitigation measures for the Westin Mobile Home Park as result of 2011 events have also served to decrease vulnerability to this area with long-standing increased flood risk. In 2017, the town purchased one of its two repetitive loss properties in the SFHA. As result of the work completed since the last plan, priorities have changed. While mitigating flood risk to transportation infrastructure remains a priority in this update, not to the magnitude seen in 2011. Because of this, the town is able to focus on other measures, such as extreme cold, in the upcoming planning cycle.

## 1.7 Summary of Planning Process

The work to update this plan was led by the planning team made up of municipal officials, school officials, local businesses, service agencies and emergency response personnel. The update project followed a work plan which provided the public the opportunity for two-way communication. Existing documents were also researched and incorporated into the plan update.

Planning team members represent a broad array of stakeholders and represents the first such team as the 2011 planning was composed of a CVRPC representative and the Town Administrator at the time. The following table presents the current Planning Team members and their title:

*Berlin Mitigation Planning Team Roster*

Town/Zoning Administrator	Dana Hadley
Police Department	William H. Wolfe, Chief

Berlin Fire resident representatives	Jerry Diamantides/ Jeremy Hansen
Berlin School	Vera Frazier
Berlin Airport	John Roberti/Jen Davis
Planning Commission	Karla Nuissl, Chair
Health Officer	Thomas Badowski
Highway Superintendent	Tim Davis
Select Board	Jeremy Hansen, Vice Chair
Select Board Chairman	Bradley Towne
Public Works Administrator	Tom Badowski
Hospital Representative	Robyn Ayer
Town Clerk	Rosemary Morse
Emergency Management Representative	Bruce Richardson

The last approved plan for the town was in 2011. This approval came shortly after the catastrophic flooding resulting from Tropical Storm Irene and, as many towns suffering severe damage and financial burden, an approved plan was needed to allow for much-needed FEMA public assistance funding. The town, by default of daily operations, experience with major disasters since 2011 and advancements in mitigation planning and guidance from state agencies, has enhanced its mitigation efforts since 2011. There is a current understanding of the need to integrate the content of this update and its goals, actions and reporting into the daily operational structure and awareness of all town officials. The planning team was developed, representing the community and regional partners as best as possible and planning updates were given consistently at warned, community meetings. June 6<sup>th</sup>, 2019 marked the kick-off meeting at a normally scheduled selectboard meeting. Both disaster history and planning requirements were discussed with a list of next steps. Additionally, a survey was drafted asking for community input and made available through the town's standard public notification process with access in the town office. The survey introduced the importance and informational needs of a 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; flooding, notification procedures, back-up power and planning. All neighboring towns (Moretown, Montpelier, Barre City/Town, Northfield, Williamstown, and East Montpelier) were sent notification via the town clerk/manager of the plan's development and were given an opportunity to provide input through email and/or phone call to the town clerk/manager. No responses were obtained from this solicitation. 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)
- 2018 Town Plan (provided current goals and regulations supporting mitigation, recent capital expenditures and infrastructure value helped to drive vulnerability assessment)
- 2018 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).

- Vermont Agency of Natural Resources (ANR) and Transportation (VTTrans) (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).
- 2013 ACCD Mobile Home Resilience Plan (served as resource for future mitigation actions)

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 selectboard meetings are summarized below.

- *5/20/19: Planning Team formed*
- *6/6/19: Kick off meeting to discuss objectives, next steps and timelines. A representative from the Regional Planning Commission supplied information on the Community Rating System. Members of the public were in attendance, but no comments were heard.*
- *6/27/19: Conference call with zoning administrator to discuss NFIP and CRS rating*
- *7/1/19: Draft sections I and II sent to planning team for review and comment.*
- *7/11/19: Repetitive loss and NFIP claims data reviewed at selectboard meeting. Data approved as accurate.*
- *8/15/19: Conference call to Westin mobile home park representative to discuss mitigation measures. Suggestion for route 12 ditching was made to further park protection.*
- *9/12/19: Berlin Emergency Planning Team (BEPT) subcommittee formed to assist with facilitation of community surveys and plan review.*
- *11/20/19: Qualitative Risk Analysis of natural hazards draft sent to planning team for review and presented at selectboard meeting. Analysis was approved.*

- 1/2/20: Warned public meeting to review the identified hazards and associated mitigation strategies. Members of the public were present, no comments were made.

During the opportunity for public comment on the draft plan from both the community and neighboring municipalities, no comments were obtained aside from the community survey and planning team input. 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 including in the appendix. The revised draft was made available for review at the town office and residents were informed via meeting minutes and the town bulletin board of the ability to review the draft and provide formal comment via the town clerk. 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 will occur following FEMA review and “approval pending adoption” status.

## SECTION 2: HAZARD IDENTIFICATION

The 2011 Plan profiled the following hazards (bold indicates continued inclusion in this update):

- **Flash flood/flooding/fluvial erosion**
- **winter storm/ice**
- **high winds/ hurricane/severe storms**
- earthquake
- forest/wildfire

For this update, the planning team considered the continued inclusion or deletion of the 2011 hazards profiled by developing and researching the natural hazard categories outlined in the state mitigation plan and for each, considered prior history, current trends and available data to estimate risk. As highlighted above, some profiled hazards remain a risk for the town. However, other hazards, due to lack of occurrence frequency, risk and/or vulnerability have been removed in this update. The one addition to this update’s profiled hazard category is *extreme cold*. The definitions of each hazard, along with historical occurrence and impact, are described below.

- **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.

**2019 Profiled Natural Hazards:** Severe Winter Storm/Ice, flooding (to include severe storms, flash floods and fluvial erosion), High winds and Extreme cold temperature

## 2.1 Natural Hazards Overview

Between 1/1/12 and 12/31/19, 123 weather events were reported in Washington County (NOAA). According to NOAA Storm data, there were 123 severe weather events from 2012-2018 in Washington County. These events included winter storm (36), flooding/flash floods (14), lighting (3), high/strong wind (8), extreme cold (2), hail (13), thunderstorm/wind (46), heat (1). Events specific to the town, in addition to declared disasters include:

- 06/08/2012: hail
- 07/04/2012: thunderstorm and wind
- 9/8/2012: thunderstorm and wind
- 9/11/2016: thunderstorm and wind
- 10/30/2017: high wind

The highest risk hazards (severe winter/ice storm, flooding, extreme cold and high winds) have been profiled to provide the basis of future mitigation strategies. However, lower risk natural hazards (drought, tornado, extreme heat, hail, landslide, earthquake, naturally-occurring radiation, hurricanes and fire hazards) are omitted from full profiling because they do not pose enough risk to substantiate mitigation efforts at this time. However, impacts from hurricanes are addressed under flooding hazard.

*Table 2-1: Summary of Vermont Emergency Declarations*

Number	Year	Type
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
4380	2018	Severe Storms and Flooding
<b>4356</b>	<b>2018</b>	<b>Severe Storms and Flooding</b>
<b>4330</b>	<b>2017</b>	<b>Severe Storms and Flooding</b>
<b>4207</b>	<b>2015</b>	<b>Severe Winter Storm</b>
4232	2015	Severe Storms and Flooding
<b>4178</b>	<b>2014</b>	<b>Severe Storms and Flooding</b>
4163	2014	Severe Winter Storm
<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>
1784	2008	Severe Storms, Tornado and Flooding
1778	2008	Severe Storms and Flooding
<b>1715*</b>	<b>2007</b>	<b>Severe Storm, Tornado and Flooding</b>
1698	2007	Severe Storms and Flooding
1559	2004	Severe Storms and Flooding
1488	2003	Severe Storms and Flooding
1428	2002	Severe Storms and Flooding
1358	2001	Severe Winter Storm
1336	2000	Severe Storms and Flooding
1307	1999	Tropical Storm Floyd
1228	1999	Severe Storms and Flooding
1201	1998	Ice Storm

### 2.1.1. Profiled Hazards

#### *An Introduction to Climate Change:*

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2018, there were 21. 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.

*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 Vermont State Hazard Mitigation Plan*

### **Severe Winter Storm**

Winter storms impact the entire planning area and can include; snowstorm, cold, blizzard and ice. 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.”*

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 Berlin are not available,

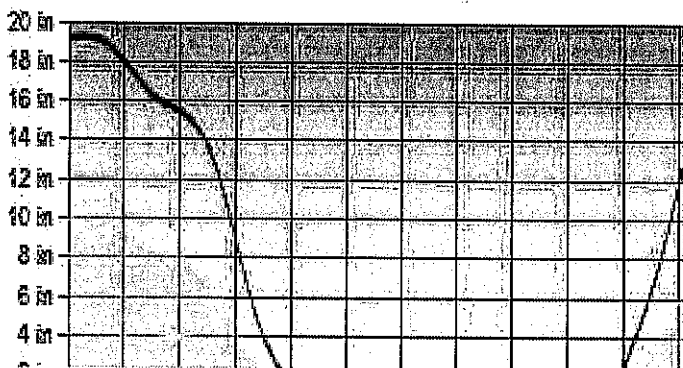
neighboring towns received up to 24". Numerous schools, businesses and local government offices closed for March 14th and 15th with numerous vehicle accidents and stranded vehicles. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase 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 Berlin 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.

*Berlin Snowfall vs. U.S. Average*

**Snowfall**



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 Berlin, the 2018 SHMP gives historic snowfall totals by county. The following is recorded for Washington County:

Duration	1-Day	2-Day	3-Day
Date	3/14/93	12/28/69	12/29/69
Amount	31''	36''	44''

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 Berlin was not 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 North American Ice Storm of 1998 was produced by a series of surface low pressure systems between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2'' in some areas. Berlin 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 Berlin and 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.wr.noaa.gov/map/?wfo=sto](http://www.wr.noaa.gov/map/?wfo=sto)).

### **Extreme Cold**

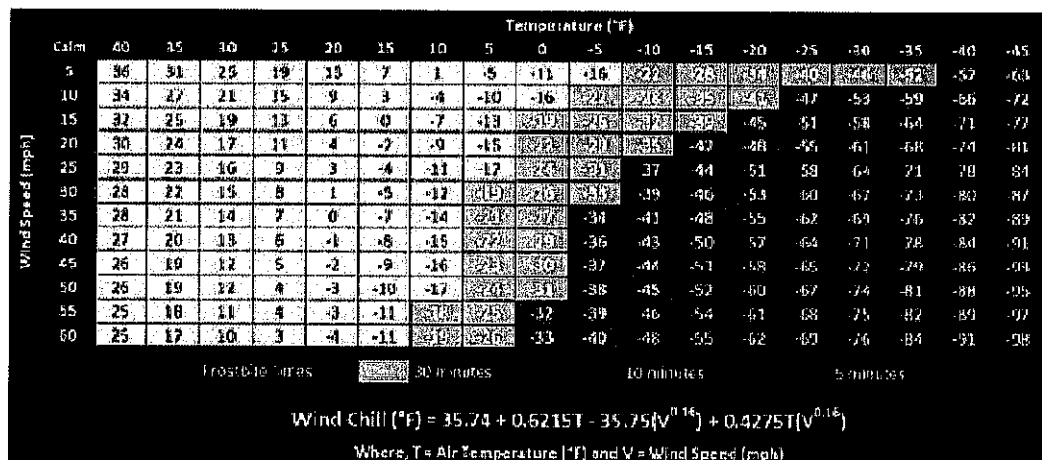
*Extreme cold temperatures can have significant effects on human health and commercial and agricultural businesses, as well as primary and secondary effects on infrastructure (e.g. burst pipes from ice expansion and power failure). What constitutes "extreme cold" can vary across different areas of the 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 is a concern and impact the entire city and region. 2015 tied the coldest winter (January to March) on record (1923) for Vermont as a whole 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 Berlin 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 societal (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:

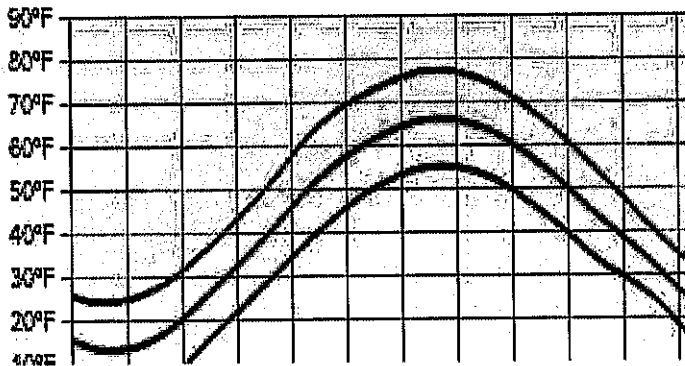


In anticipation of extreme cold temperatures, the National Weather Service may issue the following watches, warnings or advisories, which are aimed at informing the general public as well as the agricultural industry:

- 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: Berlin Temperature Ranges vs. National Average*

### Average Temperatures



### Flooding

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

*-2018 State Hazard Mitigation Plan*

Flooding/flash flooding/fluvial erosion is Berlin’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 other. 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. History of Occurrences (within Berlin and Central Vermont from NCDRC Website and FEMA DR List. Closest flood gauge is located in Montpelier, VT approximately 6 miles downstream on the Winooski River):

Date	Event	Location	Extent
7/19/2015	Flash Flood	Barre	1m damage
7/04/2013	Flash Flood	Montpelier Jct	50k damage
8/28/2011	Flood/Tropical Storm	Statewide, Berlin	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet) – DR 4022
5/27/2011	Flash Flood	Berlin, County Wide	Montpelier flood gauge at 17.59 feet, 3-5" of rain – DR 4001
8/02/2008	Flash Flood	Berlin, County Wide	2-5" of rain
7/11/2007	Flash Flood	Berlin, County wide	3-6" of rain in 2 hrs, DR 1715
4/14/2002	Flood	County wide, Berlin	1-3" of rain across the county
12/17/2000	Flood	County Wide, Berlin	3" of rain, \$1 M in damages
9/16/1999	Tropical Storm Floyd	County Wide, Berlin	Montpelier flood gauge at 9.30 feet, 5-7" rain county wide, DR 1307
6/27/1998	Flash Flood	Berlin, County Wide	\$2M in damages, 3-6" rain across county, DR 1228
7/15/1997	Flash Flood	County Wide	2-4" of rain, \$500k in damages
1/19/1996	Flood; ice jam	County Wide, Berlin	Montpelier flood gauge at 14.64 feet
8/10/1976	Flood	County Wide, Berlin	Montpelier flood gauge at 12.31 feet, DR 518
6/30/1973	Flash Flood	Barre Town	Montpelier flood gauge at 17.55 feet
9/22/1938	Flood, Hurricane	County Wide, Berlin	Montpelier flood gauge at 14.11 feet
11/03/1927	Flood	County Wide, Berlin	Montpelier flood gauge at 27.10 feet

Specific extent data for flood levels in Berlin is lacking as the closest flood gauge is located in Montpelier. During Tropical Storm Irene and the May 2011 events, flooding in Berlin was severe along the Dog River and Stevens Branch. The Montpelier flood gauge was 4 feet above flood stage. Flooding in certain areas was up to 5 feet (see flood map attached.) The worst flooding event in Berlin's history was the 1927 event; however, exact data from that event is not available. In 1927 event, the Montpelier flood gauge was at 27.10 feet; however, since the 1927 flood a number of flood control dams have been installed in the region to prevent the same flooding extent. Lesser but more regular flooding occurs in Berlin, with generally 1-2 feet of

water along low lying areas by the Stevens Branch and Dog River. These areas are identified on the local areas of concern map. Berlin and Barre City can work together to have a river gauge installed so that the Town may better monitor flood levels.

Four significant bodies of water exist within Berlin: The Dog River along VT Route 12, Berlin Pond, the Stevens Branch Creek along US Route 302, and the Winooski River along US Route 2, Junction Road, and Three Mile Bridge Road. Significant flooding and ice jams are common on the above-mentioned rivers.

The majority of development along the US 302 corridor (Stevens Branch Creek), the lower section of the Dog River, and the Montpelier Junction area are located within the National Flood Insurance Program's (NFIP) designated 100-year floodplain. As of 2017, there were approximately 160 buildings in Berlin located within the Special Flood Hazard Area (the floodway and the 100-year floodplain). 111 of those buildings were mobile homes located in the Weston, Berlin and River Run mobile home parks. 72 of those buildings were in the floodway (including 47 mobile homes). Only 45 (28%) of those buildings had flood insurance policies. 3 of those buildings were critical or public structures (VTrans Central Garage Complex on Route 302). 1 was a repetitive loss property (a building that has sustained \$1,000 or more in flood damage on at least 2 occasions in any 10-year period) remaining. The town purchased the only other repetitive loss property in Berlin through FEMA's Hazard Mitigation Buyout Program in 2017.

The effective date of Berlin's FIRM is 8/15/1984. The estimated loss for a severe flooding event for all properties located within the Town's 100-year floodplain is approximately \$77,185,800. Berlin has 47 active NFIP policies with a total coverage of \$7,161,400. The Zoning Administrator is responsible for enforcement of flood hazard regulations. The Town has not had any compliance issues; however, it was mentioned that the regulations are difficult to administer.

The Montpelier Junction area continues to be vulnerable to flood hazards. The Montpelier Junction area is located at the confluence of the Dog and Winooski Rivers. The entire area is situated within a designated Well Head Protection Area and most of the region is either within or near to a NFIP designated Floodplain. This area serves as the Montpelier stop for the New England Central Railroad (NECR) as well as its interchange with the Washington County Railroad. A variety of industrial uses are located within this area, including DCP Mid-Stream (120,000 gallons of pressurized propane in above ground tanks) and the Capitol Steel & Supply Company.

Partridge Road on the East side of the Stevens Branch Creek also remains vulnerable. The Partridge Road Bridge provides the only access to this area which includes Partridge Farms, a single-family and condominium development, and the 30-unit Berlin Mobile Home Park. An ice dam/block occurred on the Stevens Branch Creek approximately 8 feet downstream of the Bridge on January 19, 1996. The ice dam event flooded residents of the Berlin Mobile Home Park and stranded all of the individuals on the East side of the Creek. This incident has brought attention to other properties that are located within reach of a potential ice dam/block or flooding event. The River Run Mobile Home Park is a 35-unit development that is located along a bend of



the Stevens Branch Creek and within the NFIP designated 100-year floodplain. This development is susceptible to flood related events. The River Run Mobile Home Park was again flooded in the spring 2011 flood event and most of the residents were displaced. Some residents returned; however, many did not.

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.

A corridor plan for the Dog River was developed by VT Agency of Natural Resources. The plan assesses the Dog River until its convergence with the Winooski River in Montpelier. The stretch of river in Berlin was rated in “fair” condition; the river is undergoing “high” to “moderate” bank adjustments and fluvial erosion. The high rates of adjustment and erosion can be attributed to several factors – straightening of the river channel, development encroachments, high levels of storm water runoff, historic gravel mining and dredging activities, undersized culverts and bridges, and lack of riparian buffers greater than 25 feet. In Berlin, there are 3 undersized bridges which should be replaced in order to decrease erosion and restore the river’s health. In addition to bridge projects, the plan identifies 19 projects that could be completed in Berlin to restore and renew the river’s health. Despite attempts to solicit a formal update from the state, actions on the specific proposed projects in the plan remain unknown. While speculated that the plan’s action items remain as propositions, the town will, as part of the upcoming planning cycle, revisit the plan to assess efficacy of originally proposed action items. In both the spring 2011 floods and tropical storm Irene, Berlin experienced severe flooding as a result of flooding in the Dog River and 4-5” of rain falling in a very short period. A greater explanation of areas damaged is provided in the High Wind/Hurricane/Severe Storms section of this plan.

### ***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 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. Rain storms 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.”*

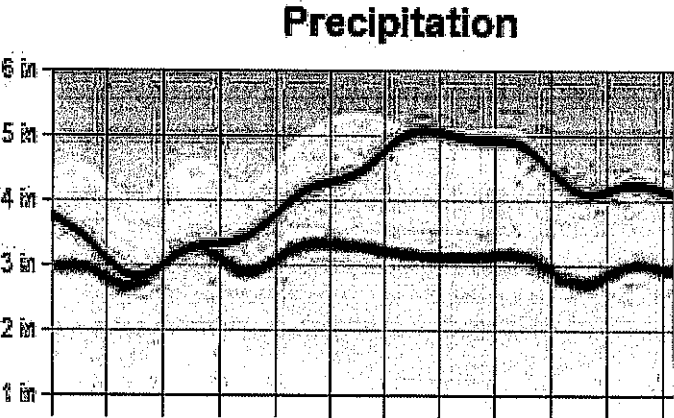
Vermont experienced major floods long before Federal disaster assistance became available. The most destructive recorded event was in November of 1927. In the month before the flood, rains in excess of 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 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, 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. The Montpelier Junction area continues to be vulnerable to flood hazards. The Montpelier Junction area is located at the confluence of the Dog and Winooski Rivers. The entire area is situated within a designated Well Head Protection Area and most of the region is either within or near to a NFIP designated Floodplain. This area serves as the Montpelier stop for the New England Central Railroad (NECR) as well as its interchange with the Washington County Railroad. A variety of industrial uses are located within this area, including DCP Mid-Stream (120,000 gallons of pressurized propane in above ground tanks) and the Capitol Steel & Supply Company.

Partridge Road on the East side of the Stevens Branch Creek also remains vulnerable. The Partridge Road Bridge provides the only access to this area which includes Partridge Farms, a single-family and condominium development, and the 30-unit Berlin Mobile Home Park. An ice dam/block occurred on the Stevens Branch Creek approximately 8 feet downstream of the Bridge on January 19, 1996. The ice dam event flooded residents of the Berlin Mobile Home Park and stranded all of the individuals on the East side of the Creek. This incident has brought attention to other properties that are located within reach of a potential ice dam/block or flooding event. The River Run Mobile Home Park is a 35-unit development that is located along a bend of the Stevens Branch Creek and within the NFIP designated 100-year floodplain. This development is susceptible to flood related events. The River Run Mobile Home Park was again flooded in the spring 2011 flood event and most of the residents were displaced. Some residents returned; however, many did not.

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: Berlin Precipitation vs. U.S. Average



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

Areas along the banks of the Dog River, Steven's Branch, Berlin Pond and Pond Brook have been identified as flood plain areas. As of 2017, there were 172 structures (including 85 mobile homes) in Berlin located within mapped river corridors or within 50 feet of small streams. 70 (41%) of those were outside the Special Flood Hazard Area. There were also 17.5 miles of roads located within mapped river corridors or within 50 feet of small streams, 13.5 of which were town roads. 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, causing 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 river bank 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 occur when the power of the flood (i.e. the depth and slope of the flow) exceeds the natural resistance of the river's bed and banks. Rivers that have been overly straightened or deepened may become highly erosive during floods, especially when the banks lack woody vegetation, or when the coarser river bed sediments have been removed. In areas where rivers are confined due to human activity and development, they have become steeper, straighter, and disconnected from their floodplains. The more trapped the river is, the greater power it will gain, which eventually results in a greater degree of damage to critical public infrastructure such as roads and stream crossings, as well as homes, businesses, community buildings and other man-made structures built near rivers. Fluvial erosion is also increased downstream when all the eroded materials (i.e. sediment and debris) come to rest in a lower gradient reach, clog the channel, and cause the river to flow outside its banks. When severe enough, fluvial erosion can also be the cause of Landslides (see: Landslides). The land area that a river accesses to meander and overtop its banks to release flood energy without excessive erosion is known as the River Corridor. A river corridor includes the meander belt of a stream or river and a buffer of 50'. The River Corridor, as defined in Vermont statute, is: the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in section 1422 of this title, and for minimization of fluvial erosion hazards, as delineated by the Agency of Natural Resources in accordance with river corridor protection procedures.*

*Vermont's River Corridor maps delineate river corridors for larger streams and rivers, and standard setbacks for smaller, upland streams. The setbacks were determined by factoring in the same stable stream slope requirements used when delineating a river corridor using a meander centerline setback. These maps are located on the Vermont FloodReady3 and Vermont Natural Resources Atlas websites.*

The Vermont Agency of Transportation (VTrans) applies the term "scour critical" to stream crossing structures especially vulnerable to streambed scour—the undermining of bridge supports by water action and erosion. A spreadsheet database is maintained by VTrans and continually updated by the Bridge Inspection Program. Structures inspected are only those of 20

ft. or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not consider debris jams, outflanking, channel change, or other issues commonly associated with fluvial erosion. Water supply source and distribution systems are also endangered by fluvial erosion. Many water distribution systems involve buried pipes that cross streams, which are vulnerable to fluvial erosion. In December 2014, the Vermont Department of Environmental Conservation (DEC) released the “Flood Hazard Area and River Corridor Protection Procedures” guide, outlining specific actions and considerations. 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.

### ***Ice Jams***

Ice jams, which can cause rapid and catastrophic flooding, are considered increasingly hazardous in parts of Vermont. In addition to the inundation damage they cause, ice jams can block infrastructure such as roads and culverts. A list of historic ice jams, including municipalities and streams, is maintained by the Vermont Division of Emergency Management and the Vermont Agency of Natural Resources. There has been some damage and minor flooding as a consequence of ice jams in the past. A list of historic ice jams, including municipalities and streams, is maintained by VEM and the Vermont Agency of Natural Resources (ANR). The US Army Corps of Engineers Cold Regions Research and Engineering Laboratory maintains a more specific database of ice jams, which includes over 903 events in Vermont with the latest occurring in 2018. Ice Jams can occur every winter along stretches of the Winooski River from Montpelier down through Richmond, VT. Low lying stretches of River Road are often impacted. March 1992 was the most severe where major flooding resulted in nearby Montpelier. In March, 2019, flooding alerts issued by the National Weather Service Friday into Saturday (March 15 & 16) with potential for river flooding and ice jams.

### ***Dams***

According to the 2013 *Vermont State All-Hazards Mitigation Plan*, “*The VT Agency of Natural Resources (ANR) Dam Safety Program maintains an inventory of 1205 dams (including 85 ANR owned dams) with impoundments greater than 500,000 cubic feet*”. Failure of any of these dams could result in significant downstream flooding. A dam breach is remains the biggest threat to the municipal sewer system. There have been no recent or historically relevant flooding events associated with the failure of any dam in *Vermont*. However, as stated in FEMA Guide P-956 “*Living with Dams: Know Your Risks*” (2013): “*Although dam failures are infrequent, the impacts can be catastrophic, often far exceeding typical stream or river flood events Berlin Pond Dam is a cultural feature (dam) in Washington County. The primary coordinates for Berlin Pond Dam places it within the VT 05602 ZIP Code delivery area. Lane Dam is a cultural feature (dam) in Washington County. Montpelier Number Four Dam is a cultural feature (dam) in Washington County. The primary coordinates for Montpelier Number Four Dam places it within the VT 05651 ZIP Code delivery area. Wrightsville Dam is a cultural feature (dam) in Washington County. The primary coordinates for Wrightsville Dam places it within the VT 05602 ZIP Code delivery area.*

## High Winds

High wind events do occasionally cause damage for the town, normally measured in downed power lines. As the wind tracking shows, high wind events that may reach category 2 speeds, but it is unlikely, based on previous events, that a category 3 event will occur in the region. On 10/30/2017, a cold front, supported by an energetic upper level system, moved across the Mississippi and Ohio River valleys to the eastern seaboard by midday Sunday (10/29) and initially developed an area of low pressure. Meanwhile, energy and deep tropical moisture, associated with the remnants of Tropical Storm Philippe (well offshore of the southeast United States) interacted with the developing east coast storm to create a rapidly intensifying storm Sunday night off the mid-Atlantic coast that traveled into the Champlain Valley by Monday morning (10/30). Sustained winds of 25 to 35 mph with frequent wind gusts of 50 to 70 mph occurred during the early morning hours of October 30th across portions of Vermont due to fully mature mountain waves. A peak wind gust of 115 mph was observed at the summit of Mount Mansfield. Numerous downed branches, trees and some snapped and uprooted trees causing widespread power outages, especially in VT where 30% of the power grid or >100,000 customers were without power. Trees fell on residences and vehicles as well. The hardest hit communities were along the western slopes of the Green Mountains. 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. The following table describes the Beaufort Scale for non-hurricane winds.

Table 2-3: Beaufort Scale and Granby Windspeed vs. U.S. Average

Beaufort*	Avg Miles per Hour	Knots	Surroundings
0 calm		0-1	Smoke rises vertically and the surface is smooth
1 light air	1.2 - 3.0	1 - 3	Smoke moves slightly with the direction of wind
2 light breeze	3.7 - 7.5	4 - 6	You can feel the breeze on your face; leaves start to rustle
3 gentle breeze	8.0 - 12.5	7 - 10	Smoke will move horizontally; small branches start to sway. Wind is felt on the face
4 moderate	13.0 - 18.6	11 - 16	Loose dust or sand on the ground is raised; larger branches will sway, leaves rustle
5 fresh breeze	19.3 - 25.0	17 - 21	Surface waves form of water are visible; wind is felt on the face
6 strong breeze	25.5 - 31.0	22 - 27	Trees begin to bend with the wind; wind is felt on the face; spray on the sea surface
7 moderate gale	32.0 - 38.0	28 - 33	Large trees sway; moderate damage to trees and shrubs
8 fresh gale	39.0 - 46.0	34 - 40	Twigs break from trees, and small branches are broken off; spray on the sea surface
9 strong gale	47.0 - 55.0	41 - 47	Branches break from trees; considerable damage to trees and shrubs

Since the last approved plan, there have been 14 high wind events in the county (zone). Four events with specific record for the town and five with specific record for Montpelier and/or Barre. With the airport, safety considerations are obviously required to assure the safety of operations and the community at large. While this unique facet of the town is not the sole causation for including high winds as a profiled hazard, given the relative frequency of events and the quick nature with which damage can occur. Attention to achievable mitigation measures are thought valid at this time. The table below represents the events mentioned above with specific associated data as recorded by the NOAA extreme weather system.

*Table 2-4: Relevant High Wind Events Since Last Approved Mitigation Plan (2011)*

Location	County/Zone	Date	Time	Type	Mag	PrD	CrD
WASHINGTON (ZONE)	WASHINGTON (ZONE)	01/18/2012	01:30	Strong Wind	43 kts. EG	7.50K	0.00K
MONTPELIER	WASHINGTON CO.	07/04/2012	19:10	Thunderstorm Wind	50 kts. EG	25.00K	0.00K
BERLIN	WASHINGTON CO.	07/04/2012	19:15	Thunderstorm Wind	50 kts. EG	10.00K	0.00K
BERLIN	WASHINGTON CO.	09/08/2012	16:25	Thunderstorm Wind	50 kts. EG	10.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	10/29/2012	16:00	Strong Wind	40 kts. EG	15.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	01/20/2013	11:00	Strong Wind	37 kts. EG	15.00K	0.00K
MONTPELIER	WASHINGTON CO.	06/02/2013	13:18	Thunderstorm Wind	50 kts. EG	2.00K	0.00K
BARRE	WASHINGTON CO.	06/02/2013	13:24	Thunderstorm Wind	55 kts. EG	15.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	10/07/2013	15:30	Strong Wind	43 kts. EG	15.00K	0.00K
(MPV)-MONTPELIER ARPT	WASHINGTON CO.	07/23/2014	15:00	Thunderstorm Wind	50 kts. EG	10.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	11/26/2014	12:00	Winter Storm		30.00K	0.00K



WASHINGTON (ZONE)	WASHINGTON (ZONE)	12/09/2014	14:00	Winter Storm		250.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	01/03/2015	18:00	Winter Weather		5.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	01/07/2015	18:00	Extreme Cold/wind Chill		0.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	02/29/2016	22:00	Strong Wind	39 kts. EG	20.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	04/06/2016	16:00	Winter Weather		5.00K	0.00K
BERLIN	WASHINGTON CO.	09/11/2016	06:11	Thunderstorm Wind	50 kts. EG	10.00K	0.00K
BARRE	WASHINGTON CO.	09/11/2016	06:11	Thunderstorm Wind	50 kts. EG	10.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	11/20/2016	12:00	Winter Storm		0.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	01/10/2017	18:00	Strong Wind	39 kts. MG	10.00K	0.00K
MONTPELIER	WASHINGTON CO.	07/08/2017	13:30	Thunderstorm Wind	55 kts. EG	20.00K	0.00K
BARRE	WASHINGTON CO.	07/08/2017	13:36	Thunderstorm Wind	60 kts. EG	100.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	10/30/2017	02:00	High Wind	50 kts. MG	250.00K	0.00K
WASHINGTON (ZONE)	WASHINGTON (ZONE)	10/16/2018	00:00	Strong Wind	42 kts. MG	25.00K	0.00K

### Profiled Natural Hazard Summary

The natural hazards impacting Vermont communities are, for the most part, homogenous. Each town and city in the Green Mountain are 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*

All of Washington County is located in the Winooski River watershed, a drainage area of approximately 1,080 square miles. Of the seven tributaries, it is the Steven’s branch, beginning in Williamstown, that drains into the Winooski in Berlin. There are 44 properties in the A-zone, 53 policies with a total coverage of \$13,440,100. There have been 43 claims since 1978 for \$2,046,822. *Source: NFIP Insurance Report*

Total Premium	V-Zone	A-Zone	Policies	Total Coverage	Claims since 1978	Total Paid since 1978
\$112,677	0	44	53	\$13,440,100	43	\$2,046,822

*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 are particularly vulnerable to erosion damage by flash flooding, bank collapse, and stream channel dynamics. The Vermont Department of Environmental Conservation, Agency of Natural Resources, has identified river corridors, which consist of the minimum area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition. In other words, the river corridor provides “wobble 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
Berlin 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 Berlin 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 has remained unaffected by recent disasters.

*Table 3-1: Washington County Declared Disasters*

DR	Date	Type
1307	11/10/1999	TS Floyd
1428	07/12/2002	Severe Storm(s)
1559	9/23/2004	Severe Storms, and Flooding
1995	06/15/2011	Severe Storm(s)
3167	04/10/2001	Snow

4022	09/01/2011	Hurricane
4140	08/02/2013	Severe Storm(s)
4066	06/22/2012	Severe Storms, Tornado and Flooding
4163	01/29/2014	Severe Winter Storm
4178	06/11/2014	Severe Storm/Flooding
4207	02/03/2015	Severe Winter Storm
4380	06/30/2018	Severe Storm/Flooding
4356	01/02/2018	Severe Storm/Flooding

*Table 1-2: Public Assistance Summary: 2011-Current:*

Blue rows indicate county-level disaster where Berlin did not require PA

1715	08/03/07	Severe Storm(s)	BERLIN (TOWN OF)	1	\$10,729.67
1790	09/12/08	Severe Storm(s)	BERLIN (TOWN OF)	19	\$159,461.40
4001	07/08/11	Severe Storm(s)	BERLIN (TOWN OF)	35	\$576,127.90
4022	09/01/11	Hurricane	BERLIN (TOWN OF)	22	\$447,722.90
4140	08/02/13	Severe Storm(s)	WASHINGTON CO	N/A	\$6,208,979.96
4178	06/11/14	Severe Storm(s)	WASHINGTON CO	N/A	\$1,824,522.67
4207	02/03/15	Winter Storm	WASHINGTON CO	N/A	\$3,949,092.78
4330	08/16/17	Severe Storm(s)	WASHINGTON CO	N/A	\$6,117,324.29
4356	01/02/18	Severe Storm(s)	WASHINGTON CO	N/A	\$4,885,885.03

Disaster Number	PW Number	Application Title	Damage Category Code	Project Amount	Federal Share Obligated	Total Obligated
4001	485	JCBEC43 Belknap Road	C - Roads & Bridges	\$22,547.30	\$16,910.48	\$16,910.48
4001	486	JCBEC46 East Hill Road	C - Roads & Bridges	\$8,464.61	\$6,348.46	\$6,348.46

4001	487	JCBEC47 Goodnow Road	C - Roads & Bridges	\$8,514.81	\$6,386.11	\$6,386.11
4001	488	JCBEC48 Chase Road	C - Roads & Bridges	\$83,444.70	\$62,583.53	\$62,583.53
4001	489	JFCBEC1 Comstock Rd	C - Roads & Bridges	\$5,170.86	\$3,878.15	\$3,878.15
4001	491	JCBEC57 Lord Road	C - Roads & Bridges	\$1,435.46	\$1,076.60	\$1,076.60
4001	492	JCBEC50 Darling Road	C - Roads & Bridges	\$46,878.67	\$35,159.00	\$35,159.00
4001	493	JCBEC49 Grainger	C - Roads & Bridges	\$1,813.12	\$1,359.84	\$1,359.84
4001	494	JCBEC53 Hersey Road	C - Roads & Bridges	\$13,289.75	\$9,967.31	\$9,967.31
4001	496	JCBEC52 Green Mountain Road	C - Roads & Bridges	\$49,030.75	\$36,773.06	\$36,773.06
4001	497	JCBEC41 Addison Drive	C - Roads & Bridges	\$52,380.90	\$39,285.68	\$39,285.68
4001	498	JCBEC54 Highland Road	C - Roads & Bridges	\$15,484.11	\$11,613.08	\$11,613.08
4001	500	JCBEC55 Jones Brook Road	C - Roads & Bridges	\$24,877.73	\$18,658.30	\$18,658.30
4001	501	JCBEC56 Junction Road	C - Roads & Bridges	\$13,972.49	\$10,479.37	\$10,479.37
4001	503	JCBEC58 Lovers Lane	C - Roads & Bridges	\$3,942.07	\$2,956.55	\$2,956.55
4001	504	JCBEC59 Midway Ave.	C - Roads & Bridges	\$3,620.63	\$2,715.47	\$2,715.47
4001	507	JCBEC60 Mirror Lake	C - Roads & Bridges	\$8,482.18	\$6,361.64	\$6,361.64
4001	509	JFCBEC4 Coos Trail	C - Roads & Bridges	\$1,290.93	\$968.20	\$968.20
4001	510	JCBEC61 Muzzy Road	C - Roads & Bridges	\$39,280.59	\$29,460.44	\$29,460.44
4001	511	JFCBEC2 Brown's Mill Rd.	C - Roads & Bridges	\$3,469.16	\$2,601.87	\$2,601.87
4001	512	JFCBEC3 Brookfield Rd.	C - Roads & Bridges	\$1,773.86	\$1,330.40	\$1,330.40
4001	513	JCBEC42 Bartlett Hill Road	C - Roads & Bridges	\$111,314.72	\$83,486.04	\$83,486.04
4001	514	JCBEC45 Crosstown Road	C - Roads & Bridges	\$12,828.42	\$9,621.32	\$9,621.32
4001	515	JCBEC44 Chandler Road	C - Roads & Bridges	\$19,969.67	\$14,977.25	\$14,977.25
4001	516	JCBEC62 Paine Turnpike South	C - Roads & Bridges	\$41,532.63	\$31,149.47	\$31,149.47
4001	518	JCBEC64 Rowell Hill Road	C - Roads & Bridges	\$32,345.64	\$24,259.23	\$24,259.23
4001	519	JCBEC63 Richardson Road	C - Roads & Bridges	\$2,266.84	\$1,700.13	\$1,700.13
4001	520	JCBEC65 Steward Road	C - Roads & Bridges	\$6,818.29	\$5,113.72	\$5,113.72
4001	522	JCBEC67 Warner Road	C - Roads & Bridges	\$3,298.77	\$2,474.08	\$2,474.08
4001	524	JCBEC66 Vine Street	C - Roads &	\$32,180.62	\$24,135.47	\$24,135.47

			Bridges			
4001	525	JCBEC71 Marvin Road	C - Roads & Bridges	\$30,761.37	\$23,071.03	\$23,071.03
4001	526	JCBEC68 West Hill Road	C - Roads & Bridges	\$55,021.06	\$41,265.80	\$41,265.80
4001	527	JCBEC69 Wheeler Road	C - Roads & Bridges	\$6,548.64	\$4,911.48	\$4,911.48
4001	528	JCBEC70 Winters Road	C - Roads & Bridges	\$2,638.74	\$1,979.06	\$1,979.06
4001	529	JCBEC72 Partridge Farm Road	C - Roads & Bridges	\$1,480.37	\$1,110.28	\$1,110.28
4022	1557	JCBEC03 Brookfield Road	C - Roads & Bridges	\$16,160.71	\$14,544.64	\$14,544.64
4022	1560	JCBEC19 Coos Trail	C - Roads & Bridges	\$2,205.06	\$1,984.56	\$1,984.56
4022	1568	JCBEC21 Crosstown Rd.	C - Roads & Bridges	\$2,052.94	\$1,847.65	\$1,847.65
4022	1571	JCBEC12 Junction Road	C - Roads & Bridges	\$43,633.85	\$39,270.47	\$39,270.47
4022	1574	JCBEC01 Chandler Rd.	C - Roads & Bridges	\$8,081.42	\$7,273.28	\$7,273.28
4022	1577	JCBEC02 Bartlett Hill Road	C - Roads & Bridges	\$3,587.44	\$3,228.70	\$3,228.70
4022	1581	JCBEC20--Marvin Road	C - Roads & Bridges	\$1,163.45	\$1,047.11	\$1,047.11
4022	1582	JCBEC08--McCarty Rd.	C - Roads & Bridges	\$1,305.41	\$1,174.87	\$1,174.87
4022	1583	JCBEC15--Browns Mill Road	C - Roads & Bridges	\$2,118.65	\$1,906.79	\$1,906.79
4022	1601	JCBEC14--Dog River Rd.	C - Roads & Bridges	\$5,848.93	\$5,264.04	\$5,264.04
4022	1609	JCBEC13--Jones Brook Road	C - Roads & Bridges	\$28,136.64	\$25,322.98	\$25,322.98
4022	1639	JCBEC7 Lovers Lane	C - Roads & Bridges	\$64,291.19	\$57,862.07	\$57,862.07
4022	1640	JCBEC4 Widow Moses Rd.	C - Roads & Bridges	\$1,081.62	\$973.46	\$973.46
4022	1641	JCBE16 Lord Rd.	C - Roads & Bridges	\$3,976.20	\$3,578.58	\$3,578.58
4022	1675	JCBEC5 Winter Road	C - Roads & Bridges	\$4,569.91	\$4,112.92	\$4,112.92
4022	1676	JCBEC9 Chase Rd.	C - Roads & Bridges	\$115,024.26	\$103,521.84	\$103,521.84
4022	1760	JCBEC6 West Hill Rd.	C - Roads & Bridges	\$28,660.18	\$25,794.17	\$25,794.17
4022	1761	JCBEC11 Rowell Hill Rd.	C - Roads & Bridges	\$49,035.70	\$44,132.14	\$44,132.14
4022	1762	JCBEC17 Paine Turnpike South	C - Roads & Bridges	\$11,799.44	\$10,619.50	\$10,619.50
4022	1774	JCBEC22 Belknap Rd.	C - Roads & Bridges	\$5,747.58	\$5,172.83	\$5,172.83
4022	1784	JCBEC18 Mirror Lake Rd.	C - Roads & Bridges	\$24,514.60	\$22,063.14	\$22,063.14
4022	1785	JCBEC10 Muzzy Rd.	C - Roads & Bridges	\$74,474.62	\$67,027.16	\$67,027.16

Disaster Number	PW Number	Application Title	Damage Category Code	Project Amount	Federal Share Obligated	Total Obligated
1715	233	ROADS AND DITCHES TOWNWIDE	C - Roads & Bridges	\$14,306.23	\$10,729.67	\$11,270.45
1790	96	PW-01 Crosstown Rd, TH40, Class 3, Berlin	C - Roads & Bridges	\$2,935.90	\$2,201.93	\$2,201.93
1790	101	PW-02 Darling Rd, TH55, Class 3 rd. Berlin	C - Roads & Bridges	\$5,868.69	\$4,401.52	\$4,401.52
1790	102	PW-15, TH42, Wheeler Rd, Berlin	C - Roads & Bridges	\$3,750.90	\$2,813.18	\$2,813.18
1790	103	Paine Turnpike South TH1-Mirror Lake Road TH63 GDB-17	C - Roads & Bridges	\$7,130.51	\$5,347.88	\$5,347.88
1790	109	PW-07-Rowell Hill Rd TH#39, Berlin	C - Roads & Bridges	\$3,936.77	\$2,952.58	\$2,952.58
1790	112	Hill Street TH 18 GDB-18	C - Roads & Bridges	\$2,090.34	\$1,567.76	\$1,567.76
1790	115	Brookfield Road TH43 GDB-19	C - Roads & Bridges	\$5,633.76	\$4,225.32	\$4,225.32
1790	116	PW-09 Jones Brook Rd TH#10, Berlin	C - Roads & Bridges	\$4,774.38	\$3,580.79	\$3,580.79
1790	117	Steward Road TH 19 GDB-20	C - Roads & Bridges	\$3,131.75	\$2,348.81	\$2,348.81
1790	118	PW 14, Addison Dr, TH28, Berlin	C - Roads & Bridges	\$3,867.86	\$2,900.90	\$2,900.90
1790	119	PW-13, TH #28 , Bennington Dr. Berlin	C - Roads & Bridges	\$1,484.96	\$1,113.72	\$1,113.72
1790	120	PW-12, Vine St. TH26, Berlin	C - Roads & Bridges	\$3,702.40	\$2,776.80	\$2,776.80
1790	121	PW-08 Bartlett Rd TH#11, Berlin	C - Roads & Bridges	\$4,782.61	\$3,586.96	\$3,586.96
1790	122	PW-10 Winters Rd TH#10, Berlin	C - Roads & Bridges	\$8,260.71	\$6,195.53	\$6,195.53
1790	124	PW-04 McCarty Rd, TH59, Berlin	C - Roads & Bridges	\$17,407.30	\$13,055.48	\$13,055.48
1790	125	PW 11 Marvin Rd. TH25 Berlin	C - Roads & Bridges	\$19,013.80	\$14,260.35	\$14,260.35
1790	136	PW-03 West Hill Rd, TH52, Berlin	C - Roads & Bridges	\$18,448.20	\$13,836.15	\$13,836.15
1790	143	PW-05 Chase Rd TH35, Berlin	C - Roads & Bridges	\$28,036.68	\$21,027.51	\$21,027.51
1790	173	PW-06 Muzzy Rd, TH49, Berlin	C - Roads & Bridges	\$68,357.65	\$51,268.23	\$51,268.23

Sources: FEMA Opensource

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 resident's ability to pay. Coupled with high unemployment, there is an increased risk for the town's residents to not meet the financial requirements for adequate heat, especially during long periods of extremely cold temperatures. Without adequate provisions, 48 hours of extremely cold temperatures could create a serious health hazard. 123 events were reported between 01/01/2012 and 12/31/2019 (2992 days) for the area. The majority of these events were non-declared disasters and an even smaller number resulted in direct impact to the town. Specific to profiled hazards, there were 24 events in the county with four specific to Berlin.

*Table 3-3: Washington County Weather Event Summary Since 2011*

Number of County/Zone areas affected:	2
Number of Days with Event:	87
Number of Days with Event and Death:	0
Number of Days with Event and Death or Injury:	1
Number of Days with Event and Property Damage:	74
Number of Days with Event and Crop Damage:	2
Number of Event Types reported:	14

### 3.3 Hazard Assessment and Risk Analysis

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 and supports the inclusion of all profiled hazards in this plan. This quantification allows direct comparison of very different kinds of hazards and their effect on the town and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. 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 Berlin, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter/Ice Storm (listed as “Winter Storm” in table) (32)
- Flooding (40)
- Extreme Cold (32)
- High Winds (15)

Flood-related disasters have had the greatest financial impact on the town. While very few deaths or injuries have been recorded for declared or non-declared disasters, the potential for health and safety risk during a severe winter storm and extreme cold events are considered higher than that posed by a flooding event.

Table 3-2 Natural hazards risk estimation matrix

Berlin Hazard & Risk Analysis: NATURAL HAZARDS	Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure Urban Fire	Wildfire	Winter Storm	Extreme Cold
<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	2	1	0	1	2	1	4	4
<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	0	1	0	0	0	1	1	1	1	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	0	2	1	1	0	1	2	1	1	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	1	2	0	1	0	0	0
<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	2	1	2	1	1	1	1	2	2
<b>Sum of Area &amp; Consequence Scores</b>	5	10	5	5	3	4	7	4	8	8
<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	3	4	1	2	1	1	4	4
<b>TOTAL RISK RATING</b> Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence	5	40	15	20	3	8	7	4	32	32

## SECTION 4: VULNERABILITY ASSESSMENT AND LAND USE

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 required maintenance expected of highway-related machinery. 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.

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. 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 health and safety of residents, workers or travelers.

### **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 but winter comes every year and residents and the town are accustomed to making intelligent decisions regarding safety and protection of infrastructure. Special populations (e.g. aging, disabled, etc.) are more vulnerable in terms of mitigating structure loads, hazardous travel and relocating to safety.

### **Extreme Cold: Moderate**

Summary: Recent evidence shows that greater extremes in temperature and overall weather fluctuation are occurring with increased frequency. A long-duration cold snap can cause significant damage to structures due to bursting pipes and the residential health and safety considerations include factors related to financial resources, fuel supply, sheltering, provisions and employment.

### **Flooding: High**

Summary: The town is flooding and this is specific to transportation routes and infrastructure more-so than buildings and people in Berlin. However slight in terms of probability, a dam failure would have catastrophic implications on homes, buildings, people and equipment. The magnitude of financial resources devoted to flood-related damage in the town equates to high vulnerability. Flooding impacts the planning area by inundation damage to structures, which are

considered well-below the FEMA flood hazard elevation and roadway drainage structures. Most of the damage is to road surfaces, drainage structures (culverts, ditching) and driveways. Roadways are also an issue for municipal road crews in each jurisdiction when they become inundated and cut off traffic. 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.

*Berlin: Municipality Economic Activity Ranking: 33*  
*2011 Population Estimate: 2886*  
*Infrastructure Vulnerability Ranking: 9*  
*Vulnerable Commercial Buildings: 61*  
*Mitigation Progress in 2018: Critical Employer Buyout post-Irene*

**High Winds: Moderate**

Summary: The town has seen events from high wind, as most communities, that can impact operations and safety. Air traffic and airport-related substances, some hazardous are present in the town and increase risk of incident via accident which high winds can exacerbate during air travel, especially take-off and landings.

*Table 4-1: Vulnerability Summary Table*

Hazard	Vulnerability	Extent (Storm Data from most severe event)	Impact (economic/health and safety consequence)	Probability
Flood	Culverts, bridges, road infrastructure.  Vulnerable Commercial Buildings: 61 160 A-Zone Properties 3 critical or public infrastructure in SFHA/.2% FHA	Tropical Storm Irene in 2011 resulted in severe flooding in Berlin with up to five feet of floodwaters in some areas.	DR 4001 resulted in greatest financial impact and damage to roads and bridges with over \$576,127 in total project costs.	High

Extreme Cold/ Snow/Ice Storm	The entire Town is vulnerable, including road infrastructure, town and privately-owned buildings, utility infrastructure	Snowfall has varied, from a few inches to over a foot or more. Heavy snow and wind may down trees and power lines. Snow/ice contributes to hazardous driving conditions.	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. 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
High Winds	The entire town is vulnerable to the results of high wind exposure. Significant damage possible to trees, power lines, building roofs	The highest recorded event occurring on 10/29/17 with 58mph gusts, the town expects high wind events that may reach category 2 speeds but it is unlikely, based on previous events, that a category 3 event will occur in the region.	Falling trees and limbs pose hazard to structures, road and people. Power disruption due to high winds pose secondary health and safety risk especially in colder months	The entire town is vulnerable to the results of high wind exposure. Significant damage possible to trees, power lines, building roofs

#### 4.1 Water, Wastewater and Electric Power Service

A combination of public and private systems provides potable water to development in parts of Berlin. There were 12 public drinking water systems in Berlin as defined and regulated by the Vermont Agency of Natural Resources that have source protection areas as of 2018.

Wastewater Municipal stormwater infrastructure consists primarily of open drainage ditches and culverts along town highways. Upgrades to this infrastructure and improved stormwater management on municipal sites will be required over the next decade under new state clean water and general road permit requirements (Act 64). Berlin's 2017 Stormwater Management Plan includes specific recommendations for improving stormwater management on municipal sites and town roads. Until very recently, most private development in Berlin was constructed

with minimal stormwater management infrastructure, which has resulted in untreated stormwater discharging directly to roadside drainage systems or surface waters. In response, the Planning Commission has drafted new stormwater requirements for private development that it recommends be incorporated into the town's land use regulations. The Vermont Agency of Natural Resources has listed the Stevens Branch from Barre City to the Winooski mainstem, and the segment of the Winooski mainstem between the Montpelier sewage treatment plant and the Middlesex dam as 'stressed' due to urban runoff. If runoff from developed land and roadways continues to reduce water quality, ANR may classify one or more of the watersheds in Berlin as 'impaired' due to stormwater, which would lead to enhanced stormwater permitting requirements for new development requiring a state stormwater permit.

Solid Waste Disposal Facilities and Services Berlin is a member of the Central Vermont Solid Waste District (CVSWD). The district's Solid Waste Implementation Plan as most recently adopted is incorporated into this plan by reference. By belonging to CVSWD, Berlin is meeting its obligation under state law to plan for the community's solid waste disposal needs. As of 2018, there were no transfer stations or drop-off locations in Berlin. A number of haulers provide pickup service or residents can take their trash to a transfer station or drop-off location in a neighboring community. Municipal sewer service is available in portions of Berlin. Through an inter-municipal agreement, Berlin purchases sewer capacity from Montpelier. The town had approximately 200,000 gallons of unused capacity in 2018.

Green Mountain Power provides electricity in most of Berlin with a small area of town served by Washington Electric Cooperative. There was three-phase power available in most of the northeast quadrant of Berlin and in Riverton as of 2018. GMP had substations in Riverton and at their facility off Nelson Drive. A VELCO 115 kV transmission line passed through the northern portion of town. As of 2018, there were no plans to significantly upgrade the electricity infrastructure serving Berlin.

#### 4.2 Estimating Potential Losses in Designated Hazard Areas

With 160 structures, including portions of town roads and bridges within the 100-year floodplain, there are only a total of 9 repetitive loss properties in town with 2 BCX claims. 111 of these are mobile homes located in the Weston, Berlin and River Run mobile home parks. 72 of these buildings were in the floodway (including 47 mobile homes). Only 45 (28%) of these buildings have flood insurance policies. 3 of these buildings were critical or public structures (VTrans Central Garage Complex on Route 302). An additional 28 buildings and the solar facility on Nelson Drive were located in the 500-year floodplain as of 2017. The town and villages do not believe that even during a flooding event similar to the worst experienced in the last 10 years that 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 the fact that the town and villages have not had to spend nearly as much on repairs following a declared disaster compared to many other towns in the region.

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

*A fundamental principle of land use planning is to guide development towards the land best suited to accommodate the proposed use and away from unsuitable land. Some of the factors affecting land capability include: Steep slopes are poorly suited for development; large areas of Berlin are characterized by steep slopes development in the rural areas of Berlin outside the northeast quadrant will be dependent on on-site septic systems for wastewater disposal. Many areas of Berlin have soils that are poorly suited for on-site wastewater systems, Riparian areas, including floodplains and river corridors, pose hazards for development. Historically, development in Berlin has been located close to rivers and streams. Looking to the future, this plan recommends siting development further away from surface waters, vast areas of Berlin are remote and not currently accessible from maintained public roads. The cost of providing infrastructure and services to development in these areas would be significantly higher than for those located in and near developed areas of town or along main roads. Extending roads into currently inaccessible areas would fragment forest blocks and increase impervious surface coverage along with the potential for erosion, sedimentation and downstream flooding. (2018 Berlin Town Plan).*

The 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. Thomas Badowski, Assistant Town Administrator & Zoning Administrator is the compliance officer for the town's participation in the NFIP. Since the last approved mitigation plan in 2011. NFIP compliance is met, in part by the following regulations:

- *“All development including fill, excavation, grading, erection or placement of structures, substantial improvement of existing structures and storage of equipment and material prescribed by the Town of Berlin are permitted within an area of special flood hazard only upon the granting of a conditional use permit by the Board of Adjustment”*
- *“All development and structures shall be:  
1. Designed to minimize flood damage to the proposed development and to public facilities and utilities, and 2. Designed to provide adequate drainage to reduce exposure to flood hazards.”*
- *“No development shall occur within 50 feet of the seasonal high water-mark of any stream or river shown on the official zoning maps. If such stream or river is within a designated flood plain area.”*

##### 4.3.1. Land Use Goals

As stated in the 2018 Town Plan:

- Focus commercial and industrial development in the northeast quadrant
- Increase the amount of housing in Berlin, diversify the housing stock, and guide most residential growth to the northeast quadrant
- Revitalize existing commercial areas in the northeast quadrant to improve aesthetics, access, and economic competitiveness
- Preserve rural character and working lands in the areas of town outside the northeast quadrant

- Maintain the base of working farm and forest land outside the northeast quadrant necessary to support viable farm and forestry businesses
- Prevent adverse environmental impacts resulting from irresponsible land use and development practices
- Improve or maintain the health of Berlin's surface waters as necessary to meet water quality standards
- Maintain a balanced tax base that generates the revenue necessary to provide municipal services without overburdening residential property owners

#### *4.3.2. Land Use Strategies*

- Implement the recommendations for maintaining, evolving and transforming land use set forth in the town plan
- Support the permanent conservation of publicly owned land around Berlin Pond, and maintain low-impact public recreation use commensurate with the pond's function as a public water supply and its natural resource values
- Ensure that stormwater run-off from developed land is managed at the source so it will not place an undue burden on public infrastructure, increase flood hazards or reduce water quality
- Guide development away from surface waters and encourage landowners to maintain or establish riparian buffers
- Encourage and support continued permanent conservation of farmland, forest land and natural areas outside the northeast quadrant
- Prioritize conservation efforts that would connect to existing public and conserved lands on Irish Hill, Paine Mountain and Berlin Pond
- Seek PILOTs for tax-exempt properties that are commensurate with demand on town services
- Allow resource extraction in rural and industrial areas of town that is undertaken in accordance with town and state regulations to avoid or mitigate off-site and environmental impacts.

#### *4.3.4 Future Development and Housing*

Finding housing that is suitable, affordable and located near jobs and needed services is a challenge for many households already – or who would consider – living in Berlin. Nearly all of the people working in Berlin live elsewhere and for many that is likely because they cannot find housing in town. Average household size has declined and lifestyle preferences have changed in recent decades leading to a mismatch between what is available and what people want for housing. Berlin's housing stock is dominated by single-family homes on rural lots an acre or more in size. A greater diversity of housing options (apartments, townhouse/condo units, cottage/small homes on small lots, etc.) will allow households of various sizes, ages and income levels to live in Berlin. Berlin has a substantial senior population that is expected to increase during the next two decades as discussed above. Seniors from surrounding rural communities may also look to Berlin for housing that is more accessible and closer to services. Berlin will need both independent and assisted living senior housing options so that residents can remain in the area as they age. As a centrally-located employment center, Berlin is well-situated to



accommodate additional housing with reduced transportation costs for those working in town or the greater Barre-Montpelier area. The northeast quadrant is accessible from major highways, is served by public transit and is close to shopping and services including medical care -- making it a suitable location for both senior and workforce housing. The town is working to provide the infrastructure needed to facilitate residential development in the northeast quadrant. In conjunction with encouraging residential development in the northeast quadrant, Berlin is seeking to discourage housing in the remote areas of town not currently served by public roads and utilities. Dispersed, low-density, rural housing costs more to service than compact, centrally-located housing and increases the amount of infrastructure that must be maintained. Often such housing pays less in taxes than it costs to provide with municipal and educational services, increasing the tax burden on all property owners in town. Further, building more rural housing would not be consistent with the goal of diversifying Berlin's housing stock (*2018 Town Plan*).

## SECTION 5: MITIGATION STRATEGIES

The greatest advancement in mitigation planning the town has achieved since 2011 has come from the direct experiences in responding to, and recovering from, the major disasters that have impacted the town in the last decade. These disasters, have, to a very large extent, redefined how the entire state views and addresses 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. This plan allows for the systematic documentation of efforts in the next planning cycle in a format that the town will continue to use. There has not been a formula for ongoing, documented, mitigation efforts prior to this update. We feel that 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. Community Goals

- a. Continue municipal service supply systems
- b. Support necessary mitigation actions for mobile homes in and out of "parks" within limits of feasibility
- c. Consider implementation of special population tracking within the community where-by residents unable to drive or that have no one to depend on can self-identify for inclusion in a maintained data-base so that rescue personal and emergency managers can account for this demographic.

- d. Encourage the elimination of existing and potential pollution sources. This is important for all lakes and ponds and is of critical importance for bodies of water which serve as municipal water supply sources
- e. Manage availability of education materials to assist residents' understanding of mitigation and applicable programs
- f. Existing developed property owners in specified districts should be encouraged to eliminate existing pollution or to upgrading existing inadequate environmental facilities.

*5.1.2. Capital Improvement Goals*

- a. Provide services and facilities deemed necessary for the orderly and rational development of the Town.
- b. Seek a new town center designation from the state for the Berlin Mall and surrounding area, which will require the following actions by the town: adopt an official map, adopt a capital improvement program, execute a community investment agreement with town center property owners, and dedicate water/ wastewater reserves to the town center
- c. Seek village center designations from the state for Riverton and Berlin Corners
- d. Continue to extend municipal water and sewer in the northeast quadrant to support future economic growth and residential development in a manner consistent with smart growth principles and as necessary

*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 LEPC and 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 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 Berlin

*5.1.5. Land Use*

- a. Development of a town center anchored at the Berlin Mall site

- b. Preservation and revitalization of the historic centers of Berlin Corners and Riverton
- c. Continued build out of the business park near the airport with light industrial and office uses
- d. Revitalization and infill of commercial, mixed use and residential areas on previously developed and suitable undeveloped land in the northeast quadrant
- e. Preservation of rural character outside the northeast quadrant
- f. Continued use of rural land primarily for agriculture and forestry
- g. Protection and conservation of Berlin Pond and surrounding land, and the Irish Hill ridgeline

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

<http://www.watershedmanagement.vt.gov/swms.html> and  
<http://www.watershedmanagement.vt.gov/stormwater.htm>)

- Avoiding and Removing Encroachments.  
[http://www.watershedmanagement.vt.gov/rivers/htm/rv\\_floodhazard.htm](http://www.watershedmanagement.vt.gov/rivers/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
  - River bed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains
  - Bridge and culvert failure

Source: [http://www.watershedmanagement.vt.gov/permits/htm/pm\\_streamcrossing.htm](http://www.watershedmanagement.vt.gov/permits/htm/pm_streamcrossing.htm)

#### 5.1.7. Policies

- a. Through both town and state-level management, the town and villages 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 Plan

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

- a. Maintaining safe operating conditions on the present system of town roads through design and modification to keep traffic at appropriate speeds and to assure the safest possible driving conditions, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available.
- b. Protection of existing town roads from flood damage and uncontrolled storm water runoff.
- c. Preserving the capacity of town roads and maintain adequate traffic flows and safety.

- d. Support the road maintenance crew through Town-provided training sessions. This includes ICS training along with the Road Commission (Selectboard).
- e. Support policies and procedures that ensure longevity of essential town-equipment and develop and maintain MOU's with neighboring towns related to equipment use during emergencies.
- f. Continue long term access opportunities to gravel and sand deposits for future road maintenance use.
- g. Consider developing a standard operating procedure (SOP) based on ICS principles for highway department response events where coordination, communication and support are at a heightened level.

#### *5.1.9. Utilities and Facilities Goals*

- a. Develop policies and procedure that ensures equipment longevity to the greatest extent possible.
- b. Develop a retention plan for highway department personnel to help avoid high turnover and preserve institutional memory.
- c. Ensure adequate provision of water sources for fire suppression by requiring dry hydrants, fire ponds, water storage, or other measures where appropriate. The Planning Commission will work with developers and property owners on this task.

##### *5.1.9.1. Educational Goals*

- a. The School Board should work with the Selectboard and the American Red Cross and Fire Department to ensure that the necessary equipment exists at the school for its use as an emergency shelter.
- b. Increase emergency planning cohesion between school and town EOPs through mutual participation and presentation at scheduled LEPC meetings and town and/or school meetings.
- c. Continue collaboration with the Vermont Chapter of the American Red Cross on their sheltering initiative program to further readiness with training and supplies related to sheltering operations.

## 5.2 Existing Town of Berlin Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The Selectboard has successfully pursued funding to address needs. 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. Berlin will earmark the funds necessary to complete one major project each year for the next 5 years and will keep its culvert inventory current to improve its institutional memory. The town has also adopted municipal road and bridge standards that meet or exceed the 2013 standards and has an approved and annually adopted Local Emergency Operations Plan and Town Plan.

*Table 5-2: Existing Town Actions that Support Hazard Mitigation:*

<b>Type of Existing Protection</b>	<b>Description /Details/Comments</b>	<b>Issues or Concerns</b>
<b>Emergency Response</b>		
Police Services	Vermont State Police/ Berlin Municipal Police Force	None at this time
Fire Services	The Berlin 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.	Continued training for fire and rescue personnel, along with maintaining and updating of equipment is essential. Recruiting and retention of staff is ongoing struggle.
EMS Services	Barre Town and Northfield. Barre Town EMS, which serves six communities in the region, operates a substation out of the Berlin fire department building and serves the eastern and norther portions of town, while Northfield serves the southwestern quadrant. The Town of Berlin makes an annual payment to each service.	Continued training for fire and rescue personnel, along with maintaining and updating of equipment is essential.
<b>Other Municipal Services</b>		
Highway Services	Town Highway Department	Has completed scoping of priority mitigation projects and budgets work each fiscal year.

Highway personnel	1 FTE/2-3 PT field personnel	None currently
Water Department	Municipal: There were 12 public drinking water systems in Berlin	None currently
Planning and Zoning personnel	Town positions filled	None currently
Residential Building Code / Inspection	2019 Land Use and Development Regulations in use	None currently
Berlin Emergency Management Team	7 members	The Berlin EM Team uses the Vermont Alert system, or VT-Alert, to send urgent notifications to warn town residents of emergencies, through a number of delivery methods, including text messages, e-mail, and voice messages via telephone. Residents are encouraged to sign up.
<b>Emergency Plans</b>		
Local Emergency Operations Plan (LEOP)	2018	Assure sheltering plans and contact information is up to date and vulnerable populations are addressed.
School Emergency/Evacuation Plan(s)	2018	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	Berlin 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	2018	Update done
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	See Town Plan	Consider using current best practices to guide actions for achieving a "No Adverse Impact" policy as well as assuring future farm development occurs with defined best practices

Land Use and Development Regulations b	2019	Update done
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.	9/27/85 current eff. map date
Certificate of Compliance with Road and Bridge Standards	7/16/2018	<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

#### 5.2.1. Flood Resilience Goals:

- Mitigate flood hazards in the most cost-effective manner possible
- Minimize the risk exposure and associated expense to Berlin taxpayers
- Ensure the Town and its facilities are prepared to meet the demands of the next flood
- Ensure the Town can receive the maximum outside assistance in the event of the next Federally declared disaster

#### 5.2.2. Flood Resilience Strategies:

- Identify and protect natural flood protection assets, including floodplains, river corridors, other lands adjacent to streams, wetlands, and upland forested cover
- Adopt flood hazard regulations that at a minimum, protect property from known risks
- Review and evaluate statewide river corridor information, when it becomes available
- Consider adopting regulations that will protect erosion prone areas for additional Development and encroachment
- Maintain and regularly update the Local Emergency Operations Plan.
- 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
- Continue to update the Town's transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool
- Upgrade undersized and failing culverts
- Keep Hazard Mitigation Plan updated every 5 years
- Assure all emergency shelters are adequate and equipped with a generator

### 5.3 All-Hazards Mitigation Goals

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, Selectboard 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

In line with FEMA requirements, the following table provides a summary of the identified mitigation actions from the last approved mitigation plan in 2011 with the required narrative on current status.

*Table 5-4 Status Update on 2011 Identified Mitigation Actions*

Hazards Mitigated	Mitigation Action	Local Leadership	Time Frame	2019 Status
Flooding, Severe Storms	Purchase property on corner of Muzzy Rd and Route 12	Select board, Property Owners, Town Admin	ASAP – no more than 2 years	Property Converted to a Park
Earthquakes	Review and adapt building codes so that new structures are earthquake resistant	SB, Town Admin	4-5 years	No Action/Not deemed feasible or necessary

Earthquakes, flooding, severe storms	Installation of mobile home tie downs	SB, property owners	2-3 years	Elevation pads installed at Westin MHP and raised 4'
Flooding, severe storms	Replacement and upgrade of culverts on West Hill Rd	Town Admin, Road Foreman	1-2 years	Completed
Winter Storms/ Severe Cold	Provide training to residents on how to insulate homes (pipes, attics) for extreme cold spells	SB, PC, Fire Dept	2 years	Energy Committee Active with Efficiency Vermont. State energy codes set for town and all new proposals brought before development and review board assessed for energy code compliance.
Winter storms/ extreme cold/ice storms	Upgrade electrical systems in municipal buildings and shelters to prevent surge/equipment damage from fluctuating current during ice and wind storms	Fire Dept, Select Board	3-4 years	Generator acquired for Town office and school has received major renovations
NFIP Compliance	Work with elected officials, the State and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education	Select Board, PC	2 years	CRS Participant and Town has adopted enhanced policies on floodplain development.
NFIP Compliance, Flooding, Severe storms	Base flood elevation home inspections - inspect foundations at time of completion prior to framing to determine if lowest floor is at Base Flood Elevation	Zoning Admin, Town Admin, Planning Commission	3-4 years	Defined flood-prone areas now need elevation certificate
NFIP Compliance	Public outreach – make and distribute NFIP pamphlets at	Select Board, Town Admin	2-3 years	Annual re-certification for CRS requires public involvement and

	Town Offices, Fire Department, and Police Department			information dissemination
Flooding, Severe Storms	Projects outlined in Dog River Corridor Plan	Select Board, PC, ANR	2-3 years	Despite best attempts, status on defined projects could not be obtained. Town will review in new planning cycle and contact relevant landowners if deemed necessary. It is assumed that the plan remained a suggestion for action and no further steps were taken.
Wild Fire	Remove taller and dead trees from land in State and municipal forest	Road crew, ANR, PC	4 years	No formal action taken by town
Wild fire, structure fire	Develop alternative water supplies/dry hydrants in south section of town and more remote areas	Select board, fire department	4 years	City water supply now has 12 sites
Wild Fire	Distribute public education materials about reducing wild fire risk	Fire Dept, Select Board	3-4 years	Action not deemed appropriate given lack of historical occurrence

Mitigation Action Groups:

In following FEMA guidance, the following mitigation action categories form the basis of the town's future mitigation actions. For each mitigation action to follow, an indication of 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. Specific Mitigation Actions

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

Action #1: Improve road infrastructure and municipal systems protection programs  
Action #2: Improve resilience to severe winter storms  
Action #3: Reduce impact of extreme cold durations  
Action #4: Raise public awareness of hazards and hazard mitigation actions  
Action #5: Continue fluvial geomorphology assessments in collaboration with DEC/VTrans and develop strategies and regulatory actions in response to identified concerns  
Action 6: Improve resilience to high wind event

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

#### **Action #1: Improve road infrastructure and municipal systems protection programs** **Group: SP, NRP, PP**

Lead Responsible Entity: Town of Berlin, Fire District, Road Foreman

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

Timeframe: 2020 – 2025

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 is 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 upgrades of the existing infrastructure.
- 2) Assessment for Fluvial Erosion/Landslide Vulnerability: Identify streambanks that have high risk of fluvial erosion that could benefit from riparian plantings or Better Roads grant. Riparian buffers prevent erosion, restore river floodplain, and help reduce the intensity of flood events; therefore, protecting town infrastructure and human health.
- 3) Culvert Upgrades: Develop a schedule and program to replace undersized culverts. Appropriately sized culverts effectively handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding damage.
- 4) Continued Monitoring of Vulnerable Infrastructure: Inventory bridges to document future damage from flooding. A constantly updated inventory will allow Berlin to keep track of frequently damaged infrastructure and will guide planning to avoid future infrastructure damage.
- 5) Road Improvements: Within political and financial restraints, consider re-engineering 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. Utilize the Vermont Stream Alteration Permit process when replacing or installing new culverts and bridges as required by State Statute.

**Specific projects include:**

1. West Hill Rd. ditching project: sections of road require ditching to reduce washout and standing water
  2. Crosstown Bridge Rd at Berlin Pont: Two current culvert are undersized and during high flow times, water enters road
  3. Montpelier Junction Road: VTrans grant obtained to clear ditches and upgrade two undersized culverts
  4. Route 12 ditching project to protect Westin MHP from flooding
  5. Vine St: Culvert undersized and needs upgrade to 2'. Ditching work also needed.
  6. Bartlett Hill Rd: Ditching work and of 5 culverts, one remains in need of upgrade
- 6) Increase Awareness of Funding Opportunities: Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized.
  - 7) ICS Training and Emergency Operations (SOP) Plan Development: Enhance knowledge of the principles of ICS and develop a Standard Operating Procedures that details the relationship, roles and responsibilities of the Highway Department and Road Commission during major events.
  - 8) Documenting: Develop a methodology that serves to efficiently capture work and expenditures on sites and keep this information at the town office.

Rationale / Cost-Benefit Review: Conducting vulnerability assessments facilitates a targeted and effective approach to road and storm water management infrastructure. This will prove useful in the development and implementation of municipal capital and operating plans as well as the

development and implementation of grant-funded mitigation projects. Some areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating against these problems would reduce short and long-term maintenance costs and improve the flow of traffic for personal and commercial purposes during flooding events. Tracking road work and understanding the HMGP program can open funding streams into the town and can make the application process much easier when required information is already available. A basic understanding of ICS will serve the town and at little or no cost. As a requirement for an approved LEOP, municipal ICS-awareness is seen as necessary state-wide. During an emergency event when the Highway Department personnel are required to work beyond normal capacity, increased communication and collaboration between the Highway Department and local entities can be enhanced with a basic SOP. An SOP can also serve to increase institutional memory when there are staff changes at every level as well as provide a template from which tabletops and drills can be based off of.

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

**Group: SP, PP, PEA**

Primary Responsible Entities: Town of Berlin, Selectboard, Planning Commission and Emergency Management Director;

Potential Partner Entities: LEPC, Berlin Fire Chief, ARC's Sheltering Initiative Program

Timeframe: 2020 – 2025

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 back-up 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 and private electric company as means of increasing efficiency of mitigation efforts and restoration when systems are down. 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: 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) 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. Increase communication with rail as deemed necessary to assure safe train travel during heavy snow/ice events.
- 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 impact of extreme cold durations**

**Group: PEA, PP, SP**

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

Primary Responsible Entities: Town of Berlin Selectboard and planning commission, CVRPC, Berlin School, local/regional assistance organizations.

Potential Partner Entities: Vermont DMEHS, LEPC

Timeframe: 2020 – 2025

Funding Requirements and Sources: Financial factors may produce barriers to change. Strategic planning and understanding of the total scope of needs and potential for change is logical first-step.

Specific Identified Tasks:

- 1) Economic Resilience: Establish program for assistance in paying heating bills during crisis situations, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services.
- 2) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the city 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.
- 3) Assess Vulnerable Population— Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.
- 4) 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.

Rationale / Cost-Benefit Review:

With an increase in extreme weather, including cold, there is a need to protect property 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.

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

**Group: PEA**

Risk or Hazard Addressed: Risk to property, residents

Lead Responsible Entities: Town of Berlin, Fire Chief, LEPC, CVRPC

Potential Partner Entities: Vermont state agencies and regional organizations

Timeframe: 2020 – 2025

Funding Requirements and Sources: Majority of information is available and both state agencies and organizations can provide materials for outreach

Progress: As mitigation planning continues to integrate into normal, day-to-day operations, the town has an opportunity to engage its residents with information that will serve to mitigate several risks. The LEPC meets regularly and covers a host of topics related to emergency preparedness and raises awareness in the community about what organizations are doing around emergency response planning and chemical safety. Town meeting day can serve as an annual update and outreach opportunity as well.

Specific Identified Tasks:

- 1) 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.).
- 2) HMGP Awareness: Attend informational sessions on the HMGP funding opportunities for acquisition, elevation and flood-proofing projects. Work with CVRPC to develop an information brochure for residents.
- 3) School Programs: Assure the school is structurally ready to handle natural hazard risks to the greatest extent possible. Continue school programs to raise student awareness of hazards, safety, preparedness and prevention. Explore establishing the school emergency notification system as the primary methodology for all emergency notification procedures and build in the contact information accordingly.
- 4) Family Programs – Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.
- 5) Fire Prevention Programs – Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.
- 6) Other hazard awareness programs – Develop public awareness programs, based on all-hazards needs. Programs to address mobile home park mitigation opportunities, pandemic hazards, preparedness and mitigation may be appropriate as directed by the state department of health and its jurisdictional offices of local health

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.

**Action #5: Continue fluvial geomorphology assessments in collaboration with DEC and develop strategies and regulatory actions in response to identified risks**

**Group: P, NRP, PEA, PP**

Risk or Hazard Addressed: Risk to infrastructure, residents

Primary Responsible Entities: Department of Environmental Conservation, CVRPC, Agency of Natural Resources (VT ANR), Town of Berlin.

Potential Partner Entities: Nonprofits, other Town of Berlin officials, and other appropriate entities.

Timeframe: 2020 – 2025

Funding Requirements and Sources CVRPC can assist in enhanced mapping of the floodplain (if and when these are developed) within the town and has provided the town with updated River Corridor Maps.

Specific Identified Tasks

- 1) Fluvial Geomorphic Assessments – The town will work with DEC through coordinated meetings, workshops and communication to increase understanding of current findings and develop an applicable framework to help guide decisions related to priority infrastructure work and vulnerability.
- 2) Fluvial Erosion Hazard Mapping – Develop a fluvial erosion hazard map for the waterways, using the GIS extension known as SGAT (or Stream Geomorphic Assessment Tool) for assessed stream reaches. As assessments are completed, a map of all assessed waterways in the town will be created.
- 3) River Corridor Management Plans – Using the River Corridor Maps, the town will develop an outreach strategy to residents/structures in or near the defined corridor. This communication should focus on flood resilience measures and opportunities. With the lack of repetitive loss properties in the town, the likelihood of viable HMGP acquisition projects is low but increasing awareness of this program can serve the town well.
- 4) Fluvial Erosion Hazard Mitigation Implementation - The town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.

**Rationale / Cost-Benefit Review:**

Continuing this project will require a sustained succession of grants, state appropriations and other funding to complete assessments in Berlin. Successful completion will provide municipal and regional benefits. The municipality's fluvial erosion areas would be adequately and electronically mapped. This will enable the municipality to make residents and businesses aware

of fluvial erosion hazards and potentially lead to municipally-directed programs, mechanisms and regulations that further mitigate against this hazard, protecting existing structures and infrastructure. Identifying fluvial erosion hazard areas could also help the municipality restrict future development in hazardous areas, if that should be an advantage to the town in the future. More accurate knowledge of fluvial geomorphology will enable the community to have a better understanding of hazard areas and what mitigation measures might most effectively address those concerns. Flooding is the most common and most significant hazard that can trigger a Federal disaster declaration in Berlin. Along with the creation of flood hazard area maps, identifying the fluvial erosion hazard areas provides improved opportunities for the community to mitigate potential losses and gauge future development initiatives.

**Action 6: Reduce vulnerability to high wind events with accepted best practices**

**Group: P, PP**

Risk or Hazard Addressed: Risk to property, residents

Lead Responsible Entities: Berlin Planning Commission, CVRPC, Electric Suppliers.

Timeframe: 2020 –2025

Funding Requirements and Sources: Included below are the tasks that will be assessed on a benefit-cost ratio level in this planning cycle.

Specific Identified Tasks:

1. Establish standards for all utilities regarding tree pruning around line: Incorporate inspection and management of hazardous trees into the drainage system maintenance process. Support and suggest the testing of power line holes to determine if they are rotting. Support the inspection of utility poles to ensure they meet specifications and are wind resistant. When feasible, support burying power lines to provide uninterrupted power after severe winds. Avoid use of aerial extensions to water, sewer, and gas lines when possible. Support use of designed-failure mode for power line design to allow lines to fall or fail in small sections rather than as a complete system to enable faster restoration.
2. Public Outreach: Ensure that school and hospital officials are aware of the best area of refuge in buildings and that their plans are viable in high wind mitigation events. Instruct property owners on how to properly install temporary window coverings before a storm. Support education to design professionals to include wind mitigation during building design/modification to an extent deemed necessary. Coordinate with airport to assure communication plans support notification procedures to protect health and safety

Rationale / Cost-Benefit Review:

High winds have impacted the town and do pose a risk for infrastructure, transportation and public safety. Many mitigation actions associated with high wind risk also address and reduce risk associated with other hazards affecting the city and maintaining the functionality of the town is important for town residents and the region as well.

*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: Berlin Action Evaluation and Prioritization Matrix

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance <sup>1</sup>	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
2	Improve road infrastructure and municipal systems protection programs	5	4	5	2	5	4	4	5	4	38
3	Improve resilience to severe winter storms	2	5	5	4	5	5	4	5	2	37
4	Reduce impact of extreme cold durations	3	2	4	2	3	2	2	3	3	24
5	Reduce vulnerability to high wind events with accepted best practices	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	3	43
6	Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessments and develop strategies in response to any identified risk	3	2	4	2	2	2	2	3	3	23

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.

<sup>1</sup> All mitigation actions outlined in this plan are, and will continue to be, consistently assessed for feasibility related to the social, political and financial factors that are inherent to town operations.

## **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 selectboard are the project leads and will work in conjunction with the selectboard, 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 Selectboard meetings, the town will schedule one meeting annually to formally assess the plan and adopt updates following the annual progress report and community meeting regarding the LHMP. Once the plan is approved by FEMA, the calendar will begin for annual review. The town will take the following implementation matrix and add actions to it each year, modifying tasks and/or needs as required so that the next LHMP update will be populated with the specific actions related to each mitigation strategy by year.

### *5.5.3 Plan Evaluation and Update Process*

The town's Selectboard 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 Selectboard
- An approach to evaluating future conditions (i.e. socio-economic, environmental, demographic, change in built environment etc.)
- Discussion of how changing conditions and opportunities could impact community resilience in the long term
- Discussion of how the mitigation goals and actions support the long-term community vision for increased resilience

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

#### *5.5.4. Plan Update Process*

The Plan update will be led by the Selectboard 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 Berlin 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 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	Primary Responsible Entity	Timeline	Task	Brief Description	Annual Progress: 2020 Progress
Continue fluvial geomorphology assessments and develop strategies in response to identified risk.	VT DEC, CVRPC, VT ANR, Town Selectboard	Spring 2020- Fall 2022	Fluvial Geomorphic Assessments and assessment-based mapping/action	Continue Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Berlin.	DEC has a comprehensive and interactive database for the Winoski River Watershed Basin. REI Scheduled for completion in 2020
	CVRPC, VT ANR, Town Selectboard	Fall 2020- Fall 2022	Fluvial Erosion Hazard Mapping	Rate the fluvial erosion hazard for each assessed reach and develop a fluvial erosion hazard map for the waterway using SGAT. Create map of all assessed reaches. Submit to VT ANR for QA/QC.	Mapping completed for floodplain and river corridor
	CVRPC, Town Selectboard	Fall 2020- Fall 2022	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	NFIP Participant
	Town Selectboard	Fall 2020- Fall 2022	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	Major infrastructure enhancement has occurred as result of flooding with FEI-specific projects planning in current planning cycle
	Town Selectboard	Spring 2020- Spring 2021	Flood Insurance Rating Map Updates	Review draft FIRM data. Update floodplain regulations/zoning.	There have been 16 LOMCS according to FEMA database

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
Improve road infrastructure and municipal systems protection programs	Town Road Foreman and Vtrans	Fall 2019-Fall 2020	Infrastructure Assessment for Storm Water Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts and storm water infrastructure.	Town has identified projects with problem, priority and estimated budget. With great institutional memory of town infrastructure, the highway department is well-equipped to assess, monitor and prioritize needs.
	Town Road Foreman, ANR	Fall 2019-Fall 2022	Infrastructure Assessment for Fluvial Erosion Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts, bridges and systems infrastructure to fluvial erosion.	Road and Bridge Standards adopted and meet or exceed 2013 standards.
	Town Road Foreman and Vtrans	Spring 2019-Fall 2024	Culvert Upsizing	Upsize culverts and ditching along roads to mitigate against repeated damages from storm water or spring snowmelt.	VTCULVERTS.ORG Culvert and Bridge Inventory has been populated.
	Town Road Foreman and Vtrans	Spring 2019	Continued Monitoring of Vulnerable Infrastructure	Inventory bridges to document future damage from flooding. A constantly updated inventory will allow Berlin to keep track of frequently damaged infrastructure and will guide planning to avoid future infrastructure damage.	Bridge replacement scheduled for 2019
	Town Road Foreman and Vtrans	Fall 2019-Fall 2024	Road Improvements	Within political and financial restraints, consider re-engineering 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.	Projects named and scoped. Each annual update will list accomplished projects here:  PROJECTS ACCOMPLISHED:



Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
continued	Selectboard	Fall 2020- Spring 2021	Develop SOP for emergency events based on any identified need and political/financial restraints. ICS training for municipal staff	Building on current Emergency Operations Plans for the Highway Department and Road Commission, and SOP can help clearly define expectations, roles and responsibilities. Develop understanding of eligibility criteria for HMGP projects.	Communication between Highway Department and Road Commission is ongoing. ICS required for LEOP approval.
	Selectboard	Fall 2020- Winter 2022	Increase Awareness of Funding Opportunities	Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized.	New
	Town Road Foreman and Clerks	Summer 2020- Fall 2020	Documenting	Develop a methodology that serves to efficiently capture work and expenditures on sites and keep this information at the town office as time and financial constraints allow	Improve current system could enhance efficiency of proving prior damage
Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress

Maintain and improve resilience to severe winter storms	Emergency Management Director (EMD), CVRPC and Selectboard	Fall 2020- Winter 2021	Improve Existing Shelter Capability/ Investigate Alternate Shelters	Maintain and improve on capabilities of existing emergency shelter capability, including emergency generator functionality. Investigate capabilities of other buildings sufficient to serve as smaller shelters.	All shelters have a generator. Explore additional shelter and secure funding for emergency power if required.
	Emergency Management Director (EMD), electric service management in conjunction with selectboard	Fall 2020- Winter 2023	Reduce risk of power failure due to ice storms:	Enhance collaboration between town and private electric company as means of increasing efficiency of mitigation efforts and restoration when systems are down. Maintain function of generators.	Current communication and operations are working well but room for improvement possible within financial and political restraints.
	SELECTBOARD, shelter facility leads	Fall 2020- Winter 2020	Notification	Develop a notification/communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)	New
	CVRPC EMC in conjunction with SELECTBOARD	Fall 2020- Winter 2020	Residential Programs	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.)	FEMA, VEM and other state agencies publish annual materials that can be obtained and distributed
	Town Road Foreman, SELECTBOARD and Virans	Winter 2020- Winter 2024	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. Increase communication with rail as	Ongoing

	Town Road Foreman, SELECTBOARD and Vtrans	Winter 2020- Winter 2024	Increase awareness of ICS structure and recommended practice	deemed necessary to assure safe train travel during heavy snow/ice events.  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	ICS required but enhanced understand may benefit
<b>Action</b>	<b>Primary Responsible Entity</b>	<b>Timeline</b>	<b>Task</b>	<b>Brief Description</b>	<b>Progress</b>
<b>Reduce impact of</b>	SELECTBOARD,	Winter 2020-2	Economic Resilience	Within political and financial	New

<p><b>extreme cold durations</b></p>	<p>CVRPC, relevant state agencies and non-profits</p>	<p>Fall 2020- Winter 2024</p>	<p>SELECTBOARD, EMD</p>	<p>restraints, establish program for assistance in paying heating bills during crisis situations, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services</p>	<p>Ongoing with improvements planned</p>
	<p>SELECTBOARD, Rescue services, Fire Departments, EMD</p>	<p>Winter 2020- Winter 2022</p>	<p>Assess Vulnerable Population</p>	<p>Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the city 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.</p>	<p>New</p>
	<p>SELECTBOARD, Fire Departments, EMD, Health Officer (suggested)</p>	<p>Winter 2020- Winter 2022</p>	<p>Notification and Education</p>	<p>Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.</p>	<p>New</p>

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
				<p>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.</p>	

<p><b>Reduce vulnerability to high wind events with accepted best practices</b></p>	<p>SELECTBOARD, Fire Department, facility leads</p>	<p>Spring 2020- Winter 2025</p>	<p>Establish standards for all utilities regarding tree pruning around line</p>	<p>Incorporate inspection and management of hazardous trees into the drainage system maintenance process. Support and suggest the testing of power line holes to determine if they are rotting. Support the inspection of utility poles to ensure they meet specifications and are wind resistant. When feasible, support burying power lines to provide uninterrupted power after severe winds. Avoid use of aerial extensions to water, sewer, and gas lines when possible. Support use of designed-failure mode for power line design to allow lines to fail or fail in small sections rather than as a complete system to enable faster restoration.</p>	<p>New</p>
	<p>LEPC, EMD, Fire Chiefs</p>	<p>Spring 2020- Spring 2025</p>	<p>Public Outreach</p>	<p>Ensure that school and hospital officials are aware of the best area of refuge in buildings and that their plans are viable in high wind mitigation events. Instruct property owners on how to properly install temporary window coverings before a storm. Support education to design professionals to include wind mitigation during building design/modification to an extent deemed necessary. Coordinate with airport to assure communication plans support notification procedures to protect health and safety</p>	<p>New</p>

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
Raise public awareness of hazards, hazard mitigation and disaster preparedness.	EMD, Fire Chiefs, Rescue Services	Fall 2020-Fall 2024	Residential Programs	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.).	New
	EMD, Fire Chiefs	Fall 2020-Fall 2024	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.	Ongoing
	Fire Chiefs	Fall 2020-Fall 2024	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.	Ongoing
	LEPC, Fire Chief	Fall 2020-Fall 2024	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs.	Ongoing

Additional Actions	Primary Responsible Entity	Timeline	Task	Brief Description	Progress





## APPENDICES

**NOTE: Appendices A-D not included with State submission or for FEMA review)**

Appendix A: Community Reports: Berlin (Flood Ready Vermont)

Appendix B: Culvert Locator: (VTrans)

Appendix C: No Adverse Impact Floodplain Management Fact Sheet (ASFPM)

Appendix D: Farm Structures in Designated Flood Hazard Area Planning Checklist (VAAFM)

Appendix E: Community Survey Responses (2)

Appendix E: Community Outreach Form

**Town of Berlin Hazard Mitigation  
Community Outreach Form**

**Introduction:** Hazard Mitigation Planning works to protect a community from natural hazard vulnerabilities and is a mandatory requirement before any FEMA funding can be awarded to a town to repair infrastructure or acquire critical equipment. By maintaining an approved plan, the town can earn a greater percentage of state funding during recovery from a disaster and be better prepared to handle a future event. Your input is crucial to the planning process and the information you provide will help produce a plan that will serve the town for years to come. Please take the time to share your thoughts on the questions below. Thank you!

Please return form to: Town of Berlin:

- Mail: 108 Shed Rd, Berlin, VT 05602
- In-person to Town Clerk or Assistant Town Clerk
- Email: [townclerk@berlinvt.org](mailto:townclerk@berlinvt.org)

Resident, Employee or Business Owner (please circle all that apply)

**Community Concerns:**

1. Have you been impacted by a natural disaster while in the Town of Berlin? Yes or No? If yes, please explain: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

2. What are your general concerns about weather-related emergency events in the town?

*Notification of all residents adequate.*  
*Shelter for those who require it.*  
*Transportation to the shelters.*  
*Power for home in event of long-term outage.*

3. What do you think the community should plan to accomplish to be better prepared for the next emergency event related to severe weather?

*Ensure shelters & transportation available.*  
*Identify hazard-prone areas, ensure residents are prepared.*  
*Work to get everyone on VT-Alert & signed up for CARE registry.*

4. What other thoughts or concerns do you have about emergencies, natural hazards and emergency response in the town? *Glad to have emergency management team available*

(use back of page if needed)

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## Town of Berlin Hazard Mitigation Community Outreach Form

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**Introduction:** Hazard Mitigation Planning works to protect a community from natural hazard vulnerabilities and is a mandatory requirement before any FEMA funding can be awarded to a town to repair infrastructure or acquire critical equipment. By maintaining an approved plan, the town can earn a greater percentage of state funding during recovery from a disaster and be better prepared to handle a future event. Your input is crucial to the planning process and the information you provide will help produce a plan that will serve the town for years to come. Please take the time to share your thoughts on the questions below. Thank you!

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**Resident, Employee or Business Owner** (please circle all that apply)

**Community Concerns:**

1. **Have you been impacted by a natural disaster while in the Town of Berlin? Yes or No? If yes, please explain:** Events: Torrential rain causing flooding and road washouts, wind storms uprooting trees, causing power outages.

Impacts: road closures, power outages, had to evacuate people from trailer parks next to rivers, move them to Red Cross shelter.

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2. **What are your general concerns about weather-related emergency events in the town?**

Getting word out to affected areas, especially people who are not "connected" via cell phones or the Internet. Also, concerned about relying on a centralized Red Cross shelter, had problems with flooding blocking access to the shelter in Barre.

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3. **What do you think the community should plan to accomplish to be better prepared for the next emergency event related to severe weather?**

Do more outreach to the community regarding methods of getting warnings, such as VT-Alert.

Also, be more prepared to open a non-Red Cross supported shelter, in case the Red Cross one can't be reached or is full to capacity.

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4. **What other thoughts or concerns do you have about emergencies, natural hazards and emergency response in the town?** The Berlin Volunteer Fire Dept has always provided great support to the town during weather emergencies, sending members door-to-door with warnings, and should

be commended. **(use back of page if needed)**