Town of Barnard, Vermont

2022 Local Hazard Mitigation Plan

2022 Plan

Prepared by the Two Rivers-Ottauquechee Regional Commission and the Town of Barnard

Date of Town Adoption: 01/18/2023

Date of Final Approval by FEMA: 01/20/2023

U.S. Department of Homeland Security
FEMA Region I
99 High Street, Sixth Floor
Boston, MA 02110-2132

FEMA

February 7, 2023

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

Dear Stephanie Smith:

As outlined in the FEMA-State Agreements for FEMA-4621-DR-VT, FEMA-4532-DR-VT, and FEMA-4474-DR-VT, your office has been delegated the authority to review and approve local mitigation plans under the Program Administration by States Pilot Program. Our Agency has been notified that your office completed its review of the Town of Barnard, Vermont 2022 Local Hazard Mitigation Plan and approved it effective **January 20, 2023** through **January 19, 2028** in accordance with the planning requirements of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), as amended, the National Flood Insurance Act of 1968, as amended, and Title 44 Code of Federal Regulations (CFR) Part 201.

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

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

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

Sincerely,

DEAN J SAVRAMIS Digitally signed by DEAN J SAVRAMIS
Date: 2023.02.07 18:33:37 -05'00'

Dean Savramis
Mitigation Division Director
DHS, FEMA Region I

DS:sl

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

CERTIFICATE OF ADOPTION
JANUARY 18, 2023
TOWN OF Barnard, Vermont Selectboard
A RESOLUTION ADOPTING THE Town of Barnard, Vermont 2022 Local Hazard Mitigation Plan

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

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

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

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

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

RESOLVED by Town of Barnard Selectboard:

1. The **Town of Barnard, Vermont 2022 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Barnard;

2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;

3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and

4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Barnard this 18TH day of JANUARY 2023.

Selectboard Chair

Selectboard Member

ATTEST

Town Clerk

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I. Introduction

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

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

II. Purpose of the Plan

The purpose of this Plan is to assist Barnard in identifying all natural hazards facing the town, ranking them according to local vulnerabilities, and identifying strategies to reduce risks from known priority hazards.

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

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

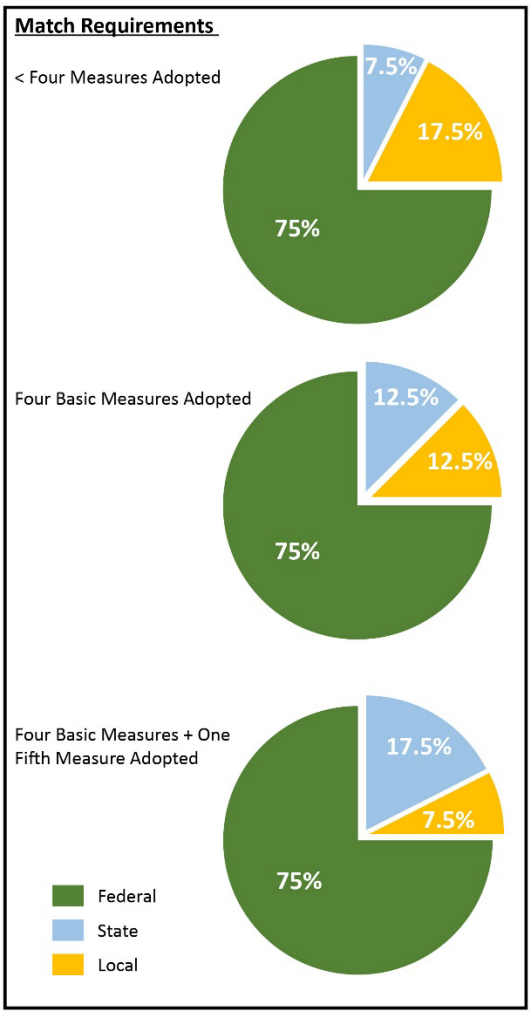
- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about the community

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

This 2022 Plan expands upon the 2015 plan by analyzing new hazards, adding new and relevant data, and creating new mitigation actions for the Town to follow over the next five years. In addition, there is also an important financial incentive for Towns to update their hazard mitigation plans. The Vermont Emergency Relief & Assistance Fund (ERAF) provides State funds to match FEMA Public Assistance grants

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

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



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

A fifth action, that few Vermont communities choose to take, is to either adopt a River Corridor bylaw or participate in the Community Rating System (CRS). River Corridor bylaws regulate land areas mapped by the State of Vermont that usually fall outside of the FEMA mapped flood zone, with the purpose of preventing erosion that could undermine structures. The CRS is a complex administrative process with a simple premise – that taking additional flood prevention steps will lessen flood damages. Communities in the CRS enjoy lower flood insurance rates. Implementing either of these two actions will decrease the local contribution under the ERAF rule to only 7.5% match for municipalities. Barnard could adopt River Corridor Protection and could therefore be eligible for receiving the highest contribution from ERAF, assuming all other criteria are met. At the time of this writing, the Town is financially responsible for 17.5% match due to the expiration of the local hazard mitigation plan.

III. Community Profile

The Town of Barnard, consisting of approximately 49 square miles, is nestled around Silver Lake along Vermont Route 12. Barnard is quite rural, with several brooks and streams, such as Barnard Brook, Broad Brook, and Locust Stream. Barnard has no major rivers. The majority of the Town lies within the White River watershed, however there is a small portion of southeast Barnard that drains into the Ottauquechee River. The Chateauguay No Town Conservation area comprises approximately 55,000

acres of largely uninhabited forestland in the towns of Barnard, Stockbridge, Killington and Bridgewater, 16,209.8 acres of which are located in Barnard. This land is located in the southwest corner of Barnard, though no town roads serve the area.

According to the 2020 Census, the population of Barnard was 992, which was an increase of 45 residents over the previous decade. There were a total of 704 houses or manufactured homes, of which 442 were occupied and 262 were vacant or seasonal. According to the Vermont Housing Finance Agency, the median home sale price in Barnard is 38% higher than the state as a whole. Between 2010 and 2020, the total number of housing units decreased slightly, from 716 units to 704 units, according to the US Census Bureau.

The Town lies within the service area of Green Mountain Power (GMP), which supplies electrical power to all sections of town.

The Town is served by the Barnard Volunteer Fire Department and the Broad Brook Fire Department, which respond to fires and other emergencies in Barnard and neighboring towns. Neighboring communities' departments are called in on large fires requiring outside resources. In 2017, a new Emergency Management Center was built, replacing the dated and cramped fire station the Fire Department had been using since 1956. The new center has 7,000 square feet of space, which facilitates emergency response.

Elected constables provide limited police security and traffic control services when needed. All other police functions are performed by the Windsor County Sheriff, located in Woodstock, or the Vermont State Police, located at the Royalton Barracks in Royalton.

Essential services are adequately available except for emergency medical services. Ambulance services are available in Barnard through the Woodstock and White River Valley Ambulance Services as well as through DART. Although once medical doctors practiced in Barnard, this is no longer the case.

IV. The Planning Process

A. Plan Developers

Kyle Katz, Planner at the Two Rivers-Ottauquechee Regional Commission (TRORC), assisted the Town of Barnard with updating its Hazard Mitigation Plan. Committee members who assisted with the revisions include:

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

Name	Role/Organization	How Participation Was Solicited
Richard Lancaster	Selectboard Vice-Chair	On 05/09/2022, Rob Ramrath, Barnard Town Administrator, coordinated with TRORC staff to set up the first meeting. The first meeting was scheduled for 6/13/2022. TRORC's staff attended that meeting, followed by many more meetings in which participants revised and developed the Hazard Mitigation Plan. See below for more meeting-specific details.
Rob Ramrath	Town Administrator	
Steve Cota	Planning Commission Chair	
Rob Tracy	Planning Commission	
Carin Park	Planning Commission Member	
Kate Reeves	Planning Commission	
Mike Manning	Emergency Management Director	
Steve Johnson Jerry Fredrickson	Planning Commission Member TRORC Board Member	

B. Plan Development Process

The 2009 Barnard Annex was originally part of the 2008 multi-jurisdictional Regional Hazard Mitigation Plan, drafted by Two Rivers-Ottauquechee Regional Commission, and approved by FEMA on September 30, 2008 with its first local annex. The Barnard Annex received subsequent FEMA approval, but, since it was part of a larger plan, FEMA treats its start date as September 30, 2008, meaning the Barnard Annex expired on September 30, 2013.

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

Summary of 2016 Changes, Additions, and Planning Process

This Plan was reconstructed as a single jurisdiction, stand-alone Barnard Local Hazard Mitigation Plan that was submitted for individual approval to FEMA and was adopted February 22nd, 2017. As such, several sections were added or updated to include all necessary information.

2022 Plan Changes and Planning Process

This Plan is an update to the 2016 Local Hazard Mitigation Plan for Barnard. While the 2016 Plan provided a good basis for the 2022 Plan, public meetings were held to update this plan.

The changes to this plan include:

- **General**
    - New sections: Plan Development Process, 2016 Mitigation Strategies Status Update chart, Existing Hazard Mitigation Programs, Projects & Activities, Plan Maintenance;
    - Data updates: New hazard incidents, emergency declarations, census data;
    - Hazards have been reevaluated with the hazard ranking system used by the Vermont Division of Emergency Management and Homeland Security.
    - New hazard mitigation strategies.
- **Hazards Analysis**
    - Extreme Cold/Snow/Ice Storm, and Flash Flood/Flood/Fluvial Erosion remain on the list of "top hazards;"
    - Extreme Heat, Wildfire, and Invasive Species have been added to the list of "top hazards;"
    - For each hazard, a location/vulnerability/extent/impact/likelihood table has been included to summarize the hazard description.

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

- **Activities**

*** Note: The meetings listed below were public sessions.*

    - **06/13/2022** TRORC staff met with Barnard HMP committee members to introduce the plan update development process, respond to any questions, and engaged in a ranking exercise to determine "Top Hazards" in the Town. TRORC planners discussed with the HMP committee the timeline for the plan and what would be discussed in subsequent meetings. This meeting was open to the public and was warned according to Open Meeting Law. No comments from the public were received.
    - **07/19/2022:** TRORC staff met with Barnard HMP committee members to discuss and finalize the list of hazards that pose the greatest risk to the Town and to discuss the status of previously identified mitigation strategies. Some discussion of the Town's existing capabilities and programs also took place. This meeting was open to the public and was warned according to Open Meeting Law. No comments from the public were received. A poster for this meeting was posted at the Town Hall, the Post Office, the General Store, and notice of the meeting was provided on the Town Website on 7/5/22. The meeting was also noticed in the Vermont Standard (See Appendix C) and the TRORC July Newsletter.
    - **08/16/2022**: TRORC staff met with the Barnard HMP committee members to review existing programs and capabilities, plan maintenance, and the top hazards for the plan.

Specific town vulnerabilities, and extent and impact of top hazards were discussed. The meeting was open to the public and was warned according to open meeting law. No comments from the public were received. A poster for the meeting was posted at the Town Hall, the Post Office, and the General Store on 8/3/22 (See Appendix C).

- **09/08/2022:** TRORC staff met with HMP committee to finish reviewing top hazards and to identify hazard mitigation strategies. This meeting was open to the public and was warned according to Open Meeting Law. No comments from the public were received. A notice for the meeting was posted on the town listserv and in the Vermont Standard. A poster for the meeting was also posted at the Town Hall, the Post Office, and the General Store.
- **10/20/2022:** TRORC staff met with the HMP committee to finish identifying hazard mitigation strategies and to review the draft of the Plan. This meeting was open to the public and was warned according to Open Meeting Law. No comments from the public were received and no members of the public attended. A notice for the meeting was posted on the town listserv and town website. A poster for the meeting was also posted at the Town Hall, the Post Office, and General Store. The draft plan was posted on the town website prior to the meeting and was available for review at the meeting as well.
- **11/02/2022:** A draft of the 2022 Hazard Mitigation Plan was provided to the Barnard Selectboard with a request for comments. No comments were received. A draft was also sent to either the Selectboard Chair or the Town Administrator of following neighboring municipalities for comment: Thetford, West Fairlee, Vershire, Chelsea, Tunbridge, Royalton, Sharon, and Norwich. No comments were received.
- **Hazard Mitigation Survey:** A survey was issued, which residents could access via the QR code on the meeting notice posters, or as a link through the meeting notices publicized on the town listserv. The survey addressed community priorities, hazard mitigation goals, hazard vulnerability and potential mitigation actions. There were no responses to the survey. In the future, publicizing the survey more broadly on the town website, as well as making a print version available, may provide more opportunities for input.

In addition to the local knowledge of the Planning Team and other relevant parties, existing plans, studies, technical and regulatory documents were referenced in the preparation of this Plan. These have been provided below.

- **Review of existing plans, studies, reports, and technical information** (*44 CFR 201.6(b)(3)*)
  - Barnard Local Hazard Mitigation Plan (Adopted 02/22/2017)
    - This Plan was referenced extensively during the plan development process, especially in regard to the worst threats and mitigation action strategies identified in 2016.
  - 2015 Barnard Culvert Inventory
    - Referenced to identify culverts in critical or poor condition.

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

- The Broad Brook Fire Log
  - Referenced for a history of occurrences of wildfire.
- 2016 Barnard Town Plan (Adopted 08/24/2016)
  - The Town Plan provided TRORC's staff with background information on the community, as well as more detail on their emergency services.
- 2012 Barnard Zoning Ordinance (Adopted 11/06/2012)
  - The Zoning Bylaws were referenced for general knowledge and for Barnard's Flood Hazard Regulations.
- 2022 Barnard Local Emergency Operations Plan (LEMP) (Adopted 05/01/2022)
  - The Barnard LEMP was referenced for general knowledge regarding the Town's emergency operations.
- 2020 US Census
  - Census data was gathered to keep statistical data within the plan current.
- 2018 State of Vermont Hazard Mitigation Plan
  - This plan was referenced for knowledge of the state's hazard mitigation planning processes and description of top hazards for the State of Vermont.
- 2013 Local Mitigation Planning Handbook
  - Referenced for background on mitigation strategy and actions development.

C. Status Update on Mitigation Actions Identified in 2016

The following table outlines the mitigation actions that were proposed in Barnard's 2016 Local Hazard Mitigation Plan. Participants in the new Plan update process reviewed these actions and reported on the status of each:

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

Mitigation Action	Local Leadership	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame	2022 Status
All Hazards					
Ensure that new Barnard Emergency Services building is in a location that minimizes vulnerability to hazards. The location should be located in areas that are not vulnerable to potential flooding and fluvial erosion. The location of the new emergency services building shall be outside of Special Flood Hazard Areas and mapped River Corridors. (Mitigation)	Selectboard	High (New)	Local resources	Spring 2017-Fall 2017	Completed. Constructed in 2017-18 adjacent to the Town Hall.

Ensure that new Barnard Emergency Services building has a generator that will provide backup power that will (Mitigation)	Selectboard	Medium (Action #2 of 10 in 2009 Plan)	Local resources	Fall 2019-Winter 2019	Completed.
Landslide					
Bank stabilization of landslide on Chateauguay Road to protect Town Garage, a critical facility, and road infrastructure. (Mitigation)	Selectboard	High (New)	CDBG-DR2	Fall 2016–Fall 2018	Completed.
Structural Fire					
Install a dry hydrant on Old Mountain Hunger Road to reduce the loss of life and infrastructure from structure fires. (Mitigation)	Fire Chief/Fire Department	Low (New)	Local resources. VT Dry Hydrant Grant Program	Summer 2021-Fall 2021	Not completed. The committee does not see this action as feasible given the few water sources on Mt. Hunger Road. This action will not continue in 2022 plan.
Extreme Cold/Snow/Ice Storm					
Clear and maintain Town road rights-of-way to protect town and utility infrastructure and to prevent the damage to health of residents from downed branches during storm events. (Mitigation)	Highway Department/ Selectboard	Medium (Action #5 of 10 in 2009 Plan).	Local resources	Fall 2019-Winter 2019 and continued annually	This occurs on an ongoing basis.
Formally request that Green Mountain Power annually clear and maintain utility corridors, which will protect town and utility infrastructure. (Mitigation)	Emergency Management Coordinator	Medium (Action #10 of 10 in 2009 Plan).	Green mountain power, Local Resources	Summer 2019-Fall 2019 and continued annually	Not completed. The committee questioned whether this action would be effective. This action will not carry over into the 2022 Plan.
Flood/Fluvial Erosion/Severe Weather					
Develop a schedule and capital budgeting program to replace undersized culverts to allow for greater volumes of water to be cleared, therefore	Selectboard, Road Foreman	Medium (Action #4 and #5 of 10 in 2009 Plan)	Local resources; VTrans	Spring 2020-Fall 2020	Ongoing.

protecting town infrastructure. (Mitigation)					
Upgrade three culverts on Lime Pond Road to allow for greater volumes of water to be cleared from flooding of natural pond. (Mitigation)	Selectboard, Road Foreman	Medium Action #4 and 5 of 10 in 2009 Plan)	Local resources; VTrans Structures Grant	Summer 2029-Fall 2019	Not completed, but will continue as a 2022 strategy.
Upsize squashed culvert on Broad Brook Road to a Bridge, which will allow more water quality to be cleared and will protect road and building infrastructure. (Mitigation)	Selectboard, Road Foreman (Action #4 and 5 in 2009 Plan).	Medium Action #4 and 5 of 10 in 2009 Plan)	Local Resources, Structures Grant	Summer 2020-Fall 2020	Completed.
Consider adopting river corridor regulations, which will incorporate VT ANR's river corridor maps, helping residents and planners know what land is necessary for riparian functions and to prevent the threat to current and future development. (Mitigation)	Planning Commission	Low Action #6 in 2009 Plan).	Local Resources; TRORC; Municipal Planning Grant; Vermont Agency of Natural Resources	Spring 2022-Spring 2023	Not completed. This action has carried over in the 2022 Plan.
Request an updated flood map from FEMA that more accurately identifies areas that are subject to flooding, therefore diminishing the loss of health and property from development in these areas. (Mitigation)	Town Zoning Administrator	Medium Action #6 of 10 in 2009 Plan)	Local resources; FEMA	Spring 2020-Fall 2020	Not completed. The committee questioned whether this action would be effective. This action will not be carried over into the current plan.
Prohibit the removal of natural vegetation along streambanks. Riparian vegetation improves stream floodplains and also reduces the damaging effects of stream channel erosion on town and private infrastructure. (Mitigation)	Selectboard	Medium (New)	Local Resources; TRORC; Vermont Agency of Natural Resources	Spring 2019-Spring 2020	Not completed. This action will be reframed and redirected in the 2022 plan.

Elevate existing buildings in Special Flood Hazard Areas in Barnard so that they are 1 foot above base flood elevations. Elevation of structures located in areas vulnerable to flooding will reduce the risk to flooding and will reduce the loss of private infrastructure (Mitigation).	Selectboard	Low (New)	Local resources; Hazard Mitigation Grant Program	Summer 2021-Summer 2025	Not completed. The committee does not see this action as feasible. This action will not carry forward in the 2022 plan.
Require residents to clean and maintain driveway culverts, or contract with residents to have Town maintain driveway culverts. Proper maintenance of driveway culverts will improve long-term town road maintenance costs and will also properly handle flood levels. (Mitigation)	Selectboard; Road Crew	Low (New)	Local resources	Summer 2022-Summer 2025	Ongoing. The town notifies residents on an as-needed basis and this action will carry over into the 2022 plan.
Conduct a road erosion road inventory to determine projects for stormwater improvement to reduce erosion sources from town road infrastructure. Proper road erosion reduction will reduce erosion and its damaging effects on public and private infrastructure. (Mitigation)	Selectboard; Road Crew	High (New)	Better Roads Grant	Summer 2018-Fall 2018	Ongoing. The Town is currently discussing the need for a road erosion inventory.

D. Changes in Town Priorities and Vulnerabilities Since the 2016 Plan

This 2016 Barnard Local Hazard Mitigation Plan reflects several changes in priorities from the 2016 Plan. This 2022 Plan and the 2016 Plan both recognize and detail Flash Flooding and Fluvial Erosion, and Extreme Cold/Snow/Ice Storms as the hazards that pose the greatest risk to health and property in the Town of Barnard. However, this 2022 Plan also addresses Extreme Heat, Invasive Species, wildfire, and Dam Failure that present risk to health and property in the Town. The 2016 Plan did not detail these hazards. Specific vulnerabilities of the Town have changed since 2016. The failure of several beaver dams have caused road washouts and property damage, leading to concerns over this issue. Hazard Mitigation Team members have also identified invasive species, such as the threat of milfoil to Silver Lake and the spread of wild parsnip and other invasives along rights-of-way as significant concerns. Wildfire and extreme heat have also become greater concerns for Town residents. Wildfire is a particular concern in rural and higher elevations, where access to water is more limited. The Town is also heavily forested, which would exacerbate the impacts if a wildfire were to occur. Other priorities,

such as flooding, extreme cold, and winter storms remain the same, reflecting the Town's continued concern for the impact these hazards can have on residents and infrastructure. This 2022 Plan identifies more detailed hazard mitigation strategies to reduce the risk to health and property as a result of the hazards that pose the greatest risk to the Town of Barnard. However, some mitigation actions identified in the 2016 Plan and the previous chart that were not specifically completed were carried over into this 2022 Plan. If an incomplete action was not carried over, reason has been given for this.

The Town of Barnard is quite rural in nature, and is considered a "bedroom community" because most of its residents travel outside of Town for their occupations. Between 2016 and 2021, 134 development permits were issued for new construction. The vast majority of these permits were residential in character, and pertained to additions, renovations, or new accessory buildings. 26 of the permits issued were for new single-family dwellings or accessory dwelling units, while 45 permits were issued for detached accessory dwellings, such as sheds, garages, or guest houses. Only 20 of the permits were issued for commercial, agricultural or municipal projects. The remainder of the permits were primarily additions or renovations to existing structures. In 2017, the new Emergency Services Facility was constructed adjacent to the Town Hall. This facility has increased the emergency preparedness capabilities of the Town, and serves as a safe gathering space for residents when a hazardous event occurs. The Town's Flood Hazard Overlay in the Town Zoning Ordinance regulates development within the SFHA, and it prohibits new residential and non-residential structures in the Special Flood Hazard Area (SFHA), while permitting some minor improvements such as at-grade parking or utilities, and certain conditional uses such as bridges, culverts and grading. Only one conditional use permit was issued for a bridge in the flood zone between 2016 and 2022. No other residential permits were issued for locations within the Town's Flood Hazard Overlay. No new development is or will be permitted in mapped flood hazard areas, which are specifically vulnerable to flooding. New development, specifically the new permits issued from 2016-2021 have had no change on the Town's vulnerability. Due to the terrain and steep valleys in the Town of Barnard, future new development may be vulnerable to either flood hazards or fluvial erosion hazards. The vulnerability of any new growth would be dependent on its proximity to the SFHA, near a small stream, or on a steep hill.

E. Existing Hazard Mitigation Programs, Projects & Activities

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

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

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve On
Community Preparedness Activities	Program—Annual update of Barnard's Local Emergency Management Plan (LEMP). Last updated and approved on 05/01/2022.	Updated by the Town Manager, assistance from TRORC and funding from Vermont DEMHS.	This document is reviewed and updated each year to ensure that the contact information of emergency response personnel is up-to-date. This information is then sent to Vermont Emergency Management for their records. The current program works well and there is no need to expand or improve on it.
	Completed Action- Shelters in Barnard: Barnard Academy on VT route 12 Town Hall on 115 north road	Staff time from the Town Clerk and volunteer time from other emergency management personnel.	These shelters are not Red Cross certified, and are not stocked with Red Cross emergency supplies. The use of this facility could be improved with Red Cross certifications, , and obtaining Red Cross supplies. A generator has been installed at the shelter.
	Program— Participation/attendance in the Local Emergency Planning Committee District 12 (LEPC 12)	Volunteer time from the Barnard Selectboard Chair and emergency management personnel; meetings convened by TRORC. Funding from Vermont DEMHS.	There is no need to expand or improve on attendance, as it is satisfactory.
Insurance Programs	Authority/ Program—participation in National Flood Insurance Program (NFIP) The Town participates and complies with the NFIP through their enforcement of the "Flood Hazard Overlay District" part of the Town's Zoning Regulations, which was last adopted on 11/06/2012. [Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]	The Town's Floodplain Administrator is a hired individual. Assistance from TRORC and Vermont ANR. Funding from local resources—annual budget.	The Town's initial Flood Hazard Boundary Map (FHBM) was dated 11/01/1974. The Town's initial Flood Insurance Rate Map (FIRM) was dated 09/18/1985. The Town's FIRM and Flood Insurance Study (FIS) have been updated, and the current effective date for both is 09/28/07. The Zoning Bylaws are kept up-to-date and regulate new development in the Special Flood Hazard Area (SFHA).
Land Use Planning	Policy/Program— Barnard Town Plan Last adopted on 03/14/2016	Volunteer time from the Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	The Barnard Town Plan is currently being updated. Normally, the Town Plan is reviewed/updated every five years, as required by statute. The Planning Commission may expand or improve on any section it deems necessary, or that is required by changes in state statue.

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve On
	Completed Authority— Barnard Unified Zoning and Subdivision Regulations. Includes a "Flood Hazard Overlay District" zoning district. Last amended on 11/06/2012.	Volunteer time from the Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Zoning Bylaws are also reviewed and updated if needed. Currently, there is no need to expand or improve on these regulations. The Town Plan is currently being updated and the Zoning Bylaws will be referenced to ensure they conform to the Town Plan.
Hazard Control & Protection of Critical Infrastructure & Facilities	Policy/Program— Barnard Hazard Mitigation Plan Adopted on 02/22/2017.	Updated with volunteer time from local officials and assistance from TRORC and Vermont DEMHS. Funding from DEMHS/FEMA.	The 2022 Barnard Local Hazard Mitigation Plan will replace the 2016 Plan. The 2022 LHMP has greatly expanded and improved upon the 2016 Plan. Future iterations of the Town's LHMP will be updated by the Town at least every five years.
	Authority— 2013 Town Road and Bridge Standards Adopted 07/17/2019	Adopted by the Selectboard, implemented by the Road Foreman, and assistance from TRORC. Funding from VTrans and the local budget to implement.	Specifies minimum construction standards for roadway, ditches, culverts and bridges and guardrails. VTrans updates the Town Road and Bridge Standards on a fairly regular basis. The Town has the authority to require above-and-beyond what is written in the policy.
	Program—Better Backroads culvert inventory completed in fall 2015 for the Town of Barnard This inventory includes georeferenced locations and attributes for all culverts in Barnard. The Town received targeted assistance in the culvert inventory and specific priority projects were identified.	Staff time from the Barnard Road Foreman; assistance from TRORC. Funding from Better Backroads grant; local personnel time.	The Town is currently using the culvert inventory to further its culvert improvement program, and seeking funding through various sources for implementation projects. Routine in-house updates occur on an on-going basis. There is no need to expand or improve upon this program at this time. The new VAPDA VT Culverts online inventory system can facilitate status updates for culverts in town.
Education/ Public Outreach	Notifications via Listserv to notify residents of available resources during hazard events, such as power outages.	Town Staff, fire department	There is no need to expand on this action.

F. Plan Maintenance

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

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

Updates and evaluation of this Plan by the Selectboard and the local Emergency Coordinator/Director will also occur within three months after every federal disaster declaration directly impacting the Town of Barnard. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at an April Selectboard meeting and after every federally declared disaster directly impacting the Town according to the graphic in Appendix B. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws. The Town of Barnard will consider incorporating of the mitigation actions outlined in this plan into the Municipal Plan during the ongoing plan update process. The Municipal Plan update will be spearheaded by the Planning Commission, who will review the plan and determine those mitigation actions/strategies/goals that should be included in the Municipal Plan.

At least one year before the Plan expires, the update process will begin (through annual updates, monitoring of progress and evaluation that will occur at the April Selectboard meeting). For this next Plan update, the Two Rivers-Ottauquechee Regional Commission (TRORC) will help with Plan updates if assistance is requested by the Town of Barnard and if funding is available. If TRORC is unable to assist the Town, then Barnard's Town Clerk, Administrative Assistant, or Selectboard will update the Plan, or the Selectboard may appoint a committee of interested citizens (including the current local Emergency

Director) to draft changes. Ultimately, it will be the Town's responsibility to update their Local Hazard Mitigation Plan.

The process of evaluating and updating the Plan will include continued public participation through public notices posted on the municipal website, within the municipal building, in The Valley News, and the TRORC newsletter and blog. These notices will invite the public to the scheduled Selectboard (or specially scheduled) meeting. The public will be given the opportunity to comment during this process. Additional stakeholders may be invited to the meeting; these include: the Woodstock Ambulance Service, VTrans, and the Vermont Agency of Natural Resources (VT ANR). VT ANR should be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain and river corridor zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk.

Updates to the Plan may include changes in community mitigation strategies; new town bylaws, zoning and planning strategies; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

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

The previous Town Plan was updated prior to the writing of the 2016 Local Hazard Mitigation Plan, so it is difficult to know how elements of the 2016 LHM Plan were incorporated into the 2016 Town Plan. However, the Barnard Town Plan has incorporated many policies and recommendations to mitigate the impacts of future hazards, many of which have been excerpted and can be found in Section VI, (B) of this Plan. Furthermore, one of the Purpose statements to the Flood Hazard Overlay Land Use Area, as indicated in the 2016 Town Plan, is to "manage the flood hazard area designated pursuant to 10 V.S.A chapter 32 § 753, the municipal hazard mitigation plan; and make the Town of Barnard, its citizens, and businesses eligible for federal flood insurance, federal disaster recovery funds, and hazard mitigation funds as may be available." The Town has incorporated hazard mitigation into many of its planning processes, and will continue to do so.

It is also recommended that the process work both ways and the Town review and incorporate elements of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ fluvial erosion hazards (FEH) and River Corridor bylaws. The Barnard Planning Commission will incorporate hazard mitigation strategies developed and identified in this Local Hazard Mitigation Plan

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

V. Community Vulnerability by Hazard

A. Hazard Identification

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

- What bad things can happen?
- How likely are they to occur?
- How bad could they be?

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

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Barnard, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While Barnard might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not hold. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially rainfall events. However, climate change can have other less noticeable impacts as well. Vermont is beginning to see a decline in native tree species, due in part to pests but also to a warming climate. We may also see greater crop losses due in part to increased pest pressure. Climate change could also lead to climate refugees: individuals and families moving away from areas experiencing the worst effects of climate change. All of these changes have the potential to affect Barnard. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

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

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

Using this ranking criteria, the table on the next page shows a list of hazards that may affect Barnard in the future, along with their ranking on which hazards are most likely to be severe. From this table, the hazards that are believed to be the most significant threats are then followed up with discussion and mitigation strategies throughout the rest of this Plan.[1] It should be noted that hazards assigned with the same "Hazard Score" are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

Table: 2022 Hazard Assessment

Hazard Impacts	Probability	Potential Impact					
		Infrastructure	Life	Economy	Environment	Average:	Score*:
Snow Storm & Ice*	4	3	2	3	2	2.5	10
Flooding *	3	3	2	3	3	2.75	8.25
Extreme Cold*	3	3	3	2	2	2.5	7.5
Extreme Heat*	3	2	3	1	3	2.25	6.75
Fluvial Erosion*	3	3	1	2	2	2	6
Dam Failure*	3	2	2	2	2	2	6

[1] It's important to note that those hazards which were not found to pose the greatest threats may still occur in Barnard's future; however, they are not the focus of this Plan.

Wildfire*	3	2	2	2	2	2	6
Invasive Species*	4	1	1	1	3	1.5	6
Erosion	3	2	1	2	2	1.75	5.25
High Winds	3	3	1	1	2	1.75	5.25
Hail	4	2	1	1	1	1.25	5
Thunderstorms	4	1	2	1	1	1.25	5
Wastewater Contamination	2	1	3	2	3	2.25	4.5
Infectious Disease	2	1	4	3	1	2.25	4.5
Landslides	2	3	2	1	2	2	4
Tropical Storm/Hurricane	1	4	3	4	3	3.5	3.5
Tornado	1	4	3	2	3	3	3
Hazardous Materials Spills	1	1	3	2	4	2.5	2.5
Drought	1	1	1	2	4	2	2
Earthquakes	1	2	2	2	1	1.75	1.75
Structural Fire	1	2	2	1	1	1.5	1.5
Tsunami (Vermont is landlocked)	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Indicates top hazards

The Barnard HMP committee discussed the results of the hazard ranking activity and decided to focus on hazards that had the potential to impact the Town on a town-wide scale and had the potential to occur frequently. The Barnard Hazard Mitigation Planning Team decided to reserve in-depth discussion of hazards in the Plan to those hazards which could have an impact on a greater scale. Due to low probability of impact, small potential impact, and scarce community resources (time and money), the mitigation committee chose not to detail these hazards in this LHMP: tropical storms/hurricanes, tornado, structural fire, hazardous materials spills, drought, earthquakes, wastewater contamination, landslides, infectious disease, erosion, high winds, hail, thunderstorms, and tsunami. For a detailed description of these hazards, the reader should review the Vermont State Hazard Mitigation Plan.

While dam failure ranked high, this was due to the failure of beaver dams and not to concerns over conventional dam failure. As such, the Team decided to group flooding and fluvial erosion, and beaver dam failure together. The Team also chose to group extreme cold, snowstorm and ice because of the similarities they pose in exhibited weather, the risk they pose to health and property in vulnerable areas in Town, and the similar strategies that are effective in mitigating the loss of health or property in the event of their occurrence.

After engaging in discussions using their best available knowledge, the Town of Barnard identified the following "top hazards" (based on frequency of occurrence and potential impact and the need for future analysis) that they believe their community is most vulnerable to:

- Flash Flood/Flood/Fluvial Erosion and Beaver Dam Failure
- Extreme Heat
- Extreme Cold/Snow/Ice Storm
- Wildfire
- Invasive Species

Each of these "top hazards" will be discussed in the following sections. Within each section, previous occurrences of each hazard will be listed, including the County-wide FEMA Disaster Declarations (DR-#), where applicable. Hazards information was gathered from local sources (ex., town history book), the National Climatic Data Center's (NCDC's) Storm Events Database), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2012, and Special Reports produced by the National Weather Service in Burlington, Vermont. Most federal information regarding past hazard events is available only at the county level. As such, information specific to Windsor County was used to evaluate the type, frequency, and relative impact of past events within the larger region. Where information specific to Barnard was available, it has been incorporated as well. This section also includes a description of each "top hazard" and a hazard matrix that will also include the following information (please see each hazard profile for a hazard-specific matrix):

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

B. Hazard Profiles for "Top Hazards"

1. Flash Flood/Flood/Fluvial Erosion and Beaver Dam Failure

The most frequent form of flooding in the State of Vermont and the Town of Barnard is riverine flooding, or overbank flooding, which occurs to rivers when they receive more rain or snowmelt from their watershed than they typically experience. Flooding causes the inundation of land that is normally dry. Overbank flooding is experienced more frequently in mountainous and hilly areas where water moves with higher velocities. Flash floods occur when severe storms drop high amounts of rainfall in short periods of time. Flash floods occur more frequently in areas with steep slopes and narrow stream

valleys. Riverine erosion is the gradual wearing away of land masses by rivers and streams. River channels are constantly changing. As rivers flow and water moves downstream, water exerts energy upon riverbanks and causes erosion.

Beaver dam failure has been included within this top hazard, since beaver dams often fail as a result of high water flow and flooding, leading to greater flooding and damage further downstream. Several significant beaver dam failures have occurred in recent history. As a result of hurricane Irene, the Nye Swamp beaver dam failed, releasing an estimated 44 million gallons of water in less than one hour. A more recent event occurred in May, 2022, when a beaver dam broke on Bowman Road, causing road damage in several places. Yet another substantial beaver dam is located at the base of Gulf Road, and is a potential hazard for Route 12.

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

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

The worst flood disaster to hit the Town of Barnard, as well as the overarching region and the State of Vermont, occurred on November 3, 1927. This event was caused by up to 10 inches of heavy rain from the remnants of a tropical storm that fell on frozen ground. Eighty-four Vermonters, including the Lieutenant Governor, were killed. The flooding in the White River valley was particularly violent, with an estimated 120,000 to 140,000 cubic feet/second (cfs) flowing out of the White River at West Hartford, Vermont. Like many towns in the region, the Town of Barnard received heavy precipitation, seeing roughly 7-8 inches of rainfall over the storm period.

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

Culvert Washout during Hurricane Irene, Lower Lime Pond Road. Photo courtesy of Gina Lancaster.

be the second greatest natural disaster in 20th and 21st century Vermont, second only to the Flood of 1927.

The Town of Barnard suffered major damage to property and infrastructure during Tropical Storm Irene, although no lives were lost. It is estimated that Tropical Storm Irene dropped 5-6 inches of rain over the Town of Barnard in a very short span of time, some of the highest precipitation totals in Windsor County (which averaged 4-7 inches over its land area). It is thought that the flooding that occurred as a result of the storm was close to being or was a full-fledged 500-year flood.

Many of Barnard's roads were damaged by the storm, including parts of: Route 12, Chateauguay Road, Green Gate Road, and Broad Brook Road. The county-wide damage for Windsor County totaled over $32.5 million. Following the flood damage, the State of Vermont and FEMA have been coordinating on the home buy-out process across the state. The Town of Barnard was spared any losses that warranted consideration as part of the FEMA buy-outs.

Bridge collapse on Route 12 North during Irene. Photo courtesy of Gina Lancaster.

The most recent significant flooding event occurred in April, 2019. The flooding was widespread and severe enough for a Federal Disaster Declaration DR-4445 to be issued for Windsor and other counties in Vermont. The flooding was caused by heavy rainfall and primarily impacted roads and bridges throughout the state. Damages for Barnard were estimated at over $100,000.

Unfortunately, flooding is very common across the region, with many events impacting the Town of Barnard specifically. The following list indicates the history of occurrence with regard to this hazard in Windsor County (given the small population of Barnard, town-specific data is limited); an asterisk "*" denotes the few instances in which town-specific data is available, and federal disaster numbers are listed where appropriate. No detailed extent data was available for fluvial erosion damage in Barnard in terms of numbers of acres lost or amount of fill that that was used to compensate for fluvial erosion after flooding during each event.

History of Occurrences:

Date	Event	Location	Extent and Impacts
04/15/2019 (DR-4445)*	Flood	County-wide	Barnard experienced $103,611.3 in damages according to FEMA's Public Assistance database. County-wide damages were estimated at $2,669,837. The Ottauquechee River reached its peak streamflow at 65 CFS and a height of 12 feet. 1.97" of precipitation was recorded for April 15th for the region.

Date	Event	Location	Extent and Impacts
07/01/2017 (DR-4330)	Severe storms, flash flooding, fluvial erosion	County-wide	Severe storms caused heavy rain to fall on pre-saturated soils throughout the county. Heavy localized rainfall caused flash flooding which damaged some roads and residences, Heavy winds caused down trees. Windsor County experienced nearly $4 million in damage according to FEMA's Public Assistance database. The White River reached its peak streamflow for 2017 on 07/02/17, reaching 20,900 CFS and a height of 13.91 feet. 2.88" of precipitation was recorded July 2nd for the region.
06/25-07/11/2013 (DR-4140)	Severe Storms, Flooding, and Fluvial Erosion	County-wide	Severe storms caused flooding and fluvial erosion throughout the region, causing damage to some infrastructure and facilities. Barnard experienced $45,228.45 in damages according to FEMA's Public Assistance database (captures at least 70% of total damage). 7 inches of rain fell in Barnard during the disaster period. Over the disaster period 149 total Green Mountain Power customers were affected, and most outages were less than four hours in duration.
08/28/2011 (DR-4022, TS Irene)*	Tropical Storm: Flooding and Fluvial Erosion	Barnard, County-wide	Widespread flooding hit the region, striking Barnard particularly badly. Homes, businesses, and roads were flooded throughout Windsor County. Fluvial erosion occurred throughout Town, as many streams experienced high volumes of water. Barnard saw 5-7" of rainfall, which damaged homes, roads, bridges, and culverts. $1,855,451.73 in total damages occurred in Barnard according to FEMA's Public Assistance database (captures at least 70% of total damage). 200 power customers were affected, and outages lasted from 9 hours to 2 days.
04/27/2011	Flood	County-wide	Heavy rains, snowmelt from an above-normal snowpack, and high temps caused significant flooding in the region. Barnard received 1 inch of rain in 24 hours. Specific outage data for this event was unavailable.
10/01/2010	Flood	County-wide	Heavy rains from the remnants of TS Nicole hit Vermont, dumping multiple inches of rain in the White River Valley, and washing out local roads. Barnard experienced 5 inches of rain in 48 hours. 19 power customers lost power for 3.25 hours.
07/21-08/12/2008 (DR-1790)	Flooding and Fluvial Erosion	County-wide	Showers and thunderstorms produced significant rainfall across the region, causing severe flash flooding and fluvial erosion in places. Flood waters originating in Addison County traveled down the White River. Barnard experienced $15,335 in damages according to FEMA's Public Assistance database (captures at least 70% of total damage). Barnard experienced nearly 7 inches of rain during the disaster period. Significant power outages occurred in Barnard. Over the disaster period, 2,159 customers lost power, however most outages lasted less than 2 hours.
06/27/2008	Flash Flood and Fluvial Erosion	County-wide	Heavy rains brought 3-6" of accumulation to northern portions of Windsor County, and caused extensive flooding and fluvial erosion along the White River and its branches. Massive road damage and washouts were reported in nearby towns of Bethel and Rochester. $1m in county-wide damage was reported. 150 power customers lost power for 2.5 hours.
07/11/2007 (DR 1715 VT)	Flash Flooding and Fluvial Erosion	County-wide	Localized heavy rainfall exceeded 3 inches within a two hour time frame. Some localized storm totals approached 6 inches across very hilly or mountainous terrain, which resulted in flash flooding and fluvial erosion of several communities. 6 power customers in Barnard lost power for 4.6 hours.
04/15-04/21/2007 (DR-1698)	Severe Storms,	County-wide	Severe storms caused flooding and fluvial erosion throughout the region, causing damage to some infrastructure and facilities. Barnard received a period of heavy rainfall, with 1.14 inches falling in 24 hours. 231

Date	Event	Location	Extent and Impacts
	Flooding, and Fluvial Erosion		customers lost power for 4.6 hours, 300 customers lost power for 3.5 hours, and 83 customers lost power for 18.27 hours.
05/14/2006	Flooding and Fluvial Erosion	County-wide	Rainfall totals from a large storm system brought 3-6" of precipitation to the county, leading to flooding, fluvial erosion, and minor washouts on several roads in the region and overflowing banks of streams and rivers. A total of $25k in county-wide damages was reported. Barnard experienced 3.78 inches in 72 hours, with 2.1 inches falling in a 24 hour timeframe. Significant power outages did not occur in Barnard.
01/18/2006	Flood	County-wide	A powerful storm and rising temperatures led to rainfall of 1.5-2.5" and additional snowmelt. This led to field flooding and ponding of water on area roadways in the region. $3k in damages reported for Windsor County. 1.5 inches of rain fell in Barnard in 24 hours. Only one customers lost power for 8 hours during this event.
10/07-10/09/2005	Flooding and Fluvial Erosion	County-wide	Heavy rains resulted in minor flooding throughout Windsor County, and caused $20k in property damage. 4.86 inches of rain fell in 48 hours in Barnard. 6 power customers lost power for 1 to 3 hours.
10/29/2003	Flood	County-wide	Heavy rains fell on already-heavily saturated soils, and streams and rivers, including the White River, rose rapidly. Low land and field flooding occurred in the watershed. Fluvial erosion occurred along stream channels of the White River. 1.78 inches of rain fell in Barnard in 48 hours. Power outage data for this event was unavailable.
07/21-08/18/2003 (DR-1488)	Severe Storms, Flooding, and Fluvial Erosion	County-wide	Severe storms caused flooding and fluvial erosion throughout the region, causing damage to some infrastructure and facilities. Barnard experienced $10,217 in damages according to FEMA's Public Assistance database (captures at least 70% of total damage). Barnard experienced 1.9 inches of rain in 24 hours during the disaster period. Power outage data for this event was unavailable.
04/13-04/14/2002	Flood	County-wide	Snowmelt and 1-3" of rainfall across the region led to flooding along the White River and its branches in Windsor County. $50k in damages was reported throughout the county. Power outage data for this event was unavailable.
07/11/2001 (DR-1715)	Flash Flood and Fluvial Erosion	County-wide	Tropical-like showers and thunderstorms caused heavy localized flooding and fluvial erosion. Rainfall exceeded 3" within a 2 hour time frame, with some areas getting nearer to 6". Many roads washed out, basements were flooded, and homes were damaged or destroyed. Power outage data for this event was unavailable.
12/17/2000	Flash Flood and Fluvial Erosion	County-wide	Small streams overflowed their banks and some roads and low lands flooded. Some stream channels were eroded as a result of large volumes of water that flowed through streams in a short period of time. The storm event caused $5k in damage throughout Windsor County. Barnard experienced 1.93 inches of rainfall in 48 hours. Power outage data for this event was unavailable.
07/31/2000	Flash Flood and Fluvial Erosion	County-wide	Heavy rainfall cased many small rivers to reach or exceed bankfull throughout the county, which caused flooding and fluvial erosion in Barnard. $10k in damage reported. Barnard experienced 3 inches of rainfall in 48 hours. Power outage data for this event was unavailable.
07/14-07/18/2000 (DR-1336)	Flash Flood and Fluvial Erosion	County-wide	Slow-moving thunderstorms resulted in heavy rainfall, particularly across mountainous portions of the region. Flooding and fluvial erosion ensued, causing a reported $500k in damage across Windsor County. Barnard received nearly 4 inches of rainfall in 48 hours. Power outage data for this event was unavailable.

Date	Event	Location	Extent and Impacts
04/04/2000	Flash Flood	County-wide	Steady rains and melting mountain snows resulted in many streams and rivers rising to/above bankfull conditions. Flooding was reported in some areas, including nearby East Bethel (flooding closed Rt. 14) and Rochester (flooding, mudslides). $10k in damage reported across Windsor County. Barnard experienced 1.08 inches of rainfall in 24 hours. Power outage data for this event was unavailable.
03/28/2000	Flash Flood	County-wide	Steady rains and melting snows led to rising water levels in many rivers and streams in the county. Led to a reported $5k in damages county-wide. Barnard specifically experienced 1 inch of rain in 48 hours. Power outage data for this event was unavailable.
09/16-09/21/1999 (DR-1307)	Severe Storms and Flooding	County-wide	TS Floyd brought heavy rains, high winds, and flooding to the region, causing extensive damage to public property. Barnard experienced $4,355 in damages according to FEMA's Public Assistance database (captures at least 70% of total damage). Barnard experienced 5.5 inches of rainfall in 24 hours. Power outage data for this event was unavailable.
07/13/1996	Flood	County-wide	Remnants of Tropical Storm Bertha moved into the region, bringing heaving rainfall and fluvial erosion that caused road washouts and mudslides in the county. $10k in damage was reported county-wide. Specific rainfall and power data for this event was unavailable.
05/11-05/12/1996	Flood	County-wide	Rain and snowmelt led to many rivers swelling and minor field flooding in places. $5k in damage reported in the county. Specific rainfall and power outage data for this event was unavailable.
01/19-01/20/1996	Flood	County-wide	A deadly storm brought above normal temperatures, strong winds, and flooding to the region. Snowmelt and rainfall hit the region, washing out numerous roads and flooding other areas. Numerous power outages were reported. $900k in damage was reported for the county. Specific rainfall and power outage data for this event was unavailable.
06/28-06/30/1973 (DR-397)	Flooding	County-wide	As much as 6 inches of rainfall fell in 24 hours in some locations. 3 deaths occurred and damage totaled $64 million.
11/02-11/04/1927 ("Flood of 1927")	Flooding	County-wide	Considered to be one of VT's most devastating events, the flood took out 1285 bridges, miles of roads and railways, and countless homes and buildings. 84 people were killed, including Lt. Gov. S. Hollister Jackson. Barnard and the nearby vicinity saw 7-8" of rainfall during the storm, following a month with 150% the typical amount.

Barnard does not have standalone flood hazard regulations. However, the Town's Zoning Bylaws severely restrict development in flood-prone areas within the designated Flood Hazard Overlay District. The Flood Hazard Overlay District prohibits development and encroachments in the floodway and prohibits new development and fill in the special flood hazard area. Mapped special flood hazard areas in Barnard include the following streams and brooks: Locust Creek, Pond Brook, Barnard Brook, Gulf Stream, and Broad Brook.

There are an estimated 35 structures in Barnard that reside in the special flood hazard area based on e911 site location. 30 of these are characterized as residential (29 single family dwellings and 1 mobile home), and 4 are characterized as camp sites. There are no commercial/industrial/public structures or critical facilities in the 500-year floodplain. Two of these structures have Flood Insurance Policies in the

SFHA. If all of the residential properties were damaged/destroyed in a severe flooding event, the damage would equal $10,237,148. The flooding that occurred as a result of Tropical Storm Irene is considered to be greater than a 100-year flood event, and likely closer to a 500-year flood event.

Additionally, there are 22 structures that reside within the River Corridor area, which was mapped by the Vermont Agency of Natural Resources. The River Corridors accurately represent the area where rivers and streams will move over time, and depict areas that are at risk of erosion due to the river or stream's lateral movement. Mapped river corridor areas in Barnard are similar to the mapped special flood hazard areas within the Town. Mapped River Corridor areas include Locust Creek, Pond Brook, Barnard Brook, Gulf Stream and Broad Brook. The locations of these brooks and streams, river corridor areas, special flood hazard areas, and vulnerable structures located within these frequently flooded areas are illustrated in Attachment A: Map of Barnard.

It is important to consider the exposure of vulnerable populations, especially children, the elderly, and low income households, to flood risk. Across Vermont, most child and elder care facilities are not registered with the State. Most child day care is private in-home care in Barnard, but there are also two licensed childcare facilities, both are located at Barnard Elementary and are not within the river corridor or the 100-year floodplain. There are no elder care facilities in the Town of Barnard. Finally, low income housing is not registered with the State, but the state does maintain a list of mobile home parks; there are no mobile home parks located in Barnard.

Recent studies have shown that the majority of flooding in Vermont occurs along upland streams, as well as along road drainage systems that fail to convey the amount of water they are receiving. These areas are often not recognized as being flood prone, and property owners in these areas are not typically required to have flood insurance (DHCA, 1998). It should be noted that, while small, mountainous streams may not be mapped by FEMA in NFIP FIRMs (Flood Insurance Rate Maps), flooding along these streams is possible, and should be expected and planned for. Flash flooding in these reaches can be extremely erosive, causing damage to road infrastructure and to topographic features including stream beds and the sides of hills and mountains. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountainside undercutting. Furthermore, precipitation trend analysis suggests that intense, local storms are occurring more frequently. Barnard will experience high intensity rain events in the future based on these trends. Due to Barnard's topography of steep slopes and narrow river valleys, fluvial erosion also has a high probability of future occurrence.

Town compliance with NFIP is enforced by the Zoning Administrator and the Development Review Board, as outlined in Barnard's Flood Hazard Overlay regulations and Zoning Bylaw. A permit is required for all construction and development in special flood hazard areas. Certain activities within the special flood hazard area, such as building utilities and recreational vehicles may be approved administratively by the Zoning Administrator. Conditional uses and activities in the flood hazard area require approval from the Development Review Board, such as grading, on-site septic, and fill to elevate existing structures.

Barnard maintains an up-to-date list of culverts and culvert condition. The Town last updated its culvert inventory in 2015, and conducting a new inventory is a priority for the Town. No development projects are planned in Barnard in areas that would be vulnerable to flooding. There are no repetitive loss properties in the Town of Barnard on FEMA's NFIP list. No detailed data was available for fluvial erosion damage in Barnard in terms of numbers of acres lost during each event.

Beaver Dam Failure

One result of flooding with a high likelihood of occurrence in Barnard is the failure of beaver dams. Within the past several years, beaver dams have failed, causing road washouts and damage to public and private property, and have isolated residents. Failed beaver dams can damage culverts, put human life at risk, and cause significant flooding in a short period of time. There is no statewide dataset that tracks beaver dam failure, and the extent and impact of this hazard is difficult if not impossible to quantify given the hyperlocal and sporadic occurrence. Estimates of damage and impact often must come from local officials. The most recent occurrence took place in June of 2022 on Bowman Road. Damages to the road was the primary result of the flooding.

Beaver Baffle installed in Barnard (2017), Photo from VT ANR Natural Resources Atlas

The Vermont Fish and Wildlife Department operates a Beaver Wetlands Conservation Project, also known as the Beaver Baffle Program. This program assists landowners, municipalities, and road crews in safely managing beaver dams to prevent failure as well as to preserve the valuable wetland habitat that beavers help to create. For dams at risk of failure, beaver baffles can be installed that will lower the water level behind the dam, and reduce the risk of flooding during high rain events. The Vermont ANR Atlas records properties in Barnard that have received site evaluations and device installations as a result of beaver dam conflicts. Currently, two sites have received evaluations, and a beaver baffle has been installed at one site.

The following occurrences of beaver dam failure were reported by the Committee or obtained from local sources.

History of Occurrences:

Date	Event	Location	Extent and Impacts
May, 2022	Beaver Dam Failure	Bowman Road, Barnard	General washout of the road. Damage extent and impacts estimates not available.
2012	Beaver Dam failure	Bennett Road, Barnard	Primary damage to culverts and roads. Caused minor flooding and washouts. No other damage extent and impacts estimates available.
08/28/11	Nye Swamp beaver dam Failure	Nye Swamp, Barnard	The Nye Swamp beaver dam broke, releasing an estimated 44 million gallons of water in less than one hour. Damage extent and impacts estimates not available.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/ Probability
Flooding and fluvial erosion	Many of Barnard's roads are vulnerable to erosional flooding due to steep terrain. Some of the most vulnerable for fluvial erosion or flooding include: Chateauguay Road and its proximity to Locust Creek; Route 12; Smith Hill Road; Broad Brook Road and East Barnard Road in East Barnard due to their proximity Broad Brook and East Barnard Brook; and Lime Pond Road.	Culverts, bridges, road infrastructure. There are 30 residential (29 single family dwellings and 1 mobile home) in the 500-year floodplain, valued cumulatively at $10,237,148. Homes and infrastructure along creeks are at risk of damage from beaver dam failure.	Tropical Storm Irene- 4-7" across county (5-7" in Barnard). No detailed data was available for fluvial erosion damage in Barnard in terms of numbers of acres lost during each event.	From TS Irene: $1,855,451.45 for Barnard from FEMA's Public Assistance database (captures at least 70% of total damage).	Highly Likely

2. Extreme Heat

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

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

- **Excessive Heat Warning**: Daytime heat indices[2] equal to or greater than 105°F for two or more hours
- **Heat Advisory**: Daytime heat indices between 95°F and 104°F for two or more hours.
- **Heat Wave**: Three or more days of temperatures equal to or higher than 90°F

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

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

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

The following list indicates the history of heat events reported for Windsor County in the National Weather Service Database. Barnard does not have a weather station. Therefore, data from the nearby Woodstock weather station was used, given the close proximity of Woodstock to Barnard.

History of Occurrences:

Date	Event	Location	Extent and Impacts
6/19/2020-6/25/2020	Heat Event	Windsor County	Heat indices in Woodstock Vermont ranged from 90-93°F between June 19th and June 25th. No available data on the size of the land area that was impacted.
6/30/2018 – 7/6/2018	Heat event	Windsor County	Heat indices ranged from 95 to 110°F across Vermont. Maximum temperatures reported at Woodstock Vermont ranged from 87°F to 97°F between July 1st and 6th. No available data on the size of the land area that was impacted.

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

3/17/2012 – 3/24/2012	Heat event	Windsor County	Maximum temperatures reported at Woodstock Vermont ranged from 81°F to 83°F from March 21st to the 23rd. March 2012 marked the warmest March month on record for Burlington Vermont. No available data on the size of the land area that was impacted. This event broke record temperatures and cut short the sugaring season.
7/21/2011 – 7/24/2011	Heat event	Windsor County	Heat indices ranged from 89 to 96°F in Woodstock Vermont between July 21st and July 24th. No available data on the size of the land area that was impacted.
8/12/2002 – 8/16/2002	Heat event	Windsor County	From August 12th – 16th high temperatures ranged from 92° - 97°F. No available data on the size of the land area that was impacted.

Town-specific data is not available for the health impacts of heat events. Limited county-level data are reported by the Vermont Department of Health. The following heat-related emergency department visits (per 10,000 population) were reported in Windsor County between 2015 and 2019: 7 in 2015, 10 in 2016, and 12 in 2018. This represents the minimum number of emergencies during that time period, as years with fewer than 6 visits were not reported in order to protect patient confidentiality. The Fire Department keeps a list of vulnerable residents to check in on in case of emergency, these include elderly residents and those at-risk for serious illness. Barnard is a tight-knit community, and residents will often check-in with their neighbors informally during or following hazard events. Barnard Helping Hands, a community-based nonprofit, also assist residents in need.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/ Probability
Extreme Heat	Extreme heat is often not localized, and is felt town,region, and statewide.	The valleys within town are most at-risk to extreme heat. South-facing slopes. Elderly, infants and children, p and those with health-risk are also vulnerable.	The highest maximum temperature recorded in Woodstock was 104°F (1916). Above 90°F temperature have been recorded for up to 7 consecutive days (2020).	Heat events can damage infrastructure, endanger or kill people, and can cause severe crop damage. 29 Windsor County residents visited the Emergency Room due to heat-related illness between 2015 and 2019.	Likely

3. Extreme Cold/Snow/Ice Storm

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Extreme Cold/Snow/Ice Storm**.

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

Extent and impact data specific to Barnard, including most snow accumulation per event, lowest record temperature, was not readily available, therefore most information is derived from county-wide statistics and data collected from the National Centers for Environmental Information (NCEI). Based on reported events, Windsor County averages between 8 and 10 winter storms per year, with 245 winter hazard events occurring in Windsor County since 2000. The majority of these events were winter storms (43%) and winter weather (34%). There has been only one winter storm in recent history, however, that resulted in a major disaster declaration – the Ice Storm of 1998 – which affected much of Vermont, including Barnard.

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

One of the most damaging winter storms of recent memory took place on February 23, 2010, and caused over an estimated $1 million in damages in Windsor County alone. Classified as a blizzard, the storm dropped 26” of snow in some parts of Windsor County. Around 50,000 customers were left without power throughout Vermont. The worst winter storm in terms of damage to hit the state recently was not a snow storm, but an ice storm. In January of 1998, just the right combination of precipitation and temperature led to more than three inches of ice in spots, closing roads, downing power lines, and snapping thousands of trees. This storm was estimated as a 200-500 year event, meaning it has a .5%-.2% chance of occurring every year. Power was out up to 10 days in some areas, and 700,000 acres in of forest were damaged in Vermont. Amazingly, Vermont suffered no fatalities, unlike Quebec where 3 million people lost power and 28 were killed. The Town of Barnard was significantly impacted by this ice storm.

Over the past few winters, Barnard has received numerous snow storms that have dropped significant amounts of snow over a one- or two-day period. The following table documents the occurrence of extreme cold/snow/ice storms in the Town of Barnard and in Windsor County.

History of Occurrences

***Impact is for the county unless otherwise specified**

Date	Event	Location	Extent and Impacts
02/03/2022-02/04/2022	Winter storm	County-; region-wide	An arctic front moved across Vermont on the morning of February 3rd, bringing light rain that changed to snow. The front continued in the region through February 4th, with heavy snow, freezing rain, and sleet falling throughout the region. Total snowfalls ranged from 6-12 inches, with some areas seeing ice and power outages. Property damage is estimated at $50,000 for Windsor County.
12/18/2021-12/19/2021	Winter storm	County-; region-wide	A weak low pressure system brought 5-8 inches of snowfall across the state. 9" was reported in Woodstock. Property damages for Windsor County were estimated at $10,000.
1/16/2021	Winter storm	County-; region-wide	A winter storm brought rain and wet snow to many areas of Vermont. Snow accumulation ranged from 3-18 inches. The wet snow caused power outages and left 30,000 customers without electricity.
03/23/2020-03/24/2020	Winter storm	County-; region-wide	A winter storm system moved into Vermont from the Midwest, bringing 7-10 inches of snow and isolated power outages. $5,000 estimated in damages for Windsor County.
12/16/2020-12/17/2020	Winter Storm	County-; region-wide	A Nor'easter moved up the Atlantic Coast and through Southern Vermont. Snowfall rates ranged from 2-4+ inches per hour. Snowfall ranged from 20-40 inches in much of Windsor County. There were $70,000 in estimated damages throughout the region.
01/20/2019	Winter Storm/Extreme Cold	County-; region-wide	A long-lived winter storm system moved into the northeast from the western US, bringing heavy snow in accumulations of 8"-16", with 15" falling in nearby Woodstock. The region also experienced extremely cold temperatures Saturday through Monday, with overnight lows at 10-20 below zero. Estimated damages for the region were $240,000.
02/07/2018	Winter storm	County-; region-wide	Low pressure systems moved across central and southern Vermont, bringing light snowfall. Accumulations for Windsor County ranged from 5-10 inches. No known damages.
03/14/2017-03/15/2017	Winter storm	County-; region-wide	A nor'easter moved up the Atlantic coast, bringing heavy snowfalls, 4-5 inches per hour in some places, as well as blizzard conditions. Snowfall across Vermont ranged from 12"-36". Windsor County snowfall ranged from 12"-24". Many schools, businesses, and offices were closed as a result of this storm. 23" of snow was reported in nearby Pomfret.
12/29/2016	Winter Storm	County-; region-wide	A weak low-pressure system brought heavy snowfall across eastern Vermont throughout the day and intensified into the night. Snow accumulations ranged from 8"-12".
2/7/2015-2/8/2015	Winter Storm	County-; region-wide	A long duration winter storm resulted in a large snow event over Vermont and Northern New York. Snowfall accumulations were from 5 to 9 inches across Vermont, with 7.5 inches accumulating

Date	Event	Location	Extent and Impacts
			in Barnard. 26 power customers in Barnard were without power for .5 hours.
1/7/2015-1/8/2015	Extreme cold/wind chill	County-; region-wide	An arctic cold front pushed over Vermont and brought extremely cold temperatures and strong winds of 15-30 mph causing dangerously cold wind chills of 25-40 degrees below zero overnight.
Period from 12/09/2014—12/12/2014 (DR-4207 VT)	Winter Storm	Barnard; County-; region-wide	Heavy, wet snow brought down trees and power lines, leading to power outages. Barnard experienced 9 inches of snow accumulation that caused an estimated $30,000 in debris clean-up costs. Snow accumulations in Barnard totaled 11.1 inches. Widespread power outages occurred in Barnard that affected 1,059 total power customers. 407 customers lost power for 6 hours, 210 customers lost power for 13 hours, but the larger portion of those affected lost power for more than 50 hours.
Period from 03/12/2014—03/13/2014	Snow Storm	Barnard; County-; region-wide	A major snowstorm with near blizzard conditions at times impacted portions of northern New York on March 12th and lingered into the morning hours of March 13th. Numerous motor vehicle accidents and school and business closures resulted due to the storm on both March 12th and 13th. 22" of snow accumulated in Barnard. No significant power outages occurred in Barnard.
Period from 02/13/2014—02/14/2014	Winter Storm	County-; region-wide	A Winter storm, responsible for record ice and snow across the southeast United States on February 12th, moved and redeveloped off the southeast United states coastline on February 13th. Snowfall across Windsor county was 12 to 20+ inches. No significant power outage occurred in Barnard.
02/05/2014	Snow Storm	County-; region-wide	Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel. 8 to 12 inches of snow fell across Windsor county. No significant power outage occurred in Barnard.
Period from 12/29/2013—12/30/2013	Winter Storm	County-; region-wide	A wet, heavy 6 to 10 inches of snow fell across Windsor county. No significant power outages occurred in Barnard.
Period from 12/14/2013—12/15/2013	Snow Storm	County-; region-wide	As this was the first storm of the 2013-2014 winter season, it resulted in numerous vehicle accidents. A widespread 10 to 15 inches of snow fell across Windsor county. No significant power outages occurred in Barnard.
Period from 03/18/2013—03/19/2013	Snow Storm	County-; region-wide	8 to 14 inches of snow fell across the county, with smaller amounts falling in the valleys and larger amounts accumulating above 1000 feet. Numerous vehicle accidents occurred, some involving tractor trailers. No significant power outages occurred in Barnard.
Period from 12/26/2012—12/27/2012	Winter Storm	County-; region-wide	Snowfall totals of 6 to 12 inches were common in Windsor county. No significant power outages occurred in Barnard.
Period from 04/28/2012—04/30/2012	Frost/ Freeze	County-; region-wide	Several consecutive days of sub-freezing temperatures from the morning of April 28th to the morning of April 30th lead to damaging and possibly devastating killing freezes for various fruit-bearing crops in Vermont. Although these temperatures may not be seasonably uncommon, the preceding record breaking late winter and early spring warmth accelerated bud development in fruit crops by 2-3 weeks.

Date	Event	Location	Extent and Impacts
			However, minimum temperatures in the teens and lower 20s likely impacted other regions as well. Fruit crop damage estimates may exceed 25 percent of normal harvest. No significant power outages occurred in Barnard.
Period from 11/22/2011—11/23/2011	Winter Storm	County-; region-wide	6 to 12 inches of a heavy, wet snow mixed with rain and sleet at times fell across Windsor county. 2 power customers were affected for about 4 hours.
Period from 03/06/2011—03/07/2011	Winter Storm	Barnard; County-; region-wide	Snowfall amounts of 4 to 16 inches were reported in Windsor county with the largest totals in the northwest and lesser amounts in the southeast. In addition 1/4 to 1/2 inch of ice occurred as well with the greatest totals in the southeast. 12" accumulated in Barnard. 9 power customers in Barnard were affected for 2.75 hours.
Period from 02/05/2011—02/06/2011	Winter Weather	County-; region-wide	A heavy wet snow quickly changed to a prolonged period of sleet and freezing rain as well as some thunderstorms. Combined snow and sleet accumulations were 3 to 6 inches. The weight of this additional snow, sleet and freezing rain contributed to several roof barn collapses in Windsor County. No significant power outages occurred in Barnard.
2/19/2011	Extreme Cold/Strong wind	County-; region-wide	A strong cold front moved across Vermont causing strong winds of 20-30 mph. Winds resulted in tree damage and widespread power outages. 1,619 power customers lost power in Barnard for 2.5 hours.
01/12/2011	Winter Storm	Barnard; County-; region-wide	Generally, 8 to 15 inches of snow fell across Windsor county. 11" accumulated in Barnard. No significant power outages occurred in Barnard.
Period from 12/26/2010—12/27/2010	Winter Storm	County-; region-wide	Snowfall totals of 6 to 15 inches with localized higher amounts occurred as well as considerable blowing and drifting of the snow due to north winds of 15 to 25 mph with gusts approaching 40 mph. No significant power outages occurred in Barnard.
Period from 12/28/2009—12/29/2009	Winter Weather	County-; region-wide	Rapidly falling single digit temperatures along with falling and blowing snow on the morning of December 29th caused roads to flash freeze. Numerous vehicle accidents occurred, especially along Interstate 89 between Montpelier and St. Albans. No significant power outages occurred in Barnard.
Period from 02/08/2008—02/09/2008	Winter Storm	County-; region-wide	This snowfall event was a two-part system across Vermont. The first part was largely confined to the northern half of Vermont and occurred during the morning and afternoon hours of February 8th. The second event was a large, powerful Nor'easter that moved south of Long Island and Cape Cod during the night of February 8th. 8 to 16 inches of snow fell across Windsor county. No significant power outages occurred in Barnard.

The Town of Barnard is no stranger to winter weather and the hazards that it brings. While information specific to Barnard is limited when undertaking a detailed analysis of risk, estimates of financial impact at the county level can provide some guidance. Since 2000, winter storms result in roughly $198,000 per year in damages, and roughly $17,000 in damages per event (NOAA). Depending on the event, the amount and weight of snow, or the amount of ice, electricity may be knocked out for a few hours or

days. The utility company currently serving the Town of Barnard, Green Mountain Power, has followed a regular tree-trimming schedule. Barnard town officials believe this is satisfactory to mitigate damage and the power outages caused by downed trees and tree limbs during a heavy, wet snow or ice event. In the event of an extended power outage, the Town will work with the school district to open its emergency shelter at the Barnard Academy. Many residents have prepared for power outages by purchasing generators or installing wood stoves. Portable generators have also been used to assist multiple households during storm events.

Winter weather hazards such as snow storms, ice, sleet, extreme cold and freezing rain have broad impacts, and the entire town is vulnerable. Heavy, wet snow or large quantities of snow may leave structures vulnerable to roof collapse, especially flat roof structures; ice can make roads hazardous for travelers; and utilities, bridges, and highways may be damaged by ice or heavy snow. Damage to utilities from heavy snow, high wind, or ice may cause power outages, which can put residents at risk to extreme winter temperatures. The most remote roads and areas of town will be most at risk, as they will be the most difficult to access in the event of extreme weather, though all residents are vulnerable to extreme cold in the case of a power outage. The extent of each hazard event is highly variable, often ranging from several inches to several feet of snow. Other variables include icy roads, freezing temperatures, and poor visibility. Travel in Barnard is complicated by mountainous terrain and steep slopes, which can result in hazardous conditions for travelers, especially along Class III and Class IV roads. The Town relies on Travel Advisories issued by the State of Vermont Department of Emergency Management Homeland Security and the National Weather Service to alert residents of dangerous travel weather.

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood / Probability
Extreme Cold/ Snow/ Ice Storm	Town wide, particularly along roads where heavy snow/ice can endanger travelers and cause downed trees and power lines.	The entire Town is vulnerable, including road infrastructure, town and privately owned buildings, and utility infrastructure.	Snow fall has varied, from a few inches to over a foot or more. Heavy snow and wind down trees and power lines. Snow/ice contribute to hazardous driving conditions.	From the December 2014 storm (DR-4207 VT), an estimated $30,000 in damages, mostly from debris clean-up costs.	Highly likely

4. Wildfire

A fire may be sparked by natural or human activities. Lightning is one of two main natural causes of wildfire. However, across the United States, approximately 90 percent of wildfires are started by humans. According to FEMA, there are three types of wildfires that can consume natural landscapes and man-made structures and features: surface fire, ground fire and crown fire. Surface fires are slow moving across the forest floor, and, as a result, kill and damage trees. Ground fires are usually caused by lightning strikes, and they burn on or below the forest floor. Crown fires, so called for their location in the crown of trees, effortlessly spread through treetops, often aided by wind.

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

The Vermont landscape is especially vulnerable to wildfire during early spring when all the snow has melted, vegetation has not begun to develop leaves, and the land and vegetation are very dry, dead, or dormant. Roughly ninety percent of the Town of Barnard is a primarily forested and hilly Town, and includes a portion of the Chateauguay No Town Conservation Area, which is comprised of approximately 55,000 acres across four towns. Because the vast majority of the Town is forest, the Town is considerably vulnerable to the impacts of wildfires, were they to occur within Town bounds. Wildfires in the town have typically been the result of natural events (e.g., lightning strikes), human error and accidents, and downed power lines sparking brush fires.

The following occurrences were reported by the LHM Planning Team that occurred in or near to the Town.

History of Occurrences:

Date	Event	Location	Extent and Impacts
06/06/22*	Brush fire	Barnard	Brush fire with a downed power line. No other extent or damage data available.
05/21/21	Killington fire	Killington	A wildfire near River Road in Killington burned approximately 26 acres on steep terrain. The fire was started by residents clearing debris.
05/24/21*	Brush fire	S. Pomfret	No damage extent or impact data available.
05/26/18*	Brush fire	Barnard	No damage extent or impact data available.
05/01/18*	Brush fire	North Pomfret	No damage extent or impact data available.
06/20/16*	Brush fire	Ellis Farm	Power line down. Fire burned for 3 hours. No other damage or extent impact data available.
04/23/16*	Burn pile fire	Barnard	No damage extent or impact data available.
04/14/16*	Brush fire	Barnard	No damage extent or impact data available.
05/15/15*	Brush fire	Sharon	No damage extent or impact data available.
05/09/08	Brush fire	S. Royalton	No damage extent or impact data available.
04/26/2008	Structure and brush fire	Barnard	No damage extent or impact data available.
Approx. 2009	Royalton Turnpike and Johnson Hill Road	Royalton	Extent and damage estimates not available.

Approx. 2005	North Road Fire	North Road, Barnard	Extent and damage estimates not available.
April, 1994	Lime Pond Road	Barnard, Lime Pond	Approximately 90 acres of low brush understory burn. Extent and damage estimates not available.

*Data obtained from Broad Brook Fire Department Fire Call Logs

One ongoing concern of the Hazard Mitigation Planning Team is the lack of an adequate water source on old Mt Hunger Road. Much of the road is located at a higher elevation (1600'), and the area itself is dry with few conveniently located water sources. A fire in this section of Town would prove challenging for emergency responders given the reduced accessibility and lack of access to nearby water sources.

As noted, recognized fire protection problems for the community include the following: development in areas distant from the village center of the Town, development on class 3 and 4 roads, distance from water sources (rivers, hydrants and/or fire ponds), inaccessibility to fires that may spread from the forest.

Hazard	Location	Vulnerability	Extent	Estimated/ Potential Impact	Likelihood/ Probability
Wildfire	Town-wide	Private property and dwellings, town buildings, utility infrastructure, forests	Depends on the location and severity of the fire. Wildfires could burn a small area or encompass a large area in town, including homes and infrastructure.	Varies depending on the location and extent of the fire. Killington fire burned 26 acres. No cost estimates for local fires were readily available.	Likely

5. Invasive Species

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

Infestations by invasive insect and plant species can ruin crops or forests. While most of Vermont does not have to deal with these occurrences, a historical invasion of "worms" occurred in 1770 in the Connecticut River valley. It seems that an untold number of "worms" originated near Lancaster, New Hampshire, beginning in late July of 1770, and streamed down the valley all through August. These "worms" were most likely the army worms (actually a type of caterpillar) that caused over $8 million dollars in damage to the 2001 hay crop, again largely along this valley. Forests are also threatened by such insects as the wooly adelgid (hemlock) and spotted beetle (maple and ash).

The State of Vermont divides invasive species into two camps: Class A and Class B. Class A species are those that are listed on the Federal Noxious Weed List but are not currently known to be present within the confines of Vermont (see 7 C.F.R. 360.200). Class B species, in contrast, are known to occur within state boundaries and are deemed a treat to residents and the environment.[3]

Up to date information on all Vermont invasive species can be found on VTINVASIVES.ORG.

[3] See the 2018 Vermont State Hazard Mitigation Plan

Invasive species do not, by their nature, have boundaries. This concept was clearly demonstrated during Tropical Storm Irene, when floodwaters uprooted Japanese knotweed plants along Vermont's waterways. Years later, the fight to eradicate the knotweed has become even more protracted as it spreads along streambanks and areas beyond, choking out native plant communities and destabilizing banks.

The presence of invasive species will likely only increase as a result of climate change. Warming global temperatures will likely result in the spread of the Emerald Ash Borer (EAB), which has decimated ash populations throughout much of the US. The Town of Barnard is located in the area of concern on the EAB map hosted by the Agency of Natural Resources. Invasive species can also affect Barnard's susceptibility to wildfire. Warming temperatures can increase stress on native tree species, reducing their defense mechanisms and making them more susceptible to attack from invasive pests. In turn, a higher tree mortality rate can lead to more woody debris on the forest floor, which can increase the likelihood of wildfire.

Invasive species are already present in Barnard, although the precise location and extent of proliferation and/or damage is not always easily defined, given that pockets of infestation are not always necessarily mapped or accounted for. For the purposes of this Plan, the LHM Planning Team has agreed to focus on the invasive species and infestation hazards that are terrestrial and aquatic plants or insect pests that Barnard is most concerned with. All invasive species provided on the list below are currently present in Barnard, and all are of high concern. Chervil and knotweed are present throughout town, while other invasive species are more localized. Milfoil is of significant concern given the threat it can pose to Silver Lake. Currently, the informational signage on invasive species at Silver Lake is faded and difficult to read, which could impact the lake's vulnerability to milfoil. More remote parts of town, such as the Chateauguay No-Town Area, seem to be less impacted by invasive species.

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Wild Chervil (*Anthriscus sylverstris)*	Yes	Wild chervil is most commonly found along roads, but will spread into fields and their shaded fringes. Seeds are easily spread by mowers and wind over great distances. The plant's sap can burn skin. The plant's white flowers bloom in May and June.	Treatment of this plant is easiest before it establishes a root system. Mowing the plants early prior to the plants going to seed can reduce their spread. Do not mow after June when the plant has seeded, and clean equipment after using to prevent spread. Eradication is difficult, and would likely require grazing, pulling, tilling, or native replanting. Successful herbicide treatments have not yet been determined.

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Eurasian Watermilfoil (*Myriophyllum spicatum)*	Yes	Eurasian watermilfoil is the most widespread aquatic invasive in Vermont, and is present in over 80 waterbodies throughout the state. Milfoil is aggressive, and reduce the diversity of native aquatic species. The presence of milfoil can degrade water quality and deplete dissolved oxygen levels.	Watermilfoil is best managed through prevention, as it is difficult to control or eradicate once established. Ensuring boats and equipment are cleaned, drained, and dried, prior to moving between waterbodies can reduce the spread. If already present, milfoil can be controlled using mechanical, physical, and chemical treatments.
Garlic mustard (*Alliaria petiolate*)	Yes	Garlic mustard is an edible weed that tends to grow along roadsides, particularly in the shade. It spreads when either seeds or plant pieces are sown into the ground.	Because of its methods of spreading, it is not advisable that garlic mustard be mowed. Rather, pulling the plant by hand is best practice. Glyphosate herbicide can also be used (although this may risk watershed contamination).
Wild parsnip (*Pastinaca sativa)*	Yes	Wild parsnip is a heavily toxic plant specimen that has photoreactive sap that causes severe burns to exposed skin. It does not tend to grow well in shaded areas, and also does not tend to grow in dense stands. The plant flowers in late spring to early summer.	Because of the plant's noxious properties, eradication can be a delicate process. Manual pulling should be done with thick gloves and long sleeves. Early mowing before the plant seeds in early July can reduce the spread. Mowing should be repeated once per year for three to five years. Gloyphosate chemical foliar low volume spraying can be used as a control in late summer (mid-July).
Giant Hogweed (*Heracleum mantegazziam)*	Yes	Giant hogweed is a noxious weed that has cropped up in some places in the region. Similar to wild parsnip in appearance, it is also a phototoxic plant, causing painful, scarring blisters. The plant flowers in late spring to early summer.	Removal of giant hogweed plants is the same as wild parsnip (see above). Extreme care must be taken with this plant, too, to avoid any contact with skin or risk injury.
Japanese Knotweed (*Polygonum cuspidatum)*	Yes	Japanese knotweed is one of the most widely spread invasive species in the region, most commonly cropping up along river edges in direct sunlight. The plant rhizomes root and spread easily, and are hard to eradicate once established. Ditch maintenance and traveling down waterways are two main ways the plant spreads. Its lacy white flowers bloom in August.	Repeated mowing or cutting, using loppers or a lawn mower once per month over the plant's growing season (spring through fall) may be the best way to eradicate knotweed plants. Eradication must continue every year for about five years. A drip technique chemical control, using glyphosate concentrate application on plant stems in August, can be combined with mechanical cutting. Pulled stems should be contained in bags to rot for one year. If bagging is not possible, then plants should be stockpiled and covered with a tarp for decomposition. Do not replant native plant species until knotweed has been fully eradicated.

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Goutweed *(Aegopodium podagraria)*	Yes	Goutweed invades fields, river edges, and floodplains. It proliferates quickly by means of underground rhizomes, and has established itself in villages throughout Windsor County. The plant's white flowers bloom in July.	New infestations should be treated quickly either before root systems become established or after leaf-out (late summer). Entire plants, including stems, roots, and rhizomes, should be removed and bagged at least a week before disposing in a landfill. Do not compost plant material because it will reseed. For large infestations, cover with a large plastic tarp and secure edges with sandbags. Glyphosate chemical control can also be used in foliar spraying after plants have leafed out.
Glossy and Common Buckthorn *(Frangula alnus) (Rhamnus cathartica)*	Yes	Buckthorn grows in two similar varieties, and can drastically change the composition of forested areas. Buckthorn has red berries, which are easily visible in fall and act as an innutritious laxative to animals. Buckthorn increases the nitrogen content in soil and has a longer growing season than native plants, which changes habitat suitability for native plant species.	Mechanical buckthorn control can consist of hand pulling small plants (including roots) or cutting stumps of larger, woodier plants at any time of the year. Glyphosate can also be applied to stumps within one hour. Larger plants may require a weed wrench. Plants may be burned after uprooting.
Purple Loosestrife (*Lythrum salicaria)*	Yes	Purple loosestrife proliferates in damp areas, like wet roadsides and swamp/wetland areas. It is a growing concern in fields and roadsides. Once established, it quickly spreads and squeezes out native plants, impacting wildlife habitat in the process.	Smaller infestations of purple loosestrife can be mowed or pulled by hand and burned or disposed of in a landfill. Removing flower heads prior to seeding can help prevent spread. Biocontrol (the use of natural enemies to control an infestation, such as beetles that do not pose harm to agriculture or other key species) has proven a success in many Vermont towns.
Hemlock Woolly Adelgid (HWA) (*Adelges tsugae)*	Yes	HWAs prey on deciduous eastern hemlock trees, and originate from southern Japan. Hemlocks desiccate, lose needles, and fail to generate new growth, severely weakening, if not outright killing, trees. Hemlocks are the 7th most prevalent tree in Vermont, and are critical for stream bank armoring and serving as a shelter and food source for wildlife.	HWAs have been confirmed in Windham, Bennington, and Windsor Counties (as of Feb. 2021, per the USDA).[4] The HWA egg sacs are found on branches and hatch in the spring, feeding on tree sap. Vigilance is needed to keep an eye on HWA spread, and insecticide treatments may help contain it.

[4] See http://na.fs.fed.us/fhp/hwa/maps/2012.pdf

Species	Present in Town and/or Village?*	Extent of Impact	Removal/Prevention Method
Asian Longhorned Beetle (ALB) (*Anoplophora glabripennis)*	Yes	Large stands of deciduous trees are target species of the beetle. These trees are especially critical to the health of our forests, slopes, carbon sequestration, and the local economy (e.g., sugar maples). According to the Forest Service, if ALBs became established across the U.S., they could kill a third of all urban trees at a compensatory cost of $669 billion and decimate the maple sugaring industry.[5]	The beetle has been identified in nearby states, namely Massachusetts (a large outbreak occurred in central Massachusetts in 2008) It has not yet been detected in Vermont at the time of this report. Vigilance for signs of presence around hardwood trees (sawdust at base of tree, oozing from bark) can alert their presence in the tree, and can prompt containment efforts. Uninfected host tree species may be treated with insecticide after the winter thaw in a quarantine area to prevent spread.
Emerald Ash Borer (EAB) (*Agrilus planipennis)*	Strong possibility it is present in town	Seven-percent of trees (around 150 million trees) in Vermont are ash, making virtually every community vulnerable to ash stand decline. Damaged trees can pose a hazard, particularly in close proximity to sidewalks, roadways, and private property. EABs generally infiltrate new host areas when they are transported in firewood and other wood products.	EAB colony establishment can take years to be visible on trees, but makes trees brittle and weak. Bare bark exposed by woodpeckers reveals intricate pathways created by the EAB. Infestations are located in all surrounding states and Quebec. Preventing the importation of firewood from outside of Vermont is one key tactic to stop the spread. Quarantine efforts have been met with mixed success, and biological and microbial control agents may prove effective containment methods.

Hazard	Location	Vulnerability	Extent	Estimated/ Potential Impact	Likelihood/ Probability
Invasive Species	Town-wide, although dependent on host plant for insect pests, or soils/available sunlight and water for plant infestation.	The entire Town is susceptible to invasive species proliferation, depending on the species and place-dependent characteristics that allow for growth and spread of problem species.	Throughout town. Less invasives in more remote areas of town. Invasive species are highly localized and each species extent varies throughout town. Chervil and knotweed are everywhere.	Insect pests can ravage local silvicultural operations, value-added market product production (e.g., maple syrup industry), and tourism. Invasive plants and insects may destroy or crowd out key native species and habitat, and some cause physical harm.	Highly likely

[5] See http://www.nrs.fs.fed.us/pubs/1983

VI. Mitigation

A. Mitigation Goals

- To reduce injury and losses, including loss of life and to infrastructure, structures and businesses, from the hazard of flash flooding, flooding, fluvial erosion, and beaver dam failure.
- To reduce injury and losses, including loss of life and to infrastructure, structures and businesses, from the hazard of extreme heat.
- To reduce injury and losses, including loss of life and to infrastructure, structures and businesses, from the natural hazard of extreme cold, snow storms, and ice storms..
- To reduce injury and losses, including loss of life and to infrastructure, structures and businesses, from the natural hazard ofwildfire.
- To reduce injury and losses, including loss of life and to infrastructure, structures, and businesses, from the natural hazard of invasive species.

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

Note: The language below was excerpted from the 2016 Barnard Town Plan.

- To discourage development in undeveloped farmlands, forest lands and especially the Barnard Chateauguay Conservation Area. Such tracts are intended to remain predominately as undeveloped or limited development areas for the purposes of conserving existing resource values (p. 11).
- To ensure the future of and protect the following: forestry under sound silvicultural guidelines, wildlife habitat, unique plant or animal habitats, clean air and the ability to see the night sky without the interference of bright lights. Wetlands and watercourses in general are afforded protection under Federal and State rules but should be given special consideration in the Town's regulations (p. 11).
- To protect the environmental integrity of forests, fields, wetlands, floodplains and surface waters (p. 12).
- Maintain a pace of development that Town institutions and our road system can sustain (p. 12).
- Protect steep slopes and ridgelines from inappropriately sited development (p. 13).
- Minimize lake-side development and retain a naturally vegetated shoreline (p. 16).
- Abide by the Clean Water Standards and Water Safety Recommendations recommended by the State of Vermont (p. 16).
- To prevent flood damage and retain flood storage capacity (p. 17).
- Preserve floodplains and associated risk areas in a state where they can handle flood flows without damage to property (p. 17).
- To protect critical natural areas from environmental damage (p. 17).

- To ensure the town and the public do not incur costs associated with development in unsuitable areas (p. 17).
- Develop regulatory and non-regulatory ways to protect the special qualities of critical natural areas (p. 17).
- Consider the creation of steep slope standards (p. 18).
- Regulate development on areas with shallow/wet soils so that they are safe and do not harm water quality (p. 19).
- Protect and enhance water quality through development standards (p. 19).
- To preserve the important habitat and water quality functions of wetlands (p. 20).
- Consider the creation of wetland buffer standards in the Zoning Bylaws (p. 20).
- To promote and maintain a transportation system that is safe, efficient and complements the other goals and planning principles of this Plan (p. 28).
- Growth and development shall not exceed the capacity of local and regional facilities and services (p. 52).
- Increase community awareness of where and how emergency services can be obtained (p. 52).
- Continue support of local emergency services (p. 53).

The Barnard Town Plan was updated and adopted on 08/24/2016, and has an 8 year lifespan.

C. Hazard Mitigation Strategies: Programs, Projects & Activities

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

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

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

Strategies given a "High" prioritization indicate they are either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A "Medium" prioritization indicates that a strategy is less critical or the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A "Low" prioritization

indicates that the timeframe for implementation of the action, given the action's cost, availability of funding, and the community's need to address the issue, is more than four years.

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

The following strategies will be incorporated into the Town of Barnard's long-term land use and development planning documents. In addition, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and flood hazard/ fluvial erosion hazards (FEH) bylaws. Specifically the Barnard Planning Commission will incorporate mitigation strategies included in this Plan directly into Barnard's Town Plan's goals, policies, and recommendations. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas. Individuals and organizations bolded in the following are primarily responsible for each corresponding action, followed by other individuals and organizations with supporting roles.

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
All Hazards				
Ensure that Barnard's Local Emergency Management Plan (LEMP) is kept up-to-date and identifies vulnerable areas and references this Plan.	Selectboard**; Emergency Management Director**	High	Local resources; TRORC; Vermont Department of Emergency Management & Homeland Security (DEMHS)	Spring 2022 and occurring yearly.
Alert residents to upcoming hazards, bad weather, and potentially treacherous travel conditions by means of Barnard Listerv. This town-wide notification system will reduce the loss of life during a hazard.	Selectboard**; Town Administrator**	High	Local resources	Ongoing

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Maintain and revise the Barnard Town website, to be used to give residents important information about upcoming hazards and potentially treacherous travel conditions. This town-wide notification system will reduce the loss of life during a hazard.	Selectboard; **Town Administrator**	High	Local resources	Ongoing
Update and maintain existing list of populations that are vulnerable to extreme cold, extreme heat, and other hazards. Call and visit vulnerable residents, if necessary, in the event that a hazard occurs. By maintaining this list, the health of vulnerable populations will be protected.	Selectboard, **Emergency Management Coordinator**	Medium	Local resources	Ongoing and occurs yearly.
Ensure that fire department update and maintain HAZMAT Awareness training at a minimum.	**Fire Department;** Emergency Management Coordinator	High	Local resources	Ongoing, and occurs annually
Flood/Fluvial Erosion/Severe Weather				
Develop a schedule and capital budgeting program to replace undersized culverts to allow for greater volumes of water to be cleared, therefore protecting town infrastructure.	Selectboard**; Road Foreman**	Medium	Local resources; VTrans	Ongoing
Upgrade three culverts on Lime Pond Road to allow for greater volumes of water to be cleared from flooding of natural pond.	Selectboard**; Road Foreman**	High	Local resources; VTrans Structures Grant	Summer, 2023

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Consider expanding stream bank protections through extending the stream bank buffer to include more zoning districts. A stream bank buffer controls the removal of vegetation along riparian edges, providing greater protection and erosion control for town and private infrastructure.	Selectboard**; Planning Commission**	Low	Local resources; Agency of Natural Resource ;	2026-2027
Upsize the box culvert at the bottom Webster Road to improve safety and lane access for vehicles.	Selectboard**; Road Foreman**	Low	Local resources ; VTrans Structures Grant	Summer, 2027
The Town will consider adopting River Corridor Regulations within its bylaws to reduce the impact of fluvial erosion on homes and infrastructure.	**Selectboard;**	High	Local resources	Ongoing
Inform residents with driveway culverts on the importance of cleaning and maintaining driveway culverts, or contract with residents to have Town maintain driveway culverts. Proper maintenance of driveway culverts will improve long-term town road maintenance costs and will also properly handle flood levels.	Selectboard**; Road Crew**	Medium	Local resources	Summer 2024
Develop a stormwater management plan to reduce the stormwater runoff from driveways onto town roads and rights-of-way, thereby reducing fluvial erosion.	**Selectboard**	Low	Local resources; administrative resources	Summer, 2027

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Conduct a new road erosion road inventory to determine projects for stormwater improvement to reduce erosion sources from town road infrastructure. Proper road erosion reduction will reduce erosion and its damaging effects on public and private infrastructure.	Selectboard**;** **Road Crew;** TRORC	Medium	Better Roads Grant	Summer 2025-Summer 2027
Work with VT ANR to develop a wetland management and conservation plan to reduce flooding and erosion and maintain healthy wetland habitat.	Selectboard**;** **Town Administrator**	Low	Local Resources	2025-2028
Keep up-to-date with Vermont Road and Bridge Standards, which will help Barnard design structures that mitigate flood damage.	**Road Foreman;** Selectboard	Medium	Local resources	Ongoing (or when they are updated by VTrans)
Extreme Heat				
Develop an information brochure available on the town website and listserv to inform residents of the risks of high heat and strategies and resources available during high heat events.	**Town Administrator ;** selectboard**;** **Health Officer**	High	Local Resources	Summer, 2023
Extreme Cold/Snow/Ice Storm				
Clear and maintain Town road rights-of-way to protect town and utility infrastructure and to prevent the damage to health of residents from downed branches during storm events.	**Highway Department/** Selectboard	Medium	Local resources	Fall 2022, Winter 2022, and continued annually.

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Coordinate with the tree warden to survey the roads and identify problem trees along town rights-of-way to remove prior to winter storm events.	Selectboard, **Tree Warden,** Road Foreman	Medium	Local resources	2022-2028
Increase public awareness of extreme winter weather events, safety measures that residents can take, and resources available to residents.	**Health Officer,** Selectboard, Administrative Officer	Medium	Local resources	Winter, 2023
Plan for, budget, and maintain roads for safe winter travel.	**Selectboard**	High	Local resources	Ongoing and occurs yearly.
Distribute safe winter driving informational materials to residents by means of Barnard listserv. Safe winter driving mitigates the loss to human health.	Selectboard, **Town Administrator**	High	Local Resources	Ongoing and occurs yearly.
Wildfire				
Educate residents and increase public awareness on the dangers of wildfire and wildfire prevention strategies residents can take by publishing a notice in local newsletters.	Selectboard, **Fire Department**	Medium	Local Resources	May, 2023
Continue to require fire permits to limit fire hazards, particularly during dry periods.	**Fire Warden**	Low	Local resources	Ongoing

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Distribute fire prevention fliers at the school to protect young residents from loss of life during fires.	**Fire Chief/Fire Department**	High	Local resources	Ongoing. Occurs once per year in the fall.
Continue to maintain existing dry hydrants, by checking, servicing, flushing, and opening them annually. Proper maintenance of hydrants will reduce the loss of life and infrastructure from structure fires.	**Fire Chief/Fire Department**	High	Local Resources	Ongoing and occurs yearly.
Enlist statewide fire education trailer for use at Barnard Academy and at community events, which will help residents identify fire hazards in their homes.	**Fire Chief/Fire Department**	Medium	Local Resources, Vermont Division of Public Safety: Division of Fire Safety	Ongoing and occurs yearly.
Invasive Species				
Develop a plan for invasive species management, and actions that residents and town officials can take to safely remove, control and manage invasive species.	Selectboard, **Conservation Commission**	Low	Local Resources	2026-2028
Develop a mowing schedule to implement on town rights of way to prevent the spread of invasive species.	Selectboard, **Road Foreman**	High	Local Resources	Summer, 2023
Publish seasonal information notices in local newsletters informing residents on the threat of invasive species.	Selectboard, **Local media sources**	Medium	Local Resources	Spring, Annually

Mitigation Action	Local Leadership*	Prioritization (Mitigation Project Status)	Possible Resources	Time Frame
Improve the legibility of the signage by Silver Lake. This signage provides information regarding the spread of aquatic invasive species and helps prevent their spread.	**Selectboard**	Medium	Local Resources, VT ANR Grant	Spring, 2023

*The entities provided in bold in the Local Leadership column are those responsible for carrying out the actions within each respective row.

Appendices

Appendix A: Critical Stream Crossings

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

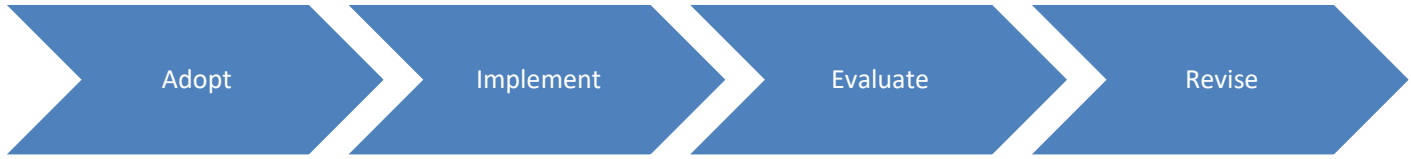
Local ID	Road Name	Latitutude	Longitude	Birdge/Cul Type	Span/Width	Height	Length	Bankfull Width	Openness
426	LIME POND RD	43.705440843	-72.576437991	30	48	48	40	12.40	0.1613
564	LAKOTA RD	43.680327523	-72.596277287	30	96	96	60	25.80	0.3101
447	LIME POND RD	43.726918183	-72.558593286	30	12	12	40	13.77	0.8715
451	ASHLEY RD	43.727159241	-72.559390058	30	36	36	30	13.30	0.2256
1	DAVIS RD	43.733030202	-72.623570639	30	72	72	40	17.50	0.3429
558	LEVASSEUR RD	43.755611041	-72.570027410	32	42	36	40	13.36	0.2620
566	E BARNARD RD	43.754646087	-72.569258370	30	120	120	42	18.53	0.5397
425	LIME POND RD	43.704355080	-72.576646408	32	66	48	40	17.77	0.3107
570	CHATEAUGUAY RD	43.733723040	-72.642921489	30	1	1	1	15.89	unknown
568	E BARNARD RD	43.749316666	-72.551132460	30	144	144	56	26.29	0.4564
197	SMITH HL	43.733446670	-72.654021261	30	15	15	30	0.06	20.8000
0259	CHATEAUGUAY RD	43.753851131	-72.637167083	3	60			21.0	0.2381
0277	CHATEAUGUAY RD	43.724855901	-72.643191517	5	192			17.0	0.9412
0284	CHATEAUGUAY RD	43.713455811	-72.646084298	3	360			9.0	3.3333
0272	CHATEAUGUAY RD	43.733709534	-72.642868587	5	144			16.0	0.7500
0090	STAGE RD	43.700496212	-72.576479208	1	unknown			13.0	unknown
0125	LIME POND RD	43.725841522	-72.553989245	1	unknown			14.1	unknown
0285	CHATEAUGUAY RD	43.710969974	-72.646084564	2	360			16.0	1.8750
0241	WEST RD	43.736007529	-72.642223563	3	26			10.0	0.2167
0179	E BARNARD RD	43.745982541	-72.544702249	1	20			27.0	0.0617
0085	STAGE RD	43.707408523	-72.580429376	1	unknown			18.0	unknown

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

Local ID	Road Name	Latitutude	Longitude	Birdge/Cu	Span/Wid	Height	Length	Bankfull V	Openness
426	LIME POND RD	43.705440843	-72.576437991	30	48	48	40	12.40	0.1613
564	LAKOTA RD	43.680327523	-72.596277287	30	96	96	60	25.80	0.3101
451	ASHLEY RD	43.727159241	-72.559390058	30	36	36	30	13.30	0.2256
1	DAVIS RD	43.733030202	-72.623570639	30	72	72	40	17.50	0.3429
558	LEVASSEUR RD	43.755611041	-72.570027410	32	42	36	40	13.36	0.2620
566	E BARNARD RD	43.754646087	-72.569258370	30	120	120	42	18.53	0.5397
425	LIME POND RD	43.704355080	-72.576646408	32	66	48	40	17.77	0.3107
570	CHATEAUGUAY RD	43.733723040	-72.642921489	30	1	1	1	15.89	unknown
568	E BARNARD RD	43.749316666	-72.551132460	30	144	144	56	26.29	0.4564
0259	CHATEAUGUAY RD	43.753851131	-72.637167083	3	60			21.0	0.2381
0090	STAGE RD	43.700496212	-72.576479208	1	unknown			13.0	unknown
0125	LIME POND RD	43.725841522	-72.553989245	1	unknown			14.1	unknown
0241	WEST RD	43.736007529	-72.642223563	3	26			10.0	0.2167
0179	E BARNARD RD	43.745982541	-72.544702249	1	20			27.0	0.0617
0085	STAGE RD	43.707408523	-72.580429376	1	unknown			18.0	unknown

Appendix B: Five-Year Review and Maintenance Plan

Five-Year Local Hazard Mitigation Plan Review/Maintenance



- Brief local leadership on plan approval
- Formally adopt plan
- Publicize plan approval and adoption
- Celebrate success

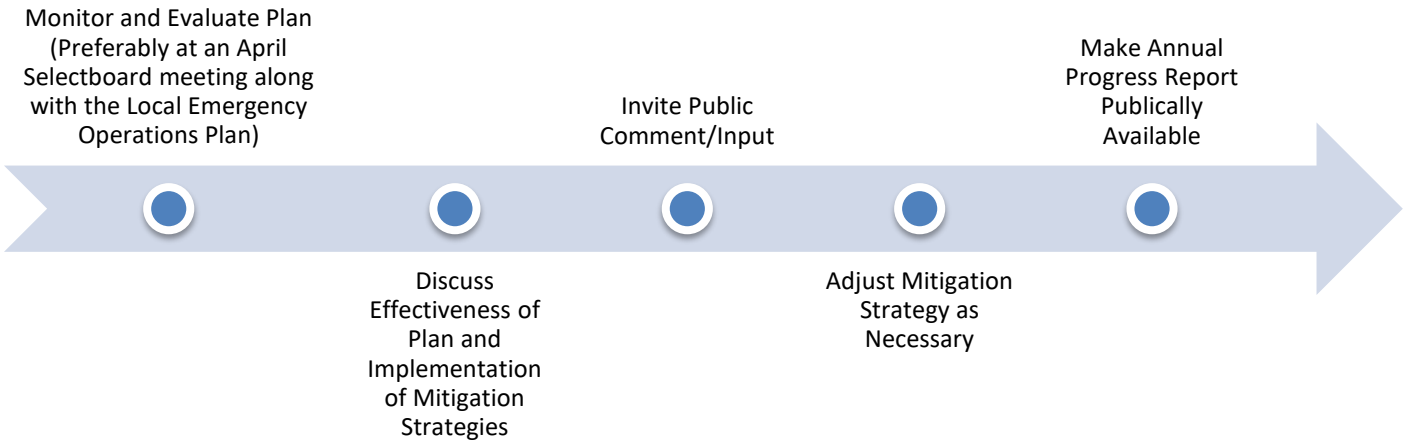
- Confirm/clarify responsibilities
- Integrate mitigation actions
- Monitor & document implementation of projects and actions
- Estblish indicators of effectiveness or success

- Effectiveness of planning process
- Effectiveness of actions
- Document success & challenges of actions
- Update and involve community
- Celebrate successes

- Review factors affecting community's context
- Analyze findings; determine whether to revise planning process or strategy
- Incorporate findings into the plan

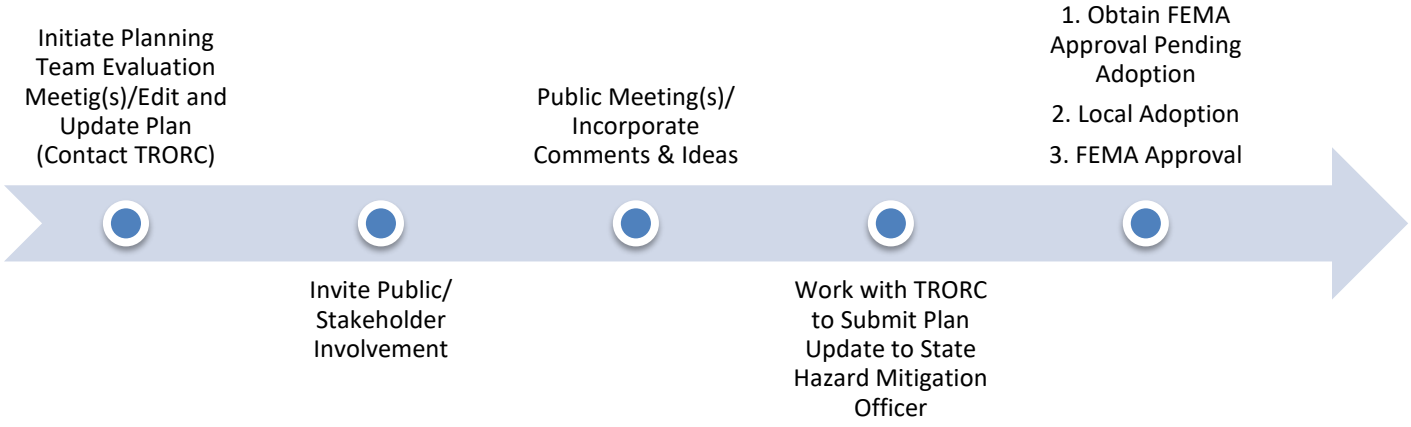
After Plan Adoption—Annually

Implement & Evaluate



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

Evaluate and Revise



Appendix C: Public Notices

Public Notice
Hazard Mitigation Planning

The Town of Barnard is in the process of updating its Local Hazard Mitigation Plan. Local Hazard Mitigation Plans enable towns to qualify for grant funds, and they make our communities safer. The upcoming Barnard Hazard Mitigation planning meeting is scheduled for Tuesday, July 19, 2022, at 7:00 PM at the Barnard Town Hall, 115 North Road, Barnard, VT 05031. The focus of the meeting will be to review the top hazards for Barnard and assess the actions undertaken to address natural hazards since 2016. The meeting is open to all interested community members. Local Hazard Mitigation Plans are part of an effort by the Federal Emergency Management Agency (FEMA) to reduce damage from foreseeable natural and human-caused areas. Examples of projects in local plans include increasing culvert sizes, regulating flood hazard areas, stabilizing landslides, and tree trimming near power lines. For more information, please contact Kyle Katz at kkatz@trorc.org.

Poster displayed for the August 16th Meeting

Public Notice
Hazard Mitigation Planning

The Town of Barnard is in the process of updating its Local Hazard Mitigation Plan. Local Hazard Mitigation Plans enable towns to qualify for grant funds, and they make our communities safer. The upcoming Barnard Hazard Mitigation planning meeting is scheduled for Thursday, September 8th, 2022, at 7:00 PM at the Barnard Town Hall, 115 North Road, Barnard, VT 05031. The focus of the meeting will be to develop hazard mitigation strategies and review hazard mitigation goals. The meeting is open to all interested community members. Local Hazard Mitigation Plans are part of an effort by the Federal Emergency Management Agency (FEMA) to reduce damage from foreseeable natural and human-caused areas. Examples of projects in local plans include increasing culvert sizes, regulating flood hazard areas, stabilizing landslides, and tree trimming near power lines. For more information, please contact Kyle Katz at kkatz@trorc.org.

DRAFT REVIEW!

The Town of Barnard is in the process of updating its Local Hazard Mitigation Plan. Local Hazard Mitigation Plans enable towns to qualify for grant funds, and they make our communities safer. At the next meeting, join the Hazard Mitigation Committee to review the draft of the Plan and provide comments and recommendations on strategies to mitigate the impacts of natural hazards. The meeting is scheduled for Thursday, October 20th, 2022 at 7:00 PM at the Barnard Town Hall, Barnard VT 05031. A draft of the plan is available on the town website. Hard copies of the plan will also be available at the meeting.

The meeting is open to all interested community members and public comments are welcome. Local Hazard Mitigation Plans are part of an effort by the Federal Emergency Management Agency (FEMA) to reduce damage from foreseeable natural and human-caused hazards. Examples of projects in local plans include increasing culvert sizes, regulating flood hazard areas, stabilizing landslides, and tree trimming near power lines. For more information, please contact Kyle Katz at kkatz@trorc.org.

Listserv notice posted for the October 20th Meeting

Attachments

Attachment A: Map of Barnard