

Adopted by the Town of Canaan Selectboard on August 14, 2017

Town of Canaan, Vermont All-Hazards Mitigation Plan Update



Prepared by:

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Certificate of Local Adoption

Town of Canaan

A Resolution Adopting the All-Hazards Mitigation Plan

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

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

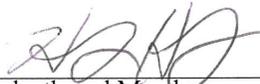
WHEREAS, the Town of Canaan and the respective officials will pursue implementation of the strategy and follow the maintenance process described in this plan to assure that the plan stays up to date and compliant; and...

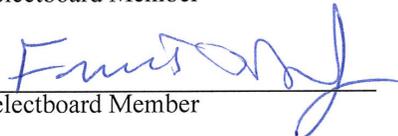
WHEREAS, a meeting was held by the Town of Canaan Selectboard to formally approve and adopt the Town of Canaan All Hazards Mitigation Plan.

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

8-14-17
Date


Selectboard Chair


Selectboard Member


Selectboard Member

Executive Summary

In 2012, the town began to update this Local All-Hazard Mitigation Plan. The results of this work are contained herein and represent the collaborative efforts of the Canaan Hazard Mitigation Planning Team and associated residents, towns and agencies that contributed to the development of this update. As hazard mitigation is a sustained effort to permanently reduce or eliminate long-term risks to people and property from the effects of reasonably predictable hazards, the town has communicated its efforts related to developing this plan to its residents and surrounding municipalities, providing a formal opportunity to provide input and review relevant sections of the plan. Along these lines, the town has documented the planning process so that future updates can follow an efficient pattern in addition to capturing this important component as means of establishing institutional memory. In realization that eligibility to receive federal hazard mitigation grants and optimize state-level reimburse or “match” dollars during a federally declared disaster is dependent on a federally approved plan, the town remains committed to sustaining its mitigation efforts and by developing this plan, will have a guide for action that will foster enhanced emphasis on mitigation in the years to come. The town realizes the importance of mitigation inherent to its own resilience as well as means to establishing strong partnerships with regional support agencies and associations, state government and FEMA. As the town moves towards formally adopting this Local All-Hazards Mitigation Plan, the purpose of this plan is to:

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

This plan is organized into 5 Sections:

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

Section 2: Hazard Identification expands on the hazard identification in the 2017 Town Plan with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the town and reviews previous federally-declared disasters to identify what risks are likely in the future. This section presents a hazard risk assessment for the municipality, identifying the most significant and most likely hazards which merit mitigation activity. The most significant hazards for Canaan have been profiled and are introduced in the grid below:

Severe winter storm	Extreme Cold	Flooding (including fluvial erosion/dam breach)
Hazardous Materials Incident		

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

Section 5: Mitigation Strategies begins with an overview of goals and policies in the most recent Town Plan that support hazard mitigation and utilizes a current road inventory to formulate a work plan for major infrastructure projects. An analysis of existing municipal actions that support hazard mitigation, such as planning, emergency services and actions of the highway department are also included. The following all-hazards mitigation goals are summarized below:

- 1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.
- 2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.
- 3) Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local All-Hazards Mitigation Plan.
- 4) Recognize the relationship between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads, utilities and storm water management.
- 5) Maintain existing municipal plans and programs, adherence to state standards and ordinances that directly or indirectly support hazard mitigation.
- 6) Consider formal incorporation of this Local All-Hazards Mitigation Plan into the municipal comprehensive plan as described in 24 VSA, Section 4403(5), as well as incorporation of proposed new mitigation actions into the town's operating procedures.
- 7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the town operating plans and infrastructure, utilities, highways and emergency services.

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

Action #1 Improve flood resilience through highway, culvert and bridge programs and floodplain management

Action #2: Improve resilience to severe winter storms

Action #3: Reduce risk and impact of hazardous materials incident

Action #4: Reduce risk and impact of extreme cold durations

Action #5: Raise public awareness of hazards and hazard mitigation actions

Action #6: Improve resilience of Village Water System

Action #7: Continue fluvial geomorphology assessment and develop strategies in response to identified risks in addition to investigating increased mapping of the SFHA. In conclusion, Section 5 provides an Implementation Matrix to aid the municipality in implementing the outlined mitigation actions with an annual evaluation process to be coordinated and administered by the Canaan Planning Commission.

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SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

The purpose of this plan update is to assist the Town of Canaan to identify all hazards facing the community and identify strategies to begin reducing risks from identified hazards. A Pre-Disaster Mitigation Planning Grant to the Northeastern Vermont Development Association (NVDA) assisted the Town of Canaan in preparing this plan. The impact of expected, but unpredictable natural and human-causes events can be reduced through community planning. The goal of this plan is to provide all-hazards local mitigation strategies that make the communities in northeastern Vermont more disaster resistant.

The Town of Canaan, like many towns in Vermont, was affected by Storms during 2011, which caused severe flooding and damage to both public and private property. After the initial emergency response and recovery to these storms, the Canaan Select Board started to educate themselves on hazards examined the town's vulnerability and responsibility to mitigate the impact of such hazards in the future. While hazards cannot be eliminated, it is possible to determine what the hazards are, where they might be most severe and identify local actions that can be taken to reduce the severity of the hazards. Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, avert the hazard by redirecting the impact by means of a structure or land treatment, adapt the hazard by modifying structures or standards or avoid the hazard by stopping or limiting development and could include projects such as:

- Flood proofing structures
- Securing propane/fuel tanks in flood prone areas
- Elevating furnaces and water heaters in flood prone areas
- Identifying and modifying high traffic incident locations and routes
- Ensuring adequate water supply, monitoring and protecting drinking water supplies
- Enlarge or upgrade culverts and road standards
- Elevating structures or utilities above flood levels
- Proactive land use planning for floodplains and other flood-prone areas
- Proper road maintenance and construction
- Ensuring critical facilities are safely located
- Providing public information

1.2 Hazard Mitigation

The Vermont State All-Hazards Mitigation Plan of 2013 defines hazard mitigation as:

“Any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. The Federal Emergency Management Agency (FEMA) and state agencies recognize that it is less expensive to prevent disaster or mitigate its effects than to repeatedly repair damage after a disaster has struck. This plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of Emergency Management—Preparedness, Response and Recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where they are, where they are most severe and to identify actions that can reduce the severity of the hazard.”

Hazard mitigation strategies and measures can reduce or eliminate the frequency of a specific hazard, lessen the impact of a hazard, modify standards and structures to adapt to a hazard, or limit development in identified hazardous areas. This plan aligns and/or benefits from the 5 goals accomplished as a State since 2010 and as referenced in Section 5 of the State's 2013 Hazard Mitigation Plan and as part of the newly created Emergency Relief Assistance Funding (ERAF) requirements. With enhanced emphasis on community resiliency, many state agencies and local organizations have an increased awareness of the importance of mitigation planning and have produced plans and resources that towns can use to support their planning efforts. This plan will reference, when relevant, pertinent tools and resources that can be used to enhance mitigation strategies.

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

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, coordinates available resources, and implements actions to reduce risks. Per *44 CFR Part 201: Hazard Mitigation Planning*, this planning process establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, local governments now must have an approved local mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan for Pre-Disaster Mitigation funds or grants to be released for either a state or local mitigation project after November 1, 2004.

There are several implications if the plan is not adopted:

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

1.4 Benefits

Adoption and maintenance of this Hazard Mitigation Plan will:

- Make certain funding sources available to complete the identified mitigation initiatives that would not otherwise be available if the plan was not in place
- Lessen the receipt of post-disaster state and federal funding because the list of mitigation initiatives is already identified
- Support effective pre and post-disaster decision making efforts

- Lessen each local government’s vulnerability to disasters by focusing limited financial resources to specifically identified initiatives whose importance have been ranked
- Connect hazard mitigation planning to community planning where possible

1.5 All-Hazards Mitigation Plan Goals

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

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

1.6 Canaan Population and Characteristics

2010 Population: 972

Median Housing Value: \$101,240

Essex County

Chartered: February 25, 1782 (Vermont Charter) Area: 21,174 Acres! 33.08 Square Miles

Coordinates (Geographic Center): 71°34'W 45°00'N Altitude ASL: 1,042 feet

Population Density (persons per square mile): 32.6 Tax Rate: \$1.700 ('14)

Equalized Value: \$84,100(14)

Community History and Background

Canaan is located in the extreme northeastern corner of Vermont, in the County of Essex. It is bound on the north by the Province of Quebec, Canada; on the east by the Connecticut River and the towns of Clarksville, Stewartstown and Colebrook, New Hampshire; and on the west and south by the towns of Norton, Averill, and Lemington, Vermont. There are two international border crossings, one near Wallace Pond and the other in Beecher Falls.

Canaan had a population of 972 as of the 2010 Census. There are two unincorporated villages in the Town of Canaan. The larger of the two is Canaan. Approximately one mile northeast from the village of Canaan, and on the Canadian border, is the village of Beecher Falls. The majority of land in Canaan is hilly woodland. Open farmland runs along the Connecticut River from the village of Canaan to the southernmost border of the township, from the village of Beecher Falls to the northeast corner of the township, and along Leach Stream from the village of Canaan northwest to the Canadian border. Vermont Route 253 runs north from Canaan Village through the village of Beecher Falls to the Canadian border. Vermont Route 102 begins at Canaan Village and continues south along the Connecticut River to Lemington on the southernmost border. Vermont Route 114 runs west from the village of Canaan to Averill. Wallace Pond, Canaan's only recreational lake, is situated on the Canadian border, with more than half the lake in Canada.

Beecher Falls is the home to Ethan Allen, a large furniture manufacturing plant. The fire station building is owned by Ethan Allen and is located next to the plant. Ambulance service is from Colebrook, New Hampshire, nearly 30 minutes away. The fire department is run by volunteers. There are currently 45 members on the department. Six new members were added in 2014, however five members left after many years of service. The Fire Department responded to 264 emergency calls in 2014. The fire department has 3 engines, 2 tankers, and 1 rescue vehicle. Funding for a new decontamination trailer was secured through Homeland Security funds in 2005. The Fire Department faces some projects that will be expensive in the coming years. The main attack truck, which is a 1989 model, needs to be replaced. The asking price of a new truck is \$400,000. The fire department also needs to replace non-compliant and worn out clothing. The cost of this replacement gear is close to \$68,000. The fire department did purchase 20 sets of gear and received them in mid-December 2014. They are looking at ways to raise the remaining money to purchase more gear. The Fire District is comprised of District #1 and #2. Fire District #1 water system improvements are in the design phase and it is anticipated that work will be performed during the summer of 2015 and 2016. The improvements consist of replacing many of the old small water mains which will now provide fire protection, a new storage tank at an elevation that provide increased pressure, connection to the Beecher Falls water system and a small treatment facility that will remove iron, manganese and other minerals from the water to improve the quality. The connection to the Canaan Fire District #2 system along an area known as "the old rail bed" will provide redundancy for both water systems. This is planned for 2016. The water mains will be replaced on Routes 253, 102, and parts of 114 and Power House Road. The State of Vermont Dept. of Transportation will be repaving all of these roads in 2015 and 2016. A new storage tank will be constructed on the new Town Forest property. The bridge from Beecher Falls to West Stewartstown, NH will be re-constructed during 2015-2016. The engineering firm that is working with New Hampshire on this project will give recommendations to Fire District #2 for replacing or relocating the water main that is attached to the bridge, as well as for funding this project. The storage tank for Fire District #2 is in New Hampshire. The initial plan is to have the water main under the river instead of under or attached to the bridge.

Beecher Falls is part of a Mutual Aid District that includes Canada and New Hampshire towns because of its unique location in the most northeastern part of Vermont. A natural gas pipeline traverses a tiny corner of the Beecher Falls. This pipeline has exploded in the past few years but caused no damage due to its remote location, in Canada.

1.7 Summary of Planning Process

The town of Canaan does not currently have a FEMA approved Local Hazard Mitigation Plan. In 2005 a Hazard Mitigation Plan for the town of Canaan was adopted as an annex to the multi-jurisdictional All-Hazard Pre-Disaster Mitigation Plan adopted by Northeastern Vermont Development Association under a Pre-Disaster Mitigation Grant. A Pre-Disaster Mitigation Planning Grant to Northeastern Vermont Development Association (NVDA) also assisted the town of Canaan in preparing this plan.

Since, 2005 much has happened to heighten the need for comprehensive, holistic emergency planning at the local level. The Northeast Kingdom was hit hard by sudden rainstorms in April and May, 2011 and again later that year certain areas of the Northeast Kingdom were damaged by Tropical Storm Irene. Damages included personal property to include driveways, roads and bridges in Canaan. The Beecher Falls Fire Station, which is part of Canaan received damage as well. FEMA has now adopted a new "National Mitigation Framework" and in 2012, updated guidance for local hazard mitigation planning. Vermont's ongoing recovery efforts from massive statewide losses from Tropical Storm Irene prompted statutory changes that will affect all Vermont municipalities. The most notable of these changes involves new rules for the Vermont Emergency Relief and Assistance Fund (ERAF). Effective October 2014, the amount of state public assistance that municipalities receive may be reduced from 50% to 30% unless the municipality has implemented the following measures:

1. Adopt a local emergency operation plan
2. Adopt flood hazard regulations that qualify for enrollment in the National Flood Insurance Program
3. Adopt current VTrans Town Road and Bridge Standards
4. Adopt a Local Hazard Mitigation Plan to be submitted for FEMA approval

In accordance with the new FEMA guidelines and the new ERAF requirement, the town of Canaan has developed a stand-alone Local Hazard Mitigation Plan that builds upon and augments previous regional mitigation and planning efforts. The development of this plan update has followed a similar process to most community planning efforts, in addition to the Hazard Mitigation protocol established by FEMA. The planning team was developed to oversee the planning process, public participation, notifying neighboring communities, plan drafting, and finally the mitigation strategy. The planning team was composed of the following individuals:

Gregory Noyes, Canaan Select Board Chair
Steve Young, Beecher Falls Volunteer Fire Department Fire Chief
Jeff Noyes, Canaan Police Chief
Odette Crawford, Interim Zoning Administrator (winter months)
Harland Crawford, Canaan Emergency Management Director/Coordinator
Paul Kunz, Boarder Patrol

Noreen Labrecque, Canaan Town Clerk
Bruce Melendy, Emergency Management Planner, NVDA
Miranda Scott, Vermont Agency of Transportation
Morgan Wade, Planning Chair
Robert Lee, Zoning Administrator
Daniel Wade, School Board
Debra Lynch, School Principle
Richard Thibault, Road Foreman
April Busfield, Water and Sewer Operator

Public Involvement:

The committee oversaw the effort to receive and consider community-wide input from all potential stakeholders, in accordance with Vermont's Open Meeting Laws. Planning and outreach kicked off at a duly warned Select Board meeting on July 9, 2012. Those attending this meeting were members of the There were other meetings in 2012 where there was discussion about the Canaan Hazard Mitigation Plan. These were at Select Board meetings which were duly warned to allow for Public Input

These meetings were on July 23, 2012, October 29, 2012, and November 12, 2012. There was no input from the Public in reference to Canaan's Hazard Mitigation Plan at these meetings. During 2013 and into 2014 there was not much activity in the Hazard Mitigation Plan update for Canaan due to priorities in other areas taken precedence. In July, 2014, efforts began again to begin the process of preparing an updated Hazard Mitigation Plan for the town of Canaan. The Hazard Mitigation Plan was on the Select Board Agenda for July 21, 2014, August 4, 2014, August 8, 2014 and September 15, 2014. These meetings were duly warned to allow for Public Input.

There was no discussion from the Public in reference to the plan at these meetings. It was decided at the September 15, 2014 Select Board meeting there would be a survey sent out in the monthly newsletter. There were over 600 mailings of this newsletter to residents of Canaan. The survey was titled, "Community Outreach Forum" from the Canaan Hazard Mitigation Planning Team. The survey had three questions:

1. As a resident, business owner or employee of the Town of Canaan, what are your concerns about emergency events in the town?
2. What do you think the community could plan to be better prepared, both financially and in health and safety for the next emergency event?
3. What other thoughts or concerns do you have about emergencies, hazards, and emergency response in the Town of Canaan?

There were three responses to this survey. The concerns of the citizens who responded were: Lack of Information about where people would go-transportation, availability of cots, food, medications, taking care of the special needs population. Sheltering Issues to include Animals, communication of the emergency plans.

One of the citizens that responded was appointed to the Planning Committee along with the Canaan Health Officer, and Historical Society President to join the existing members that attended the first planning meeting in July, 2012. All towns bordering Canaan were sent notification of the plan's development and subsequent drafts and were given an opportunity to provide input formal invitation to respond to the town via letter, phone or email. The Vermont towns bordering Canaan include: Norton, Averill and Lemington. The New Hampshire town is

West Stevenson and the Canadian towns include East Hereford and Chemin Des Cotes. The Canaan Hazard Mitigation Plan was on the Local Emergency Planning Committee 10 meeting Agenda for February 10, 2015, allowing for input from the Public and neighboring communities in reference to the Plan. A draft of the plan was also mailed out to neighboring communities, put on the Town Website for Public Input and copies were available at the Canaan Town Office. Monthly updates on plan development were included in each Selectboard meeting and an overview of hazards and disaster history was given at both the September Selectboard and Planning Commission meetings, where a discussion to incorporate pertinent facets of the LHMP into the next town plan and subsequent zoning regulations occurred along with a presentation by NVDA on the river corridor. While responses from neighboring towns was minimal, the town's diligence in creating a transparent plan is exemplified by the level of outreach attempted. Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist, the plan was written using data sources that included:

1. Surveys and warned, public meetings collecting public comment (issues raised were addressed in plan and the public meeting)
2. 2017 Canaan Town Plan (provided current goals and regulations supporting mitigation, recent capital expenditures and infrastructure value helped to drive vulnerability assessment)
3. 2017 Zoning and Flood Hazard Regulations (Used for historical foundation of policies that support mitigation)
4. 2017 Canaan Road Erosion Site Inventory (created in adjunct to this plan and used to scope infrastructure priorities for the 5-year planning cycle as well as give the town a method to track and capture needed work)
5. 2013 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).
6. Vermont Agency of Natural Resources (ANR) and Transportation (VTrans) (Provided key policy recommendations on environmental conservation, high accident locations, climate change and fluvial erosion data).
7. Vermont Departments of Health (VDH) and Environmental Conservation (DEC) (provided information related with public health services that could be impacted during a disaster and state support functions designated to both VDH and DEC. DEC also provided river corridor data for mapping purposes.
8. Great Bay Hydro Erosion Monitoring Report (provided current disaster planning policy initiatives and scoping information on dam breach scenarios).
9. FEMA Open Source (data.gov) Data for Disaster History and PA funding (provided comprehensive declared disaster by year and type as well as project descriptions and cost per event).
10. FEMA NFIP "Bureau.Net" database (provided detailed information on repetitive loss properties and associated flood insurance claims).
11. EPA's Incident Action Checklist for cold weather resilience of water systems (provides a guidance tool for public works to cross-reference actions on the system).
12. 2013 ACCD Mobile Home Resilience Plan (served as resource for future mitigation actions)

SECTION 2: HAZARD IDENTIFICATION

2.1 Identify Hazards

The 2005 Plan profiled the following hazards (bold indicates continued inclusion in this update):

- **Flooding**
- Hazardous Materials
- Structure Fire
- **Water Supply Contamination**
- Chemical or biological incident
- **Dam Failure**
- School Safety Issues

For this update, the planning team considered the continued inclusion or deletion of the 2005 hazards profiled by developing and researching three distinct hazard categories and for each, considered prior history, current trends and available data to estimate risk. As highlighted above, some profiled hazards remain a risk for the town. However, other hazards, due to lack of occurrence frequency, risk and/or vulnerability have been removed in this update or referred to as vulnerabilities. For example, a main concern for school safety is flooding. The definitions of each hazard, along with historical occurrence and impact, are described in this section.

The planning team looked at three distinct hazard categories, assuring synchronicity with the state hazard mitigation plan's identified hazards and for each, considered prior history, current trends and available data to select (profile) hazards that are most likely to impact the town. The profiled hazards will form the basis of mitigation actions for the next five-year planning cycle.

While it is understood that FEMA will only reimburse the town for disasters caused by natural hazards, considerations for other the categories can increase resilience to a natural disaster as the technological and social hazards often occur as a secondary consequence of the natural disaster and often, in adjunct, where-by becoming vulnerabilities. The following is a discussion of existing and potential hazards in Canaan. The definitions of each hazard, along with historical occurrence and impact, are described. The three hazard categories:

- **Natural Hazards:** weather / climate hazards (drought, hurricane/tornado, high winds, severe winter storm, extreme temperatures, climate change, lightning, hail), flooding, geological hazards (landslide / erosion, earthquake, naturally-occurring radiation), and fire hazards.
- **Technological Hazards/Vulnerabilities:** utility failure (telecommunications failure, loss of electrical service, loss of sewer service, loss of water service, loss of gas service), hazardous substances (hazardous material storage and release, hazardous waste sites, military ordnance, pollution events), and transportation incident.

- **Societal Hazards/Vulnerabilities:** crime, civil disturbance, terrorism, epidemic, mass casualty, food supply crisis, economic downturn, and key employer loss.

2.1 Profiled Hazards

In addition to the continued inclusion of some of the 2005 profiled hazards, the town is adding Extreme Cold and Severe Winter Weather of the Profiled Hazard list. The following discussion on natural hazards is based upon information from several sources. General descriptions are based upon the *2013 Vermont State Hazard Mitigation Plan*. Due to the rural nature of Northeast Kingdom, there is little historical data available for presentation related to all hazards but when available, relevant data is included.

The highest risk hazards have been profiled to provide the basis of future mitigation strategies. However, lower risk natural hazards (severe thunderstorm, hurricane/tropical storm, drought, tornado, high winds, extreme heat, hail, landslide, earthquake, naturally-occurring radiation and fire hazards) are omitted from full profiling because they do not pose enough risk to substantiate mitigation efforts at this time. It should be noted that flooding from any hurricane/tropical storm is captured in flood hazard section of this plan. While the risk of structure fire is low, Canaan, as most towns, is concerned but this concern does not warrant inclusion in this plan as the mechanisms of fire mitigation are considered inherent in normal fire department operations and viable mitigation strategies will be captured in the public education piece associated with this plan.

Table 2-1: Summary of Vermont Emergency Declarations

Number	Year	Type
3338	2011	Hurricane Irene
3167	2001	Snowstorm
3053	1977	Drought

Source: FEMA

- *Table 2-2: Summary of Vermont Major Disaster Declarations since 1998 (Essex County: Bold and “*” denotes Canaan PA received).*

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

4207	2015	Severe Winter Storm
4178	2014	Severe Storms and Flooding
4232	2015	Severe Storms and Flooding
4163	2014	Severe Winter Storm
4140	2013	Severe Storms and Flooding
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding

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

Source: FEMA

2.1.1.1. Profiled Hazards:

An Introduction to Climate Change:

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2011, there were 11. It is commonly accepted that weather extremes are becoming more commonplace in Vermont. Since 2011, record setting snow, rain and cold have been experienced in the state. In recent years, it has become evident that human activities, mostly associated with the combustion of fuel, have added to the natural concentration of greenhouse gases in the atmosphere and are contributing to rapid climate change on a global scale. While projections of the effects of climate change vary, it is generally predicted that Vermont will have warmer temperatures year-round, with wetter winters and drier summers. An increase in the size and frequency of storms is also predicted. Thus, climate change in the next century will likely increase the chance of weather-related hazards occurring. An increase in precipitation may also result in increased flooding and fluvial erosion. Drier summers may increase the chance of drought and wildfire. A warmer climate may also result in the influx of diseases and pests that cold winters previously prevented. The severity of climate change is also difficult to predict, though the effects may be mitigated somewhat if greenhouse gas emissions are reduced soon. In 2011, Governor Shumlin formed the *Vermont Climate Cabinet*. The Cabinet, chaired by the Secretary of Natural Resources, is a multidisciplinary approach to enhance collaboration between various state Agencies. Its primary objectives include providing the Governor with advisory information and facilitating climate change policy adoption and implementation. In 2013, the Vermont Agency of Natural Resources (ANR) released the Climate Change Adaptation Framework which addresses climate change exposures, vulnerability-specific elements within each of the natural resource sectors, and ongoing and proposed actions that can be or have been

taken to prepare for the expected changes. In line and in conjunction with the ANR report, the primary goal of a VTrans climate change adaptation policy is to minimize long-term societal and economic costs stemming from climate change impacts on transportation infrastructure.

Severe Winter Storm

Winter storm frequency and distribution varies from year to year depending on the climatological patterns. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches. According to the *2013 Vermont State All-Hazards Mitigation Plan*:

“A winter storm can range from moderate snow to blizzard conditions. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period. A blizzard is a snowstorm with sustained winds of 40 miles per hour or more with heavy falling or blowing snow and temperatures of ten degrees Fahrenheit or colder. An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires, and similar objects and to produce widespread power outages.”

The following table represents the best available data related to snowfall for the town. While the town hasn’t specific snowfall data, the following list provides the events impacting the county. The two events in late 2005 produced significant property damage (PrD).

						PrD	CrD
ESSEX (ZONE)	VT	03/08/2005	20:00	EST	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	03/12/2005	16:00	EST	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	10/25/2005	21:00	EST	Winter Storm	50.00K	0.00K
ESSEX (ZONE)	VT	11/22/2005	20:00	EST	Winter Storm	20.00K	0.00K
ESSEX (ZONE)	VT	12/16/2005	12:00	EST	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	03/04/2006	10:00	EST	Winter Storm	5.00K	0.00K

ESSEX (ZONE)	VT	01/15/2007	05:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	03/02/2007	02:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	03/16/2007	19:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	04/12/2007	08:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	12/11/2008	20:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	12/02/2007	18:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	12/16/2007	03:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	01/01/2008	13:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	02/01/2008	11:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	02/06/2008	04:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	02/26/2008	12:00	EST- 5	Winter Storm	5.00K	0.00K
CALEDONIA (ZONE)	VT	02/26/2008	12:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	03/01/2008	01:00	EST- 5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	12/21/2008	09:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	01/28/2009	08:00	EST- 5	Winter Storm	5.00K	0.00
ESSEX (ZONE)	VT	02/22/2009	07:00	EST- 5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	01/02/2010	15:00	EST- 5	Winter Storm	15.00K	0.00K
ESSEX (ZONE)	VT	02/23/2010	15:00	EST- 5	Winter Storm	10.00K	0.00K

ESSEX (ZONE)	VT	04/27/2010	14:00	EST-5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	02/24/2012	15:00	EST-5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	12/27/2012	00:00	EST-5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	03/19/2013	03:00	EST-5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	12/14/2013	19:00	EST-5	Winter Storm	5.00K	0.00K
ESSEX (ZONE)	VT	03/12/2014	08:00	EST-5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	11/26/2014	14:00	EST-5	Winter Storm	10.00K	0.00K
ESSEX (ZONE)	VT	01/27/2015	08:00	EST-5	Winter Storm	10.00K	0.00K

Source: <https://ncdc.noaa.gov>

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

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

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

Regionally, the winter of 2010-2011 was the third-snowiest on record with a total of 124.3 inches. In any Vermont community, this potential exists every winter for a storm that exceeds immediate capacity. Regional historic January snowfall totals fell in 1987 (47.5’), 1978 and 1979 (46.5’, 45.8’). Total average snowfall for the region in December is 26.2’, January is 22.6’, February averages are slightly less at 16.9’ and March is 18.3’. February 14th-15th, 2007 saw the greatest 24-hour max snowfall total at 23.5’. The snowfall totals are annual averages based on weather data collected from 1981 to 2010 for the NOAA National Climatic Data Center. While declared snow storm disaster have been declared for the county, Canaan has not received PA funding for these events. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are brought down by falling trees and branches.

Sources: www.ncdc.noaa.gov, www.nws.noaa.gov

Extreme Temperatures

While there is no historical evidence to support a concern over the consequences of extremely hot temperatures on human health and safety in Essex County, high temperatures can help to create severe storms as the one evidenced on September 11th, 2013, where record heat (90F) helped to produce damaging hail and winds in parts of the NEK and other areas of Vermont and NY. Recent extremes in cold temperatures is a concern. 2015 tied the coldest winter (January to March) on record (1923) for Vermont as a whole according to the NOAA’s National Centers for Environmental Information, whose dataset dates to 1895. Cold temperatures are expected in the Northeast but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real

concern for Essex County and the rest of the state. Essex County’s winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit and a max-low of -26 degrees Fahrenheit in February. However, the January of 1970 had a mean temperature of 6.6 degrees Fahrenheit which is the coldest mean temperature for the county and January is the statistically coldest month in all of Vermont. Since 1900, January produced temperatures in the negative 20’s and 30’s consistently for Essex County with record cold temperatures occurring in 1914 (-38). While the temperatures for the town remain within averages seen in the last 85 years, the town expects dangerously cold temperatures every winter. The following table shows the dates listed on NOAA. Temperature data Source: www.ncdc.noaa.gov

ESSEX (ZONE)	VT	01/25/2007	05:00	EST- 5	Extreme Cold/wind Chill	0	0	0.00K	0.00K
ESSEX (ZONE)	VT	03/06/2007	00:00	EST- 5	Extreme Cold/wind Chill	0	0	0.00K	0.00K
ESSEX (ZONE)	VT	03/09/2007	00:00	EST- 5	Extreme Cold/wind Chill	0	0	0.00K	0.00K
ESSEX (ZONE)	VT	01/14/2009	03:00	EST- 5	Extreme Cold/wind Chill	0	0	0.00K	0.00K
ESSEX (ZONE)	VT	01/07/2015	20:00	EST- 5	Extreme Cold/wind Chill	0	0	0.00K	0.00K

2.1.2. Flooding

Flood History

The Town of Canaan has a history of flooding, however none have been totally devastating. The summer of 2004 saw road damage along Route 102 and in the village area. These sections of road were considered town highways and were repaired through the Vermont Agency of Transportation. See the dam section below for more discussion on threat from flooding from a possible dam breach. Ice jams are frequent along the Connecticut River especially at bridge locations. The spring of 2011 brought more flooding in the village area on town highways as well as to the pumping stations adjacent to the Beecher Falls Fire Station, and to the Fire Station. The pumping stations have been elevated since the storms of 2011. Willard Stream along Route 102 has a history of flooding and causing damage to farms in this area. Because this is private property there has not been a plan put in place as part of mitigation for this area. Other areas that

have cause damage due to flooding are Hall Stream and River Road. With the May, 2011 flooding setting the benchmark for roadway vulnerability, the town mitigated the highest risk areas, where undersized culverts resulted in the most roadway flooding and damage the town has seen. Roads that were most heavily damaged and repair include:

- Penn Rd.
- Fund Rd.
- Kemp Hill Rd.
- Dubeau Rd.
- Canaan Hill Rd.

The bridges in town are on River Rd. and Jackson Lodge Rd. but these were not damaged and not considered high risk structures. School safety issues are related to the school being located in the flood area. Evacuation will be difficult in high flood situations. The close proximity to the border crossings is also a potential problem if terrorists are involved. Total enrollment is approximately 200 students preK-12. The school has prepared an emergency plan for a variety of potential incidents ranging from bomb scares to drugs to guns. It was noted in the 2005 plan that a generator is needed at the school for emergency power, as the school is also used as a Shelter in Emergency situations. A generator has now been installed at the school.

Flooding is the most common recurring hazard event in the state of Vermont. June of 2015 broke records across the state for the wettest on record. Essex County received nearly 6 inches of rain in June, 2015 but flooding did not result. This amount is high but not highest for the region. 9.65'' fell in 1973 in Saint Johnsbury and the greatest 24-hour rainfall records for the town occurred in May 30th, 2011 at 6.47''. Recent history, including the flooding events of 2011 and the records set in 2015 suggest that increases in total rain fall and severity are to be expected along the lines seen with the records set across the state recently. There are three sources of historical precipitation data for Vermont. The data are reported at the county level: 1) recurrence time intervals for 24-hour rainfall storm depth, 2) annualized daily frequency of rainfall, and 3) rainfall-intensity frequencies. The first source of data is the recurrence time intervals for 24-hour rainfall storm depth. The recurrence depth data describes the expected intensity of major rainfall events with respect to both rainfall depth and frequency of occurrence.

Table 2-8: 24-Hour Rainfall Depths (inches) for Common Recurrence Intervals (ANR, 2002)

County: Essex
1-yr, 24-hr Rainfall Depth: 2.2''
2-yr, 24-hr Rainfall Depth: 2.3''
10-yr, 24-hr Rainfall Depth: 3.1''
100-yr, 24-hr Rainfall Depth: 5.1''

The second source of data are the annualized daily frequencies of rainfall, which were obtained from the National Climatic Data Center (NCDC), Climate Normals program for 1981 – 2010. The data provides the average number of days per year with measurable precipitation (greater than 0.01 inches) on a county by county basis. This data allows for the conversion of the annual probabilities derived from the recurrence time intervals to daily probabilities. The annualized

estimated daily frequency of measurable rainfall for Essex County is 157 days (4th highest in the state) with 107 days of rain and 50 days of snow. The final source of data are rainfall-intensity frequencies. Hourly precipitation totals throughout the state of Vermont were obtained from the NCDC's Cooperative Observer Program (COOP). Hourly rainfall data were available for 26 COOP locations between 1962 through 2012. Each station is associated with the specific county in which it was located, and the hourly precipitation totals for each station are aggregated by county to yield a frequency distribution of hourly rainfall intensities.

Table 2-5: Bulk PA Funding as a Result of Flooding

Disaster Number	Declaration Date	Incident Type	State	County	Applicant Name	Number of Projects	Federal Share Obligated
1307	11/10/1999	Severe Storm(s)	Vermont	Essex	CANAAN (TOWN OF)	3	\$4,919.71
1995	06/15/2011	Severe Storm(s)	Vermont	Essex	CANAAN (TOWN OF)	7	\$39,691.13

Source: FEMA

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

Inundation and Floodplains

Regarding flood inundation issues, the 2013 Vermont State All-Hazards Mitigation Plan states:

“While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and often times catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man made structures. Channel adjustments with devastating consequences have frequently been documented wherein such adjustments are linked to historic channel management activities, flood plain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities. The 100-year, or “base” floodplain is the national standard for floodplain management. The area is shown on City Flood Insurance Rate Maps (FIRMs) as issued by FEMA. The 100-year floodplain has one chance in a hundred of being flooded in any given year. The probability that a 100-year flood will occur is a statistical determination based on past flooding in an area. This is not to say that a flood of such magnitude cannot occur two years in a row or twice in the same year. The term

only means that in any given year, the odds are 1% that the area will be flooded. The same logic holds true for defining a 500- year flood. In this case, a flood of the 500-year magnitude has a 0.2% chance of occurring in a year. Much flood damage in Vermont occurs along upland streams, damaging private property and infrastructure such as bridges, roads, and culverts. The failure of beaver dams, private ponds and public and private culvert crossings contributes to flood surges and often dramatically increased damage downstream. Homes and other private investments along these streams are generally not recognized as a flood area on FEMA maps of flood hazard zones and, thus, are not typically identified as being vulnerable to flooding or erosion. City plans and zoning regulations have generally not identified these stream corridors as areas needing protective setbacks for development or zoning.”

In general, floods in the area are caused by heavy rains. Springtime rains are often associated with snowmelt. A winter thaw, accompanied by rain often leads to ice jams which also cause riverine flooding. Hurricanes traveling up the east coast of the country produce occasional flooding situations. The most frequent flooding occurs in early spring as a result of snowmelt and heavy rains, but flooding has historically occurred in every season. Flooding has also occurred due to debris collection and ice jams. Notable floods in this area have occurred in several years.

Fluvial Erosion

The town has two priority mitigation actions to accomplish this planning cycle in response to erosion hazards along roadways and the specific nature of these projects will be addressed in the mitigation section. While there has been no mechanism to capture the levels of shoreline erosion in the town, and therefore no true measure of magnitude related to the extent of the issue, it is believed that the current erosion issue at the Leech Stream Water line with a 10-12 foot loss of shoreline per year is the greatest level the town has seen. While this may not capture the greatest erosion levels, historically, the location and the risk the erosion poses to the waterline is a major concern.

Generally, erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the town’s streams and rivers. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *2013 Vermont State All-Hazards Mitigation Plan* contains the following discussion of fluvial erosion:

“Vermont’s landscape has historically contributed greatly to the widespread practice of the channelization of rivers and streams in order to maximize agricultural land uses and facilitate

the development of transportation infrastructure. Channelization, in combination with widespread flood plain encroachment, has contributed significantly to the disconnection of as much as 70% of Vermont's streams from their flood plains. In this unsustainable condition and when energized by flood events, catastrophic adjustments of the channel frequently occur, usually with consequent fluvial erosion damage to adjacent or nearby human investments. All areas of the state suffer equally from fluvial erosion hazards. Some areas have suffered more than others simply because of the location of storm tracks. Transportation infrastructure and agricultural property are the most frequently endangered types of human investment affected by fluvial erosion hazards. Residential, commercial and other municipal properties are also frequently endangered. Changes in watershed hydrology that significantly influence fluvial stability are commonly associated with urbanization or with silvicultural practices. However, watershed scale hydrologic changes have been observed in Vermont as a localized phenomenon either in small, highly urbanized watersheds or in small, rural sub watersheds where clear cutting of a large percentage of the watershed land area has recently occurred. Stream geomorphic assessments and a fluvial geomorphic database maintained by the Agency of Natural Resources have identified main stem rivers typically channelized from 60-95% of their lengths. When human investments and land use expectations include all the land in the valley up to the river banks, there results extreme public interest in maintaining this unsustainable morphological condition despite its great cost and resultant hazard to public safety."

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

- Sources: 1. *A Risk-Based Flood-Planning Strategy for Vermont’s Roadway Network: UVM*
2. *Floodready.vermont.gov*
3. *weather.gov/btv*
4. *Fema.gov/states/Vermont*
5. *floodsafety.noaa.gov/states/vt-flood.shtml*

High Hazard Dams

According to the 2013 *Vermont State All-Hazards Mitigation Plan*,

“The VT Agency of Natural Resources (ANR) Dam Safety Program maintains an inventory of 1205 dams (including 85 ANR owned dams) with impoundments greater than 500,000 cubic feet”.

Failure of any of these dams could result in significant downstream flooding. There are 55 high hazard dams on the dam inventory, none of which are considered at significant risk for failure in the town.

Above Canaan and part of the Connecticut River system is the Murphy Dam, a large earthen dam of Lake Francis. The Murphy Dam was built approximately 70 years ago and impounds a large expanse of the river. This dam is monitored 24 hours per day and is perhaps the highest risk to the communities of Beecher Falls and Canaan. An inundation plan is on file with the State of New Hampshire, State of Vermont, and all towns below the dam for 81 miles until the Centennial Mill Dam is reached in Gilman, Vt. Should this dam breach, it is estimated that within one hour and 40 minutes, a huge standing wall of water would inundate Beecher Falls and the village of Canaan. The peak flow would be 54 feet above the 100-year flood limit at approximately 2.8 hours after the Murphy Dam breach. The elementary and high schools and emergency facilities would be underwater with catastrophic ramifications. An early warning system of reverse 911, combined with sirens, is needed to address this potential disaster. A second evacuation shelter is needed on higher ground. Presently the warning would be dispatched through Derby and there may be a significant (20 minute) lag time depending on accurate warnings from above the Murphy Dam. Another much smaller hydroelectric dam is just north of Route 114 called the Power House Dam. This dam poses little threat to Canaan. Both dams are controlled by the New Hampshire Dept. of Public Service and the N.H. Dept. of Environmental Conservation.

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

2.2 Technological Risks

The following discussion on technological hazards is based upon information from several

sources. While the town understands that beyond natural hazards, most technological/societal-type concerns are vulnerabilities, the section below serves to explain the concerns of the town and give, when known, historical occurrences.

2.2.1. Utilities

Water and Sewer System Failure:

Canaan and nearby Beecher Falls have two municipal systems for water and sewer service. Canaan has a municipal water system that is a spring-fed well. The reservoir is covered, and is gravity fed into the distribution system. A new wastewater treatment facility was built in 2014, which has generators. In case of drought, the municipal system will have to use the well with a backup pump. The springs are in Canada and the water is a chlorinated supply. During the summer of 2015 the town abandoned the use of the spring and draws its water exclusively from the well at Ethan Allen park. Beecher Falls has a separate water supply from New Hampshire. As with any municipal system, concern exists regarding any disruption of service or loss of system integrity. While there is no history of major problems or disruptions with these systems, the town maintains a rigorous maintenance policy and has a comprehensive section in the town plan devoted to these systems (2017 Canaan Town Plan).

Loss of Electrical and Fuel Service:

As in many of the towns in Vermont, Canaan uses a number of different forms of energy, which come from a variety of sources. Vermont Electric Co-Op serves the entire Town of Canaan. Basic house current is available in the villages and along the highways; far up in the hills, there are “off the grid” dwellings. Three-phase electrical service, necessary for heavier uses, is available along Vermont Routes 114, 102, 253, and 141.

Heating oil, propane gas, wood pellets and other stove fuels are supplied by a number of area distributors. Firewood is also locally available. Motor fuels are sold at service stations in and around Canaan. A large natural gas pipeline is located in Beecher Falls, but there are no local connections. Vermont Electric Cooperative upgraded the transmission lines along Route 102 in Canaan to three-phase power in 2015. According to them, this improvement will improve reliability and flexibility to buy from lower-cost power producers. There have no major, sustain power outages in recent memory that posed a threat to town operations or health and safety. However, affordability of residential fuel is an increasing problem and the town will work towards resolution during this planning cycle. Canaan has historically used water power. Eversource of NH has an active hydroelectric generating station in Canaan village, making clean electricity when there is sufficient flow (2017 Town Plan). Affordability remains the largest concern for town regarding its residents. During an extreme cold snap, where heating resources are at an increased demand, the financial impact to some residents can be overwhelming. With increased emphasis on the issue in many areas of the state, resources and mitigation strategies are arising and the town will build its resilience in this area during this planning cycle.

2.2.2. Hazardous Substances

Hazardous Material Storage and Release:

Most hazardous materials in Canaan are located at the Ethan Allen furniture manufacturing plant in Beecher Falls. This is also where the fire equipment and safety equipment are located. It is always a concern that there may be a hazardous materials incident on the highways in and around Canaan. High accident locations are on Harrison Hill and Route 114. Many of these accidents involve moose during the early evening hours in the summer. Canaan fire responds to incidents in neighboring Norton where there is another border crossing and active railroad crossing. Derailments have occurred in the past at this location.

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A major Superfund Amendment and Reauthorization Act (SARA) provision is Title III, also referred to as SARA Title III or the Emergency Planning and Community Right-to-Know Act (EPCRA). EPCRA establishes guidelines for Federal, State and local governments and industry regarding emergency planning and providing communities with information on hazardous chemicals within their jurisdiction. The State of Vermont's implementation of its SARA requirements was approved by the Legislature in 1994. Essex County was designated as an emergency planning district and DEMHS established a Local Emergency Planning Committee, known as LEPC #10, for the county. The function of the LEPC is to carry out duties proscribed in SARA Title III. In addition, Vermont statute dictates that the LEPC shall insure that the local emergency response plan has been implemented upon notification of a release of hazardous chemical or substance, consult and coordinate with municipal emergency service providers, DEMHS and the managers of all HAZMAT facilities within Essex County regarding the facility plan, and review and evaluate requests for funding. Farmers are not required to report agricultural chemicals stored on their properties, but they do not typically store and keep large amounts of these chemicals. There are various sized propane tanks all around town and ones not anchored could pose a threat during a flooding event. Most commonly associated with mobile homes, the town has 34 mobile homes that comprise 6.5% of the grand list.

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in neighboring Norton where there is another border crossing and active railroad crossing. Derailments have occurred in the past at this location.

Canaan has two border crossings into Canada. The border security has increased in the past ten years due to increased smuggling to include humans, however the traffic volumes are moderate compared to other border crossings in Vermont. A new Border Patrol Building was built in 2013 just off Route 114. This increases security due to the location and the number of Border Patrol Officers passing through Canaan on their way to and from the office. Wallace Pond, a summer vacation lake, is half in Canada and half in Canaan. Many summer residents boat freely in these international waters.

No data was available or obtained beyond the hazardous materials release data. This data shows that nearly all such hazardous materials spill incidents consist of accidental discharges of gasoline, diesel or fuel oil when customers or delivery personnel are pumping these products. The majority of spills were in quantities of less than 5 gallons. DEC's *Local Planning and Zoning Options for Water Quality Protection* supports efforts that could increase water quality protection by addressing issues such as: development setbacks from ponds, lakes, rivers and streams; requiring vegetation in watercourse buffer zones; keeping thorough inventories of water bodies; and protecting and maintaining water quality through wetland protection regulations. Water resources often cross town, county, state, and national borders. A watershed's water quality can only be protected or enhanced through the cooperation of the municipalities and landowners.

Road Infrastructure Failure:

The most common consequence to flooding for many Vermont towns is road and bridge (infrastructure) damage and Canaan has sustained infrastructure damage in previously declared disasters. The greatest magnitude of significance in both financial and logistical considerations as was seen during the May floods of 2011 (DR 1995). Seven projects totaled \$39, 691 in Federal funding. Aside from 2011, the town has remained relatively protected from major infrastructure failures resulting from both disaster and non-disaster events, seeing only about \$5,000 in damage-related Federal funding for three projects in 1999 (DR 1307). The town has engaged the community in identifying transportation-related needs via a community survey. Improving and maintaining the condition of roads and bridges and improving safety were highest priorities reported from the survey.

2.3 Societal Risks

The following discussion of societal hazards is based upon qualitative information from discussions with law enforcement professionals as well as quantitative data from the State of Vermont. The 2013 Vermont State All-Hazards Mitigation Plan is also referenced.

Crime:

Vermont crime statistics indicate a total downward trend in crime based on data from 13 years prior when violent crime was increasing and property crime was decreasing. Vermont remains lower on every statistical crime scale in comparison to the country as a whole. The town does not

feel that crime is a major issue currently. However, with a recent increase in drug-related events in the state, some are concerned about the potential for drug-related activity and crime entering their communities and with Canaan’s international border, there exists trafficking concerns. Recent federal funding will allow Vermont to increase the amount of State Troopers and this will serve to increase protection against potential criminal activity and opportunity exists for the local police force to continue its own professional development through training a collaboration with state and county law enforcement and border patrol.

Terrorism:

While the potential for terrorist activity is present in every community, rural communities are not the same as major metropolitan areas. However, the border crossing does pose additional concern for a small community like Canaan. A school-based active shooter is a concern for any community and parent with a child in school. Regarding terrorism in Vermont, the *2013 Vermont State All-Hazards Mitigation Plan* states:

“Terrorism and civil hazards include actions intentionally aimed at threatening lives and property. They may range from a single person on a shooting rampage to a cyber attack that harms computer systems, to the organized use of weapons of mass destruction (WMD). WMD events could involve chemical, biological, explosive or radioactive weapons. DEMHS and Vermont State Police conducted a risk/threat assessment of potential WMD attacks in 2000 that ranked potential targets by State Police district. At that time, no known or suspected terrorists have been identified as operating in Vermont. However, some in the U.S intelligence community believe that radical Islamist/extremist organizations may have small cells in Montreal and Toronto, not far from the US border. In this regard, Vermont is considered a potential transit point for terrorist organizations operating out of Canada who may travel through the state to reach points to the south....Vulnerability studies conducted at the state level have focused on dam security-”

Epidemics and Mass Casualty Incidents:

Fatal or serious contagious diseases are increasingly being considered as hazards. In the US, influenza kills an average of 36,000 people per year. An influenza epidemic on the scale of that which occurred in 1918 could potentially sicken up to 35% of the population, including over 200,000 people in Vermont (Vermont Department of Health, draft *Pandemic Influenza Preparedness and Response Plan*, 2012). Due to the process of manufacturing vaccines, sufficient supply might not be available in the event of a serious outbreak of influenza. Concerns about avian influenza in 2006 prompted the Vermont Department of Health to issue a report, the *Pandemic Preparedness and Response Plan*, outlining the state’s response to an influenza epidemic. There is also concern over how to distribute supplies, enforce quarantines, keep critical personnel from becoming ill, and disseminate information in the case of an epidemic. Other health threats mentioned in the Vermont State All-Hazards Mitigation Plan are water or food supply contamination, bioterrorism, an epidemic affecting farm animals and poultry, and rabid animals. Of these, avian influenza remains a concern for Vermont poultry owners, regardless of size. The Vermont Agency of Agriculture recommends adherence to strict disease prevention measures.

SECTION 3: RISK ASSESSMENT

3.1 Designated Hazard Areas

3.1.1. Flood Hazard Areas

The Town of Canaan is located in the Upper Connecticut River Tactical Basin, in the area north of the Nulhagen River. The Connecticut River extends along the eastern boundary of the Town with New Hampshire. Named surface waters and watercourses in Canaan include: Wallace Pond, Leach Stream, Hall Stream, Morrill Stream, Bolter Brook, Keyer Brook, Clay Brook and Willard Stream. The locations of wetlands are depicted on the “Natural Resources Constraints” map included in the appendix to this Plan.

FEMA-mapped Special Flood Hazard Areas:

Areas of Canaan were mapped by the Federal Emergency Management Agency in 1980 to depict areas of special flood hazard. These areas are depicted on the Flood Insurance Rate Map (FIRM) and Floodway Map, with base flood elevations noted. The Town has been a member of the National Flood Insurance Program since 1980. The Town has flood hazard regulations that regulate development on land that is within the area of special flood hazard area, as depicted on the FIRM. The Town’s flood hazard regulations, which are incorporated in the Town’s zoning bylaw, were last updated in 2008. Membership in the NFIP enables property owners in the FEMA-mapped flood hazard area to obtain flood insurance. It is estimated that approximately 50 structures are in or near the flood hazard areas mapped by FEMA. Wallace Pond, Canaan’s only recreational lake, is situated on the Canadian border, with more than half of the pond in Canada (2017 Canaan Town Plan).

According to the FEMA NFIP report, Canaan has 4 properties in the A-Zone, 6 total policies with \$1,777,700 in coverage. There have been 7 claims since 1978 totaling \$343,539 in pay-outs, the most in Essex County (69% of all pay-outs since 1978). There are no repetitive loss properties in Canaan and there have been no BCX claims. There have been nine LOMCS (FEMA Repetitive Losses/BCX Claims Data Table).

NOTE: BCX claims are ones located out of the SFHA.

3.1.2. Fluvial Erosion Hazard Areas

About two-thirds of Vermont’s flood-related losses occur outside of mapped floodplains, and this reveals the fundamental limitations of the FEMA FIRMs. A mapped floodplain makes the dangerous assumption that the river channel is static, that the river bends will never shift up or down valley, that the river channel will never move laterally, or that river beds will never scour down or build up. River channels are constantly undergoing some physical adjustment process. This might be gradual, resulting in gradual stream bank erosion or sediment deposit – or it might be sudden and dramatic, resulting a stream bank collapse. In fact, this type of flood-related damage occurs frequently in Vermont, due in part to the state’s mountainous terrain. Land near

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

The Agency of Natural Resources has released a State-wide River Corridor map which depicts areas subject to fluvial erosion. These areas are depicted on the River Corridor Map contained in the Plan. In many cases, the River Corridors coincide with the areas mapped on the FIRM. However, the river corridor maps are intended to depict areas at risk of fluvial erosion due to the dynamic movement of water in rivers and streams, whereas the FIRM depicts areas subject to inundation. For that reason, areas like wetlands that are depicted on the FIRM will not be mapped on the River Corridors. Areas that are currently within the Statewide River Corridors in Canaan are not subject to the local flood hazard regulations unless they coincide with the FIRM areas. There are approximately 15 structures within the mapped River Corridor.

Repetitive Loss Properties

The town has no repetitive loss properties (buildings or homes).

3.2 Non-designated Hazard Areas

3.2.1. Ice Storm Damage

The historic impacts of ice storms in Canaan are minimal in comparison to other areas of the state. According to regional FEMA ice accumulation maps, the greatest ice accumulation for the town was between .55-.99 inches. While no formal measurements were obtained, the lower estimate is likely to describe the impact of the 1998 storm for the town.

1998 data: <https://www.fema.gov/disaster/1201>

3.2.2. Infrastructure and Buildings at Risk

Infrastructure within the River Corridor include the wastewater treatment plant, and the Town well located on Leach Stream. The Town of Canaan has made considerable progress in upgrading infrastructure to mitigate against future flood losses. In 2012, a number of culverts were replaced and upsized on Kemp Hill. In 2015, a Better Back Roads grant funded ditching and stone-lining along roads on Canaan Hill, and in 2016, a new grant is funding additional work on Canaan Hill which will involve replacing 7 undersized culverts.

Another area that floods consistently after several days of heavy rains is the intersection of Halls Stream Road and River Road. River Road extends along the Connecticut River on the eastern edge of Town. Although it appears that nothing short of elevating the road 10 feet will resolve this flooding issue, the Town mitigates risks to people from this flooding by working with the fire department to set up road blocks after periods of heavy rain to alert motorists to avoid the

intersection. A privately-owned home on Leach Stream near Rt. 114 is threatened by erosion, as is the road in this location. It is critical to continue to monitor this situation.

Houses on Wallace Pond are also threatened by flood hazards. Leach and Morrill Streams flow into Wallace Pond. By regulating development in river corridors upstream of Wallace Pond, increased flood hazards to homes in this area can be avoided. It is also noted that in the winter, ice flowing downstream piles up on the shore of Wallace Pond (2017 Canaan Town Plan).

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

While Canaan has had a history of flooding, the financial impact has been minimal in comparison to many others in the state.

Table 3-1: KEY:

DR	Date	Type
1307	11/10/1999	Severe Storm(s)
1995	06/15/2011	Severe Storm(s)

Table 1-2: Canaan, FEMA-declared disasters

<i>Disaster Number</i>	<i>Declaration Date</i>	<i>Incident Type</i>	<i>State</i>	<i>County</i>	<i>Applicant Name</i>	<i>Number of Projects</i>	<i>Federal Share Obligated</i>
1307	11/10/1999	Severe Storm(s)	Vermont	Essex	CANAAN (TOWN OF)	3	\$4,919.71
1995	06/15/2011	Severe Storm(s)	Vermont	Essex	CANAAN (TOWN OF)	7	\$39,691.13

Sources: FEMA and the 2017 Canaan Town Plan

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

3.3 Hazard Assessment and Risk Analysis

Although estimating the risk of future events is far from an exact science, the Planning Team used best available data and best professional judgment to conduct an updated Hazards Risk Estimate analysis, which was subsequently reviewed and revised by town officials in June of 2017. This analysis assigns numerical values to a hazard’s affected area, expected consequences, and probability and supports the inclusion of all profiled hazards in this plan. This quantification allows direct comparison of very different kinds of hazards and their effect on the town and serves as a method of identifying which hazards hold the greatest risk based on prior experience and best available data. The following scoring system was used in this assessment:

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

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

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

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

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

3.3.1. Natural Hazards

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

- Severe Winter Storm (36)
- Flooding (32)
- Extreme Cold (32)

Flood-related disasters have had the greatest financial impact on the town. While no deaths or injuries have been recorded for declared or non-declared disasters, the potential for health and safety risk during a severe winter storm are considered higher than that posed by a flooding event. Lightning and high winds further the risk for power loss and while high winds can occur any time of year (and normally occur in unison with rain or snow events), lightning is isolated to warmer months.

Table 3-2 Natural hazards risk estimation matrix

Canaan Hazard & Risk Analysis: NATURAL HAZARDS	Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure Urban Fire	Wildfire	Winter Storm	Extreme Cold
	Area Impacted Key: 0 = No developed area impacted 1 = Less than 25% of developed area impacted 2 = Less than 50% of developed area impacted 3 = Less than 75% of developed area impacted 4 = Over 75% of developed area impacted	1	3	2	1	0	1	2	1	4
Consequences										
Health & Safety Consequences Key: 0 = No health and safety impact 1 = Few injuries or illnesses 2 = Few fatalities or illnesses 3 = Numerous fatalities	0	1	0	0	0	1	1	1	1	1
Property Damage Key: 0 = No property damage 1 = Few properties destroyed or damaged 2 = Few destroyed but many damaged 3 = Few damaged but many destroyed 4 = Many properties destroyed and damaged	0	1	1	1	0	1	2	1	1	1
Environmental Damage Key: 0 = Little or no environmental damage 1 = Resources damaged with short-term recovery 2 = Resources damaged with long-term recovery 3 = Resource damaged beyond recovery	2	2	1	1	2	0	1	0	0	0
Economic Disruption Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 2 = Low direct and high indirect costs 3 = High direct and high indirect costs	2	2	1	2	1	1	1	1	2	2
Sum of Area & Consequence Scores	5	9	5	5	3	4	7	4	8	8
Probability of Occurrence Key: 1 = Unknown but rare occurrence 2 = Unknown but anticipate an occurrence 3 = 100 years or less occurrence 4 = 25 years or less occurrence 5 = Once a year or more occurrence	1	4	3	4	1	2	2	1	4	4
TOTAL RISK RATING Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence	5	36	15	20	3	8	14	4	32	32

3.4 Hazard Summary

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

1. Flooding
2. Severe Winter Storm
3. Extreme Cold

It should be noted that the profiled hazard are likely to be the cause of the highest-rated technological vulnerabilities. Flooding is the highest rated hazard for Canaan due to previous damage events and subsequent costs to repair. Within each of the highest rated hazards, there exists the potential for the secondary, but no less important, consequence of increased financial demand on residents as a result of an event. While winters in Vermont are characterized by cold weather, recent increases in the duration of extremely cold temperatures increase the costs of heating energy and this is a challenge that the state and local communities are being forced to address.

SECTION 4: VULNERABILITY ASSESSMENT

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

Of the profiled hazards, the following vulnerability rating (high, moderate, low) is given below. This vulnerability rating is based on the disaster case history for the town and when the greatest financial impact was seen due to the disaster. The specific vulnerability to the population as a whole or any specific sub-population (e.g. elderly) is subjective because there is no historical data to rank vulnerability to health and safety of residents, workers or travelers.

Severe winter storm: Moderate

Summary: While all structures are vulnerable to major snow loads, there is little evidence to support concern over structure failure due to snow loads on roofs, ice on gutters, etc. Town snow removal equipment is vulnerable to damage with greater use, especially during emergency situations as well as road damage from plowing. Populations caught outdoors, commuting or working outside during a severe winter storm are more vulnerable to cold-related injury and/or snow related accidents but winter comes every year and residents and the town are accustomed to making intelligent decisions regarding safety and protection of infrastructure. Special populations (e.g. aging, disabled, etc.) are more vulnerable in terms of mitigating structure loads, hazardous travel and relocating to safety.

Flooding: High

Summary: The greatest vulnerability for the town is flooding and this is specific to transportation routes and infrastructure more-so than buildings and people. Current demands/priorities for the highway department are directly linked to past or potential flood damage. While the magnitude of damage has been slight, there is a consistent effort to mitigate flood and flood-related damage to the town's infrastructure. In the event of a major flood, most of the land lying between Vermont Route 102 and the Connecticut River would be flooded. Fortunately, practically all of this land is currently in agricultural use. In order to insure against the damage and inconvenience a major flood would cause, other types of development should be somewhat limited in this general area. Substantial flooding also occurs along the banks of Leach and Hall Streams. A dam failure would have catastrophic implications on homes, buildings, people and equipment.

Extreme Cold: Moderate

Summary: The relationship between weather patterns, marginal economic resilience and the rising costs of heating energy creates concern for many communities, including Canaan.

4.1 Additional Vulnerability Estimation Matrices

The following matrices are used to estimate vulnerabilities as well and will be addressed in the next section. According to the Hazard and Risk Estimation for [Canaan], the following technological hazards received the highest risk ratings out of a possible high score of 80:

- Power Loss (14)
- Hazardous Materials Incident (20)
- Gas (heating oil)/ Fuel loss (30)

The town is vulnerable to power loss and in colder months, this could place the residents of the town in harm's way. While the history of major power loss over extended periods of time is minimal, there have been repetitive short-term outages but in very short duration due to advancements in power company detection zones and ability to repair quickly. With a designated high accident location and a town-wide 50mph speed limit, the concern for a hazardous substance spill resulting from a transportation accident remains, especially when driving conditions are bad. With the recent severity of cold temperatures lasting for longer durations, accessibility of heating fuel is a concern and this accessibility is defined by transportation issues resulting from a major storm where roads are impassable and from resident's ability to pay for the fuel. As with many disaster scenarios, the hazards categories are related to one another. Natural hazards can cause a technological problem which can then cause a societal problem. In mitigating a natural hazard, there is the potential for a cascade of protection for both the technological and societal considerations the town has defined as concerns.

Table 3-3 Technological Vulnerability Estimation Matrix

Canaan Hazard & Risk Analysis: TECHNOLOGICAL VULNERABILITY		Gas/Fuel Service Loss	Hazardous Materials Incident	Power Loss	Radiological Incident	Sewer Service Loss	Telecommuting-Carbons Failure	Water Service Loss	Major Transportation-Incident	Border Issue
Area Impacted										
Key: 0 = No developed area impacted										
1 = Less than 25% of developed area impacted										
2 = Less than 50% of developed area impacted										
3 = Less than 75% of developed area impacted										
4 = Over 75% of developed area impacted		3	2	4	4	4	4	4	1	1
Consequences										
<i>Health & Safety Consequences</i>										
Key: 0 = No health and safety impact										
1 = Few injuries or illnesses										
2 = Few fatalities or illnesses										
3 = Numerous fatalities		1	2	1	2	1	1	1	2	1
<i>Property Damage</i>										
Key: 0 = No property damage										
1 = Few properties destroyed or damaged										
2 = Few destroyed but many damaged										
3 = Few damaged but many destroyed										
4 = Many properties destroyed and damaged		2	1	1	1	0	0	0	1	0
<i>Environmental Damage</i>										
Key: 0 = Little or no environmental damage										
1 = Resources damaged with short-term recovery										
2 = Resources damaged with long-term recovery										
3 = Resource damaged beyond recovery		2	2	0	2	1	0	1	1	0
<i>Economic Disruption</i>										
Key: 0 = No economic impact										
1 = Low direct and/or indirect costs										
2 = High direct and low indirect costs										
2 = Low direct and high indirect costs										
3 = High direct and high indirect costs		2	3	1	1	2	1	3	1	1
Sum of Area & Consequence Scores		10	10	7	10	8	6	9	6	3
Probability of Occurrence										
Key: 1 = Unknown but rare occurrence										
2 = Unknown but anticipate an occurrence										
3 = 100 years or less occurrence										
4 = 25 years or less occurrence										
5 = Once a year or more occurrence		3	2	2	1	1	1	1	2	1
TOTAL RISK RATING										
Total Risk Rating =		30	20	14	10	8	6	9	12	3
Sum of Area & Consequence Scores										
x Probability of Occurrence										

3.3.2. Societal Vulnerabilities

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

- Epidemic (24)
- Economic Recession (6)
- Terrorism (8)

The likelihood of an epidemic is difficult to gauge, but its consequences could be severe. An epidemic can involve non-human entities as well. The current concern of Avian Influenza has the state Agency of Agriculture issuing strict guidelines for communities like [Canaan] that have a substantial amount of poultry farms of varying size and structure. In terms of human epidemics, the largest organizations in the town (and the ones with the highest populations on any given day would be most susceptible to becoming zones of high attack rates and would look to State Health Department recommendations on closure notices. An economic recession could have major implications for residents already vulnerable. An act of terrorism is unlikely in the town but due to the proximity to an international border and major metropolitan areas like New York City, Boston and Montreal, an event elsewhere could have a negative impact on the town.

Table 3-4 Societal hazards risk estimation matrix

Canaan Societal Vulnerabilities	<i>Crime</i>	<i>Civil Disturbance</i>	<i>Terrorism</i>	<i>Epidemic</i>	<i>Economic Recession</i>	<i>Key Employer Loss</i>
Area Impacted Key: 0 = No developed area impacted 1 = Less than 25% of developed area impacted 2 = Less than 50% of developed area impacted 3 = Less than 75% of developed area impacted 4 = Over 75% of developed area impacted	1	1	1	3	4	3
Consequences						
Health & Safety Consequences Key: 0 = No health and safety impact 1 = Few injuries or illnesses 2 = Few fatalities or illnesses 3 = Numerous fatalities	1	1	2	2	0	0
Property Damage Key: 0 = No property damage 1 = Few properties destroyed or damaged 2 = Few destroyed but many damaged 3 = Few damaged but many destroyed 4 = Many properties destroyed and damaged	1	1	1	1	0	0
Environmental Damage Key: 0 = Little or no environmental damage 1 = Resources damaged with short-term recovery 2 = Resources damaged with long-term recovery 3 = Resource damaged beyond recovery	0	0	2	3	0	0
Economic Disruption Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 2 = Low direct and high indirect costs 3 = High direct and high indirect costs	1	1	2	3	2	1
Sum of Area & Consequence Scores	4	4	8	12	6	4
Probability of Occurrence Key: 1 = Unknown but rare occurrence 2 = Unknown but anticipate an occurrence 3 = 100 years or less occurrence 4 = 25 years or less occurrence 5 = Once a year or more occurrence	1	1	1	2	1	1
TOTAL RISK RATING Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence	4	4	8	24	6	4

4.2 Critical Facilities

The Center for Disaster Management and Humanitarian Assistance defines critical facilities as: “Those structures critical to the operation of a community and the key installations of the economic sector.” The town plan lists all Canaan properties and their use. With this, there is no evidence to suggest that any critical facility is highly vulnerable during any hazard event but the school is in the flood hazard area but no history of flooding, it remains a low vulnerability.

4.3 Infrastructure

Flooding is the highest risk profiled hazard and town infrastructure has high vulnerability to damage during major flood events. There are 46.1 miles of highway in Canaan of which Vermont Routes 102, 114 and 253 accounts for nearly half or 17.84 miles. Town Highways consist of: Class II: 2.35 miles Class III: 15.08 miles Class IV: 10.86 miles

4.3.1 Bridges, Culverts, and Dams

Bridges:

There are only two bridges in Canaan: Hudson Road and Old County Road. Both are considered of low importance and are currently listed in “unknown” condition on VTCulverts.org.

<https://vtculverts.org/bridges#list>

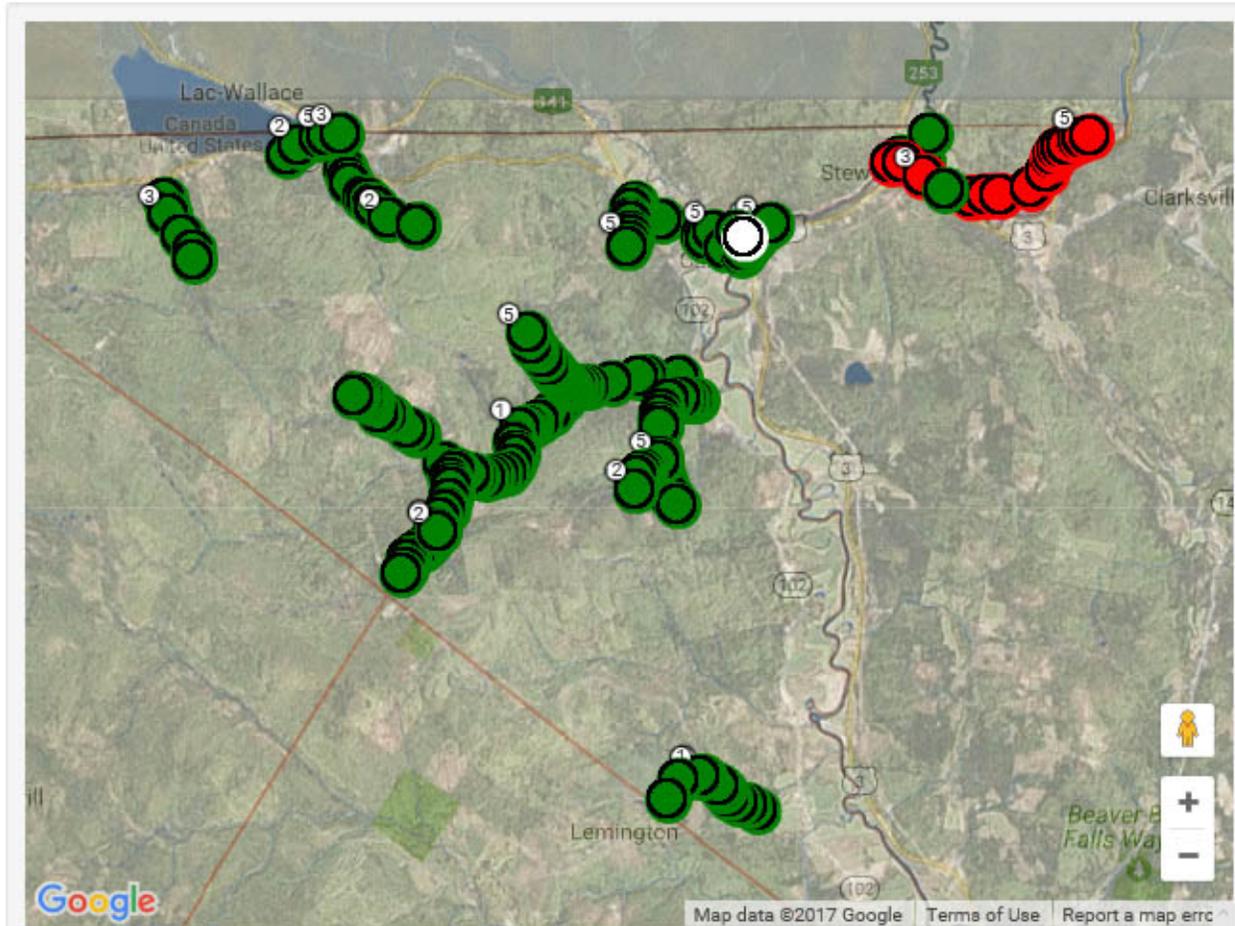
Culverts:

According to the states online tracking site (VTCulverts.org), Canaan has a total of 191 culverts with the following ranking:

1 Unknown
0 Urgent
1 Critical
33 Poor
44 Fair
98 Good
14 Excellent

Of these, only the culverts on River Road of classified as “High Importance” (designated in the red zones in the map below. All others are considered low importance (green). Undersized culverts remain the biggest concern for the town.

Table 2-4: Vulnerability Ranking Map for Canaan Culverts



Source: <https://www.vtculverts.org/structures>

Dams:

Should the Murphy Dam breach, it is estimated that within one hour and 40 minutes, a huge standing wall of water would inundate Beecher Falls and the village of Canaan. The peak flow would be 54 feet above the 100-year flood limit at approximately 2.8 hours after the Murphy Dam breach. The elementary and high schools and emergency facilities would be underwater with catastrophic ramifications. An early warning system of reverse 911, combined with sirens, is needed to address this potential disaster. A second evacuation shelter is needed on higher ground. Presently the warning would be dispatched through Derby and there may be a significant (20 minute) lag time depending on accurate warnings from above the Murphy Dam. There is no history of a dam breach/failure in the town.

4.3.2 Water, Wastewater and Natural Gas Service Areas

The Town of Canaan has two Fire Districts. The water is metered in both districts and then there is a debt service fee also included in the quarterly statements. Canaan Fire District #1 annual water rents is approximately \$55,400.00 and the debt service charge is \$64,158.00 annually. Canaan Fire District #2 annual water rents is approximately \$34,500.00 and they have two debt service charges totaling \$25,786.00 annually. The Canaan Wastewater Treatment charges are approximately \$190,700.00 annually. A loss of one or both systems would have a significant impact on both residents and the town. However, with no history of a loss of service to the municipal water/sewer systems, vulnerability is low.

4.4 Estimating Potential Losses in Designated Hazard Areas

Future losses should be lessened through mitigation of the repetitively flooded properties, most of which are roads, bridges and culverts. The FIRM maps are not compatible with the GIS maps containing contour, rivers, roads and structures and it is not possible to estimate the amount of potential loss at this time. It is recommended that the NFIP maps be redone using the Vermont Geographic Information System standards based on orthophoto mapping. The Median Housing Value (MHV) for Canaan in 2014 was \$101,240. The Equalized Value for all properties in Canaan in 2014 was \$84,100,000. The past FEMA damages amounted to \$25,229 over 16 years so the damage is not expected to be large unless the Murphy Dam was to breach. Under this scenario, the entire Connecticut River valley would be devastated with total loss of property and life. This would include Beecher Falls and the village area plus surrounding properties.

4.5 Land Use and Development Trends Related to Mitigation

The total population has decreased from 1107 to 972 between 2003 and 2010. The Town of Canaan has adopted a local plan and zoning regulations to guard against future development in inappropriate locations such as flood prone areas. Canaan is a member of the National Flood Insurance Program (NFIP). Canaan is not a rapidly developing community and is not expected to have a rapid influx of new development in the near future. All development strategies are carefully reviewed by the Zoning or Development Review Board. All buildings being improved in or near frequently flooded areas are required to elevate or provide additional mitigation measures. Canaan's zoning bylaws provide for four residential districts, accommodating a variety of residential housing types. Multi-family residences are permitted in the Residential Commercial zoning district, along with two-family and single-family homes. One and two-family homes are permitted in the Residential One-Half, Residential One, and Residential Two districts. Single family homes with accessory apartments are permitted in the Agricultural, Rural Lands, and Wallace Pond districts. Mobile Home Parks are permitted as conditional uses in all zoning districts, and have specific standards. The Canaan zoning bylaw also allows for flexibility in development through its "planned unit development" provisions.

4.5.1. Proposed Land Use

The Zoning Bylaws hold to the recommended practices under the NFIP and all continued compliance and participatory requirements are managed by the Zoning Administrator. The

Administrative Officer (AO) enforces the flood hazard regulations, which are integrated with the City's zoning regulations. The AO receives and reviews permit applications and forwards for board review as appropriate. In accordance with FEMA requirements, the AO maintains records of all permits issued for development in areas of special flood hazard; elevations, in relation to mean sea level, of the lowest floor, including basement, of all new or substantially improved buildings; elevations, in relation to mean sea level, to which buildings have been flood proofed; flood proofing certifications; and all variance actions, including justification for their issuance.

4.5.2. Land Use Goals

The town is committed to retaining its rural character and its economic base of working farms and productive forests without hampering the landowner's ability to profit from either the use or sale of his or her assets.

4.5.3. Land Use Strategies

The town will continue to encourage stewardship of its natural resources through information and education and promote viability of resources through Current Use, Vermont Land Trust and Local Vermont products.

4.5.4 Future Development and Housing

Despite the advantages of attracting new businesses and housing, the town does not foresee major development occurring in the next five-year planning cycle. Other than individual real-estate transactions, there is little anticipated business development projected.

4.5.5 Housing

Residential development is concentrated in the two village areas of Beecher Falls and Canaan. One mobile home park with 18 units is situated in the Village of Canaan. Most new housing development is occurring in areas outside the village centers. Anecdotal evidence suggests that the people moving to Canaan today are entrepreneurs seeking to live in a rural setting with opportunities for outdoor recreation.

Seasonal homes and camps are located primarily around Wallace Pond and along Canaan Hill, Kemp Hill, and Todd Hill Roads, with a few others scattered throughout the Town. While some are owned by local residents and used primarily as summer cottages, hunting camps or winter retreats, others are owned by vacationing non-residents who may wish to convert these homes to year-round use.

4.5.6 Residential Development Patterns

Since 2008 there have been 21 subdivisions resulting in the creation of 27 new lots. From 2010 to 2015 there have been eight (8) permits issued for the construction of new single-family dwelling units. Using the terrain to help conserve energy should be considered in land development. Building on south facing hillsides exposes buildings to more solar energy, reducing the need for conventional heating. Earth sheltered homes can also be less costly to heat and cool. Planting deciduous trees to the west also provides shade and reduces the need to expend energy to cool homes in summer.

Homes that are clustered require shorter networks of streets and utilities. Shorter streets and electrical lines require less energy to build and maintain. In addition, with shorter electrical lines there is less line loss. This alone can result in a significant savings of money and energy. (2017 Canaan Town Plan).

4.5.7 Housing Goals and Objectives

It is recognized that attractive housing options can increase the quality of life in Canaan, and make the Town more attractive to companies seeking to relocate or expand in Canaan. The 2011 Survey indicated that providing retirement housing and housing for elderly is a high priority for residents. In addition, a range of attractive housing products can serve to attract families with children to the Town, supporting enrollment in the Canaan Schools. One of the challenges that the Town needs to address is the high cost of renovation of the older housing stock.

SECTION 5: MITIGATION STRATEGIES

The 2005 Plan listed the following Mitigation Actions, the current status (progress) is added in the far-right column:

Project/Priority	Mitigation Action	Who is Responsible	Time Frame and Potential	Initial Implementation	PROGRESS
Reverse 911 or Siren/HIGH	Will provide an early warning system for flooding.	Fire Chief and Selectboard	ASAP pending funding. FEMA — FMA, HMGP	Seek cost of implementation, public education	Meetings held/cost prohibitive. Town is part of 5-town region-wide Dispatch and current upgrade may allow for add-on system. Flexibility of new system will allow for professional dispatch (old dispatch was at customs)

Generator with hookups/ HIGH	Backup power for the school and the town hall which serves as emergency operations center. Sewer Plant	Fire Chief and Selectboard	School is Done. Town Hall-Dec. 2016 Sewer Plant-Dec.2018	Done. Have applied for a grant for EOC. Will seek funding	ACHIEVED Town office (new generator in 2016 and border patrol building which can be used for emergency have back-up and American legion (no generator) and northland restaurant
New Fire Station/ HIGH	Canaan does not own its own building. If Ethan Allen goes out of business, the building goes too.	Fire Chief, Selectboard	2015-2020, local resources, FEMA, USDA Rural Development loan/grant	Discuss options between town and Ethan Allen.	Could not find way to pay for move but fire, in anticipation of flooding and assuring access will stage vehicles around town to assure all of the town has coverage
Training for new volunteers/ HIGH	Need new volunteers to take place of retiring older volunteers	Fire Chief	2015-2020— Fire Grant training	Schedule training and recruit volunteers.	School program involves kids in first response and fire department. Fully staffed.

The greatest advancement in mitigation planning the town has achieved since 2005 has come from the direct experiences in responding to, and recovering from, the major disasters that have impacted the town in the last decade. These disasters, have, to a very large extent, redefined how the entire state views and addresses mitigation. The work of state agencies, including those devoted to transportation, planning and emergency management have also changed the way towns go about their day-to-day operations and planning, both in emergency situations and out. It is because of this that the town views this update as the new standard in their mitigation planning efforts. This plan allows for the systematic documentation of efforts in the next planning cycle in formats that the town will continue to use. There has not been a formula for ongoing, documented, mitigation efforts prior to this update. While the town has learned a great deal, and put much of the knowledge to practice in its highway department and planning efforts, these have not come as a result of the 2005 plan. We feel that the implementation matrix captures specific progress in certain areas but more importantly, gives the town a guide from which all future action and updates can be based on.

5.1 Town Goals and Policies that support Hazard Mitigation

1. Mitigate flood hazards and maintain good water quality by undertaking restoration projects, reducing stormwater runoff from new development, and assuring long-term protection of the River Corridor from incompatible development and uses.

- a. Work with staff engineers at the VT Department of Environmental Conservation (DEC) to monitor the erosion problems at Leach Stream near Route 114, and undertake corrective action as necessary.
- b. Amend the Flood Hazard regulations to regulate development within the River Corridor Areas mapped by DEC, in order to mitigate flood hazard risks and protect investments made in restoration projects, and receive a higher amount of funding under ERAF.
- c. Consider establishing impervious coverage limitations as part of the Town's zoning district standards to limit stormwater runoff that can contribute to flooding and degrade water quality.
- d. Participate in regional flood hazard area education events to inform local residents.
- e. Encourage the public to establish conservation easements in critical locations.

5.1.1. Community Goals

- a. Continue maintenance and resilience actions for municipal systems.
- b. Take advantage of the UVM/ACCD mobile home park preparedness programs to support resiliency of this disproportionately impacted population during disasters.
- c. Consider implementation of special population tracking within the community where-by residents unable to drive or that have no one to depend on can self-identify for inclusion in a maintained data-base so that rescue personal and emergency managers can account for this demographic.
- d. Work with residents, NVDA, rescue services, Vermont EMS and the LEPC to accomplish community outreach to develop understanding of the scope of practice of EMS in rural Vermont.
- e. The Selectboard and Planning Commission shall pursue grant funding for shelter emergency generators.
- f. Selectboard and Planning Commission shall continue to study the availability of firefighting water supplies, recommend locations and install dry hydrants where needed.
- h. The Selectboard and Planning Commission shall pursue grants and program participation for the provision of wireless and broadband communications.

5.1.2. Capital Improvement Goals

- a. Provide services and facilities deemed necessary for the orderly and rational development of the Town.
- b. Selectboard shall investigate options for the construction of public building or buildings to house Road Department equipment and operations and possibly an animal holding facility for dogs impounded by the Town and propose such facility to the voters.

5.1.3. Public Participation Goals

- a. Continue to solicit input regarding planning issues from town residents and from other entities which can help to offer solutions and insight into the problems the Town faces both now and in the future via formal meetings and advertised opportunities for input.
- b. Utilize the LEPC and NVDA to increase awareness, enhance planning and engage in exercises that address needs in the community.

5.1.4. Regulatory Devices Goals

- a. Continue to use the Zoning Bylaws. The bylaws have been established to conform to, and be in harmony with, the Vermont Municipal and Regional Planning and Development Act. Any conflicts that are identified between the two documents will defer to Title 24 VSA, Chapter 117 as the prevailing authority
- b. Maintain and continue a Capital Expense Budget and Program for the purpose of ensuring that the rate of growth does not outstrip the town's ability to pay for the associated necessary services such as roads, schools, police and fire protection, solid waste, etc.
- c. Develop and maintain a "No Adverse Impact" (NAI) approach to flood hazard management by institutionalizing the best practices set forth by the ASFPM.
- d. Utilize best practices in flood-plain management for farm-related development in town.

5.1.6 Natural Resources

- a. Ensure that the existing health ordinance is enforced to maintain protection of both surface and groundwater supplies.
- b. Ensure that permits issued for development near sensitive areas, such as steep slopes, high elevations, wetlands, scenic vistas and wildlife habitats, contain conditions assuring conformance to the goals set forth by the state of Vermont and when applicable and feasible, those defined as best practices by floodplain management organizations such as the ASFPM as well as those set forth in this plan and the most recent town plan.
- c. The town should work with the NVDA and ACCD to continue the process of identifying the Town's land conservation priorities, and to the degree possible, link them to broader regional conservation work.
- d. In line with the VTrans mission statement regarding climate change, the town remains committed to:

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

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

- Slowing, Spreading, and Infiltrating Runoff (The State Surface Water Management Strategy is found at <http://www.watershedmanagement.vt.gov/swms.html> and <http://www.watershedmanagement.vt.gov/stormwater.htm>)
- Avoiding and Removing Encroachments. http://www.watershedmanagement.vt.gov/rivers/htm/rv_floodhazard.htm http://www.watershedmanagement.vt.gov/rivers/docs/rv_RiverCorridorEasementGuide.pdf
- River and Riparian Management: DEC has prepared a compendium of *Standard River Management Principles and Practices* to support more effective flood recovery implementation; improve the practice of river management; and codify best river management practices in Vermont. The document compiles the most current river management practices based on the best available science and engineering methods to create consistent practice and language for risk reduction while maintaining river and floodplain function. Best practices are established to address common flood damages, including:
 - Erosion of banks adjacent to houses and infrastructure
 - Erosion of road embankments
 - Channel movement across the river corridor
 - River bed down-cutting that destabilizes banks, undermines structure foundations, exposes utility crossings, and vertically disconnects rivers from adjacent floodplains

- Bridge and culvert failure

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

5.1.7. Policies

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

5.1.8. Transportation Plan

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

- a. Maintaining safe operating conditions on the present system of town roads through design and modification to keep traffic at appropriate speeds and to assure the safest possible driving conditions, including consideration of additional paving (though only on portions of roads prone to damage) should state funding become available.
- b. Protection of existing town roads from flood damage and uncontrolled storm water runoff.
- c. Preserving the capacity of town roads and maintain adequate traffic flows and safety.
- d. Support the road maintenance crew through Town-provided training sessions. This includes ICS training along with the Road Commission (Selectboard).
- e. Support policies and procedures that ensure longevity of essential town-equipment and develop and maintain MOU's with neighboring towns related to equipment use during emergencies.
- f. Continue long term access opportunities to gravel and sand deposits for future road maintenance use.
- g. Consider developing a standard operating procedure (SOP) based on ICS principles for highway department response events were coordination, communication and support are at a heightened level.

5.1.9. Utilities and Facilities Goals

- a. Maintain current relationships with the Vermont State Police and Rescue for police and emergency medical services, respectively.
- b. Develop policies and procedure that ensures equipment longevity to the greatest extent possible.

- c. Develop a retention plan for highway department personnel to help avoid high turnover and preserve institutional memory.
- d. Promote high-speed internet access in the Village to encourage local businesses to reside in [Canaan].
- e. Ensure adequate provision of water sources for fire suppression by requiring dry hydrants, fire ponds, water storage, or other measures where appropriate. The Planning Commission will work with developers and property owners on this task.

5.1.9.1. Educational Goals

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

5.2 Existing Canaan Actions that Support Hazard Mitigation

Canaan has been proactive in planning its future as well as protecting its citizens from potential disasters. The fire department is well trained although there is a fear of less members due to a declining volunteer population. The school is their shelter but it is located in the flood plain. The shelter has been certified by the Vermont Red Cross since the 2005 Local Hazard Mitigation Plan. Canaan is located in such an area that is remote and has several high hazard potentials that could impact the community. Other possible shelter locations are the American Legion and the U.S. Customs Border Station. Canaan has recently updated their Local Emergency Operations Plan. They have representatives that regularly attend the Local Emergency Planning Committee (LEPC) 10 meetings quarterly in Derby. The fire department has upgraded its equipment through Homeland Security funds, including communication equipment. The town has adopted the recommended Highway Codes and Standards that require regular upgrades on bridges, highways, ditching and culverts to avoid flood damage. A number of culverts have already been upgraded. Canaan has adopted a Town Plan and Zoning. They are a member of the National Flood Insurance Program. All new development must be reviewed by the Zoning Board of Adjustment. Permit requests range from 20 to 60 in any given year. Most are for subdivisions, renovations and existing building modifications. All development in or near the identified flood areas must conform to zoning standards. Canaan checks its water system daily as required by State regulations. The system is locked to protect against vandalism or unwanted substances. The Town acquired Riverside Water Works from Ethan Allen in 2007 and was awarded a grant/loan from USDA to study/construct updates to the system. Phase 1 of this was completed in 2010 with a new 150,000-gallon storage tank being constructed above Route 3 in Stewartstown, a new eight-inch main on Route 3 including fire hydrants, a source well replacement and individual

water meters. Phase 2, involving the installation of approximately 6300 linear feet of 8” water main and 1200 linear feet of 2” water main to replace deteriorated galvanized water mains, was completed in 2011.

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The Selectboard has successfully pursued funding to address needs. Exemplified by Better Back Roads, Structures Grants and FEMA funding, the town has been able to enhance its resilience and overall preparedness. The town has addressed its current and future needs and by and large, road improvement projects remain the primary focus for the town and the areas identified were selected based on the condition of culverts and ditches and primarily focused on runoff issues particularly as the incidence of heavy storms has increased. In many cases, culverts properly sized for normal rain events are overwhelmed by the severe ones. The town will seek local, state and federal funds to address the sites identified as priorities. Canaan will assure the funds necessary to complete one major project each year for the next 5 years and will keep its culvert inventory current to improve its institutional memory. Related to flood resilience goals and strategies.

5.2.1. Flood Resilience Goals:

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

5.2.2. Flood Resilience Strategies:

- Identify and protect [Canaan]’s natural flood protection assets, including floodplains, river corridors, other lands adjacent to streams, wetlands, and upland forested cover
- Adopt flood hazard regulations that at a minimum, protect property from known risks
- Review and evaluate statewide river corridor information, when it becomes available
- Consider adopting regulations that will protect erosion prone areas for additional Development and encroachment
- Maintain and regularly update the Local Emergency Operations Plan.
- Continue to meet the VTrans Road and Bridge standards. Participate in regional Road Foreman trainings and Transportation Advisory Committee meetings to stay abreast of flood resilience measures for the Town’s roads and bridges
- Continue to update the Town’s transportation infrastructure information in the Vermont Online Bridge and Culvert Inventory Tool
- Upgrade undersized and failing culverts
- Maintain a Local Hazard Mitigation Plan
- Equip the town’s emergency shelter (the school) with a generator

Table 5-1: Existing municipal actions that support hazard mitigation, Canaan

Type of Existing Protection	Description /Details/Comments	Issues or Concerns
Emergency Response		
Police Services	Local, County, Border Patrol and Vermont State Police	None at this time
Fire Services	Canaan VFD	None at this time
Fire Department Personnel		none
Fire Department Mutual Aid Agreements	Mutual Aid (4 participants)	None at this time
EMS Services	EMS 45 th parallel is new out of Colebrook and supports Canaan Fire and Rescue	EMS 45 th parallel is new and increases response time efficiency and coordination
Other Municipal Services		
Highway Services	Town Highway Department	none
Highway personnel	1.5 FTE field personnel	
Water / Sewer Department	Municipal 1.5 FTE	New sewer system in 2014. Upgraded receiver assists other towns waste which increases revenue.
Planning and Zoning personnel	Yes	None at this time
Residential Building Code / Inspection	No	None at this time
Emergency Plans		
Local Emergency Operations Plan (LEOP)	2017	Assure sheltering plans and contact information is up to date and vulnerable populations are addressed.
School Emergency/Evacuation Plan(s)	2017	Increased collaboration (with town staff, school, LEPC, NVDA), knowledge of roles and drills are next step. Grace Community Church is backup location for evacuation.
Municipal HAZMAT Plan	None	Not required but enhanced knowledge via HMEP funded transportation study conducted by LEPC would benefit town.
Shelter, Primary	School	Work with ARC's Shelter Initiative and obtain certification, training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.
Replacement Power, backup generator	yes	None
Shelter, Secondary:	American Legion	None
Replacement Power, backup generator	None	
Municipal Plans		
Town / Municipal Comprehensive Plan	2017	None at this time
Canaan Road Erosion Site Inventory	2017	Act 47 in place for comprehensive Road Runoff assessment and in adjunct, potential flood hazards
Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.)	Utilize most current state regulations	Consider using current best practices to guide actions for achieving a "No Adverse Impact" policy as well as assuring future farm development occurs with defined best practices
Participation in National Flood Insurance Program (NFIP) and Floodplain/Flood Hazard Area Ordinance	Yes	None at this time
Culvert and bridge Inventory	2017	https://vtculverts.org/map https://vtculverts.org/bridges#list Strive to coordinate lists and keep up to date

5.3 Canaan All-Hazards Mitigation Goals

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

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

5.4 Mitigation Actions

Flooding and the potential for hazardous material incidents (as a result of flooding and transportation accidents) are the two main issues that the town will address. Local officials are proactive in preparing for the hazards for which they are most vulnerable. Their highest priority concern is the health safety and welfare of the local citizens and businesses. The Fire Department has several concerns that center around a catastrophic flood event with the Connecticut River and the potential for an incident involving illegal movement across the Canadian border, involving polluting of the Canaan Water supply. A new system would eliminate some of these threats. In following FEMA guidance, the following mitigation action categories form the basis of the town's future mitigation actions. The planning team decided to adopt this approach for all future

mitigation work. For each mitigation action to follow, an indication of group will be given with the abbreviations below:

Mitigation Action Groups:

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

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

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

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

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

5.4.1. Current Capabilities and Need for Mitigation Actions

The Town Plan’s goals and policies that support hazard mitigation and the existing mitigation actions demonstrate the variety of policies and actions forming the foundation of this All Hazards Mitigation Plan.

- 1) Severe Winter Storm – The Town regards its current hazard mitigation efforts carried out by the road departments as adequate to address winter storm impacts to local roads, however temporary road closure due to winter storms may isolate parts of town. Winter storms are often the cause of the power loss and telecommunications failures and can strain the delicate nature of the residential financial status and affording heating energy.
- 2) Flooding – Major infrastructure that has seen repeated damage due to flooding is a concern for the town and they are active in identifying priorities, working with State Transportation and Natural Resource Agencies as a means to increasing infrastructure resilience. Flood scenarios also increase vulnerabilities to hazardous materials release, municipal water/sewer failure. The Town will investigate establishing a Flood Hazard Overlay District to include all

designated flood hazard areas and utilize current River Corridor Maps to support decision making.

- 3) Extreme Cold – The entire town and village are vulnerable to both short-term and extended periods of extreme cold. Extended cold can strain the delicate nature of the residential financial status and affording heating energy. Mitigating risk to infrastructure, equipment, livestock and residents is part the action plan for this planning period.

5.4.2. Specific Mitigation Actions

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

- Action #1 Improve flood resilience through highway, culvert and bridge programs and floodplain management
- Action #2: Improve resilience to severe winter storms
- Action #3: Reduce risk and impact of hazardous materials incident
- Action #4: Reduce risk and impact of extreme cold durations
- Action #5: Raise public awareness of hazards and hazard mitigation actions
- Action #6: Improve resilience of Districts Water Systems
- Action #7: Continue fluvial geomorphology assessment and develop strategies in response to identified risks in addition to investigating increased mapping of the SFHA

Each of the seven actions listed above are explained below in regard to progress, project leads and partner agencies and specific action steps:

Action #1: Improve flood resilience through highway, culvert and bridge programs and floodplain management

Group: SP, NRP, PP

Lead Responsible Entity: Town of Canaan Road Foreman and Selectboard

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

Timeframe: 2017 – 2022

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

Progress: The Road Foreman continually monitors road and storm water management capabilities in an annual road assessment. There is a 5-year rotation plan in place to assure proper drainage and surfacing of non-paved roads. Since 2005, all bridges and culverts have been electronically accounted for. In 2015, the University of Vermont released Scour research and opportunities for scour sensors.

Specific Identified Tasks:

- 1) Infrastructure Assessment for Storm water Vulnerability – Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts and other storm water management infrastructure to predicted storm water and snowmelt in areas with a documented history of recurring problems. The infrastructure will be evaluated regularly prior to replacement or upsizing of the existing infrastructure.
- 2) Continued Monitoring of Vulnerable Infrastructure - Monitor bridges and culvert locations that have erosion and scouring concerns and track via the Road Erosion Site Inventory.
- 3) Road Improvements and Landslide Protection - Within political and financial restraints, re-engineer certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects include:

1. Canaan Hill Road: Graveling Project for about 1 mile of road. Water collects in road and increasing erosion.
2. Todd Hill Road and Hudson Road: Near the Lemington Town Line. Gravel needed to reduce run-of and erosion along ¾ mile stretch.
3. River Bend: Class II road by Hall Stream and Connecticut River needs riprap along steep bank for about 500 feet. Erosion is encroaching integrity of roadway. Sewer integrity is at risk and residential home at risk. Both must be
4. Canaan Hill Road: Leigh Place and Chopping Brook. Water flows into 90 degree turn and 8 foot culvert is needed to stabilize road
5. Canaan Hill Road: past turn out and Keyar Brook. Road follows a 10-15 foot high bank and encroaching road (stream back and road ditch are the same). Needs stabilization and riprap
6. Leech Stream Water line at risk due to stream erosion, erosion 10-12ft. per year. By state highway but town interest in water line safety and houses.

- 4) Documenting – Develop a methodology that serves to efficiently capture work and expenditures on sites and keep this information at the town office.
- 5) Increase Awareness of Funding Opportunities - Increase understanding of FEMA’s HMGP program so that this potential funding source can be utilized through trainings and communication with the State Mitigation Office.
- 6) ICS Training and Emergency Operations (SOP) Plan Development – Enhance knowledge of the principles of ICS and develop a Standard Operating Procedures that details the relationship, roles and responsibilities of the Highway Department and Road Commission during major events.

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

serve the town and at little or no cost. As a requirement for an approved LEOP, municipal ICS-awareness is seen as necessary state-wide. During an emergency event when the Highway Department personnel are required to work beyond normal capacity, increased communication and collaboration between the Highway Department and local entities can be enhanced with a basic SOP. An SOP can also serve to increase institutional memory when there are staff changes at every level as well as provide a template from which tabletops and drills can be based off of.

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

Group: SP, PP, PEA

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

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

Timeframe: 2017 – 2022

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

Progress: Roads are monitored and altered, when necessary so that plowing can occur without damage to trucks and/or road. Shelters are identified and back-up power installed. Snow clearing equipment is regularly serviced and the town maintains an adequate supply winter mitigation supplies.

Specific Identified Tasks:

- 1) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the town and intends to move forward on planning and public involvement. More formalized training is required and the ARC's "Shelter Initiative Program" can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
- 2) Reduce risk of power failure due to ice storms: Enhance collaboration between town road foreman and electric company related to down-limbed induced power failure. Maintain function of generators.
- 3) Notification: Develop a notification/communication plan that conveys essential sheltering information using school phone system and back-up methodology (email, text, etc.)
- 4) Residential Programs: Provide guidance and communication to residents on the structural and mechanical actions that can occur to reduce risk to severe winter storms (e.g. weather-proofing, anchoring, alternative heating sources, tree trimming, financial programs, etc.)
- 5) Enhance monitoring of roads for safe and effective plowing: Efficient snow removal is the foundation to winter storm (snow) events, assuring roads are plowable before winter remains an important facet of highway department functions. This process will allow for the systematic mitigation of previous year ice humps, paved road cracks and potholes that are deemed a risk to safe plowing and winter travel.
- 6) Increase awareness of ICS structure and recommended practices: The town can mitigate the effects of a severe winter by understanding how a large-scale storm is managed when the State EOC is operational. Additional awareness of local-level roles and responsibilities during statewide event is a mitigation action.

Rationale / Cost-Benefit Review:

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

Action #3: Reduce risk and impact of hazardous materials incident

Group: PEA, PP

Risk or Hazard Addressed: Most hazardous materials in Canaan are located at the Ethan Allen furniture manufacturing plant in Beecher Falls. This is also where the fire equipment and safety equipment are located. High accident locations are on Harrimon Hill and Route 114. Many of these accidents involve moose during the early evening hours in the summer. Canaan fire responds to incidents in neighboring Norton where there is another border crossing and active railroad crossing. Derailments have occurred in the past at this location. Given the magnitude of high accident locations, the town is concerned about a transportation-related chemical spill in addition to capabilities of fire department and rescue to adequately respond.

Progress: The town has addressed the need for a strategic plan to support its Fire Service and response capabilities.

Primary Responsible Entities: Town of Canaan, Fire Chief

Potential Partner Entities: LEPC, VTrans, state police

Timeframe: 2017 –2022

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

Specific Identified Tasks:

- 1) Develop a strategic plan for major Fire Department purchasing and identify funding streams with timelines for application for Fire Equipment. This includes potential relocation of fire department using applicable funding sources (e.g. CDBG grant).
- 2) Require continued training of Fire Department staff
- 3) Involve Ethan Allan emergency managers in ongoing LEPC and selectboard presentations to better coordinate response and understand risks
- 4) Collaborate with regional LEPC on a HMEP grant to identify hazardous substances being transported in town (namely on roads and highways with high-accident location status)
- 5) Encourage and promote rail company presentations at local LEPC/Selectboard mtg. to better coordinate and understand risk and prevention measures.
- 6) Assess speed limits in high-accident locations and consider alterations if deemed too high.
- 7) Coordinate with State Tier II reporting department via LEPC to assure that all high-risk locations are reporting accurately.

Rationale / Cost-Benefit Review:

The Fire Department requires the proper equipment and provisions and plans need to be in place to assure this. The nature of rural EMS and recent changes at the state and national level regarding scopes of service and best practices can be communicated with residents to improve

perceptions and understanding of this essential service at very little cost. Investigating funding sources for fire equipment can reduce the financial burden on the town and fiscal planning can help to assure the necessary funds will be in place when future, projected needs arise.

Action #3: Reduce risk and impact of extreme cold durations

Group: PEA, PP, SP

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

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

Potential Partner Entities: Vermont DMEHS, LEPC

Timeframe: 2017 – 2022

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

Specific Identified Tasks:

- 1) Economic Resilience: Establish relationships with utility companies to offer special arrangements for paying heating bills, if not already required by state law. Develop and sustain a program that serves to connect resource organizations with residents in need of support services.
- 2) Maintain Existing Shelter Capability: Maintain and improve capabilities of existing shelters. Notification procedures and shelter staffing is a priority for the city and intends to move forward on planning and public involvement. More formalized training is required and the ARC’s “Shelter Initiative Program” can be used at no cost to the town to enhance both shelter management knowledge and sheltering supply cache.
- 3) Assess Vulnerable Population— Develop an awareness of the most at-risk community members during an evacuation and/or sheltering event. Focusing on those that lack resources or capability to reach facilities when in need and create plans, including outreach protocol on how to address this potential hurdle.
- 4) Notification and Education – Investigate and develop a notification/communication plan that conveys essential sheltering information. Educating citizens regarding the dangers of extreme cold and the steps they can take to protect themselves when extreme temperatures occur by sustaining a process that serves to disseminate educational resources for homeowners and builders on how to protect pipes, including locating water pipes on the inside of building insulation or keeping them out of attics, crawl spaces, and vulnerable outside walls. Inform homeowners that letting a faucet drip during extreme cold weather can prevent the buildup of excessive pressure in the pipeline and avoid bursting through a yearly public service campaign.
- 5) Work with business owners and residents to determine magnitude of problem. Identify current resources available for identified at-risk populations and engage in outreach to alert those in need of assistance of the resources available. Requiring minimum temperatures in housing/landlord codes.

Rationale / Cost-Benefit Review:

With an increase in extreme weather, including cold, there is a need to protect property and the population. Given the magnitude of population dependence on social services, indicating

economic and other social vulnerabilities, effective outreach, education and collaboration with resources supports this mitigation action category.

Action #5: Improve resilience of Village Water System

Group: SP, NRP, P

Lead Responsible Entities: Fire districts, Town of Canaan

Progress: Current oversight works to assure the continued functionality of the system with a routine maintenance and inspection plan. New sewer system improvements have led to the town being able to accommodate other towns and increase revenue for service.

Specific Identified Tasks:

1. Develop understanding of best practices associated with small municipal water system management, including well longevity and protection from contamination.
2. Develop strategy to prioritize actions that will lead to greatest resilience of system at the least amount of cost.
3. If customer action is determined to influence resilience of system, develop and disseminate information on recommendations and notification procedures in the event of contamination.
4. Develop action plan that assesses the relationship between flood events and water system integrity.

Rationale / Cost-Benefit Review:

The Village Water System is a long-standing service and provides a substantial amount of revenue into the Village. Loss of the system would have major financial consequences for the village residents, school, village and town. Effort placed on the study and development of actions to increase resilience of this system is needed.

Action #6: Raise public awareness of hazards and hazard mitigation actions

Group: PEA

Lead Responsible Entities: Town of Canaan Selectboard and Emergency Management Director, Fire Chief, NVDA

Timeframe: 2017 –2022

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

Specific Identified Tasks:

- 1) Hazard Resilience for Property Owners- Develop and maintain education materials to inform property owners on how to protect their homes and businesses through accepted hazard

resilience actions (e.g. securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.). Use ACCD/UVM resources for outreach to mobile home residents regarding anchoring, floodproofing and other best practices for flood resilience.

2) HMGP Awareness: Attend informational sessions on the HMGP funding opportunities for acquisition, elevation and flood-proofing projects. Work with NVDA to develop an information brochure for residents.

3) School Programs – Assure the school is structurally ready to handle natural hazard risks to the greatest extent possible. Continue school programs to raise student awareness of hazards, safety, preparedness and prevention. Explore establishing the school emergency notification system as the primary methodology for all emergency notification procedures and build in the contact information accordingly.

4) Family Programs – Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.

5) Fire Prevention Programs – Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.

6) Dam Preparedness – Dam management has inundation maps and their own notification procedures which they shared with the town. The town should consider developing an outreach strategy based on likely scenarios and the subsequent properties that would be affected. Consider involving state agencies in planning and/or exercises that focus on the logistical considerations after dam breach.

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

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

Action #7: Continue fluvial geomorphology assessment and develop strategies in response to identified risks in addition to investigating increased mapping of the SFHA.

Group: P, NRP, PEA, PP

Primary Responsible Entities: NVDA, Agency of Natural Resources (VT ANR) (for assessments and mapping), Town of Canaan Selectboard (for ordinance changes and other actions).

Timeframe: 2017 – 2022

Progress: The Vermont Agency of Natural Resources has established a Stream Geomorphic Assessment Data Management System (<https://anrweb.vt.gov/DEC/SGA/default.aspx>), the town and NVDA can access pertinent and helpful information to assist with mapping and planning.

Funding Requirements and Sources: Through EMPG funding, NVDA can assist in enhanced mapping of the floodplain within the town. Continuation of assessments and strategy development is contingent upon individual municipalities and/or regional and local organizations, securing funding in partnership with ANR. The level of municipal participation is contingent upon the level of participation asked of staff and that such work would not hinder the ability of municipal staff to carry out their day-to-day municipal duties.

Specific Identified Tasks

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

Rationale / Cost-Benefit Review:

Continuing this project will require a sustained succession of grants, state appropriations and other funding to complete assessments in Canaan. Successful completion will provide municipal and regional benefits. The municipality’s fluvial erosion areas would be adequately and electronically mapped. This will enable the municipality to make residents and businesses aware of fluvial erosion hazards and potentially lead to municipally-directed programs, mechanisms and regulations that further mitigate against this hazard, protecting existing structures and infrastructure. Identifying fluvial erosion hazard areas could also help the municipality restrict future development in hazardous areas, if that should be an advantage to the town in the future. More accurate knowledge of fluvial geomorphology will enable the community to have a better understanding of hazard areas and what mitigation measures might most effectively address those concerns. Flooding is the most common and most significant hazard that can trigger a Federal disaster declaration in Canaan. Along with an update to the flood hazard area maps,

identifying the fluvial erosion hazard areas provides improved opportunities for the community to mitigate potential losses and gauge future development initiatives.

5.4.3. Prioritization of Mitigation Strategies

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

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

The ranking of these criteria is largely based on best available information and best judgment of project leads. For example, all road improvement projects were initially identified by Road Foreman and approved for inclusion in this plan by the road commission. It is anticipated that, as the town begins to implement the goals and actions of their Mitigation Strategies, they will undertake their own analysis in order to determine whether or not the benefits justify the cost of the project. Also, most proposed FEMA HMGP mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

Table 5-2: Canaan Action Evaluation and Prioritization Matrix

Rank	Mitigation Action	Responds to high hazard	Funding potential	Protection value	Time to implement	Social and Political acceptance	Technical feasibility	Admin feasibility	Benefit to Cost	Environmental advantage	TOTAL
2	Improve flood resilience through highway, culvert and bridge programs and floodplain management	5	4	5	2	5	4	4	5	4	38
3	Maintain and improve resilience to severe winter storms	2	5	5	4	5	5	4	5	2	37
6	Reduce risk and impact of hazardous materials incident	3	2	4	2	3	2	2	3	3	24
5	Reduce risk and impact of extreme cold durations	3	4	5	2	5	3	3	5	1	27
4	Improve resilience of Village Water System	3	5	4	4	5	4	3	5	1	34
1	Raise public awareness of hazards, hazard mitigation and disaster preparedness	4	5	5	5	5	5	5	5	3	43
7	Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessments and develop strategies in response to any identified risk	3	2	4	2	2	2	2	3	3	23

5.5 Implementation and Monitoring of Mitigation Strategies

5.5.1. Public Involvement Following Plan Approval

After adoption, the town will continue to maintain web-presence of the mitigation plan with an opportunity for community input available on its website. Additionally, the town will hold an annual public meeting after performing the annual progress report for the mitigation plan to discuss achievements and the following year's implementation plan. At town meeting, the town will present mitigation information and provide the public an opportunity to increase understanding and involvement with planning efforts. The LEPC will also host an annual mitigation plan presentation where response/state agencies, neighboring communities and other stakeholders can provide input. The town will also notify its neighboring municipalities of the availability of information for review and any significant risks and/or mitigation actions that have an impact on surrounding towns.

5.5.2. Project Lead and Monitoring Process

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

5.5.3 Plan Evaluation and Update Process

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

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

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

5.5.4. Plan Update Process

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

5.5.5. Implementation Matrix for Annual Review of Progress

The following table is intended to aid municipal officials in implementing the mitigation actions for [Canaan] and to facilitate the annual monitoring and progress reporting. Progress has been included as a guide to future updates. Each year, the town will reserve a Selectboard meeting to review and update the Implementation Matrix as means to establishing an accurate evaluation of the plan’s efficacy and the information required for the succeeding update to the plan.

Table 5.5.6 Local All-Hazards Mitigation Plan Implementation Matrix

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Annual Progress: 2017 Progress
Continue fluvial geomorphology assessments and develop strategies in response to identified risk.	VT DEC, TransCanada, NVDA, VT ANR	Spring 2018- Fall 2022	Fluvial Geomorphic Assessments and assessment-based mapping/action	Continue Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Canaan.	DEC has a comprehensive and interactive database for the Basin and Dam preparedness has done some of this work in the past that the town can build from.
	NVDA, VT ANR	Fall 2019- Fall 2022	Fluvial Erosion Hazard Mapping	Rate the fluvial erosion hazard for each assessed reach and develop a fluvial erosion hazard map for the waterway using SGAT. Create map of all assessed reaches. Submit to VT ANR for QA/QC.	
	NVDA, Planning Commission and Selectboard	Fall 2019- Fall 2022	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	Zoning in place to limit/restrict dev. In know flood hazard areas
	Canaan Planning Commission	Fall 2017- Fall 2022	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	Major infrastructure enhancement has occurred as result of Msy 2011 flooding with FEH-specific projects planning in current planning cycle
	Canaan Planning Commission	Spring 2020- Spring 2021	Flood Insurance Rating Map Updates	Review draft FIRM data. Update floodplain regulations/zoning.	There have been 7 LOMC in the town according to FEMA database
Improve flood resilience through highway, culvert and bridge programs and floodplain management	Road Foreman, Commission	2017-2018	Infrastructure Assessment for Storm water Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts and storm water infrastructure.	Town has developed a Road Erosion Site Inventory with problem, priority and estimated budget. With great institutional memory of town infrastructure, the highway department is well-equipped to assess, monitor and prioritize needs.
	Road Foreman, Commission	2018-2019	Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability	Assess the vulnerability and operational capability of municipal roads, culverts, bridges and other infrastructure to fluvial erosion.	Road and Bridge Standards adopted and meet or exceed 2013 standards.
	Road Foreman	2017-2022	Culvert Upsizing	Upsize culverts and ditching along roads to mitigate against repeated damages from storm water or spring snowmelt.	VTCULVERTS.ORG Culvert and Bridge Inventory has been populated. Town has developed a Road Erosion Site Inventory with problem, priority and estimated budget.
<i>Canaan All-Hazards Mitigation Plan Update adopted _____ 1</i>					

Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
continued	Selectboard, Road Foreman	2017-2018	Develop SOP for emergency events	Building on current Emergency Operations Plans for the Highway Department and Road Commission, and SOP can help clearly define expectations, roles and responsibilities. Develop understanding of eligibility criteria for HMGP projects.	Communication between Highway Department and Road Commission is ongoing.
	Road Foreman	2017-2022	Road Improvements and tracking system	Consider re-engineering certain road sections to lower overall maintenance costs, improve snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Develop process by which all Highway Department actions and expenses are documented.	ongoing
	Road Foreman	2018-2022	Erosion/Landslide Mitigation	Undertake erosion or landslide mitigation projects where roads regularly incur damage from adjacent rivers/streams and hillsides.	ongoing
Maintain and improve resilience to severe winter storms	Emergency Management Director	2017-2018	Improve Existing Shelter Capability	Maintain and improve on capabilities of existing emergency shelter capability, including emergency generator functionality	The School has a generator. Explore other sheltering options and secure funding for emergency power if required.
	Emergency Management Director	2017-2018	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters.	See Above
Reduce risk and impact of major transportation incidents	Canaan Selectboard, Fire Department	2017-2018	Develop strategic plan to assure funding for Fire Department	Fire Truck will need to be replaced in the near future.	Potential funding sources have been identified.
	Calex Rescue, Selectboard	2017-2018	Enhance community understanding of the scope of service of EMS with sustainable outreach program	The role of rural EMS is changing, increasing community understanding of scopes and best practices can enhance functionality and	Response data has been developed by Calex and can be used by the town and Calex to guide outreach strategy.

			resiliency.	
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Action	Primary Responsible Entity	Timeline	Task	Brief Description	Progress
	Canaan Selectboard, Fire Department	2017-2022	Enhance training and skills for response to major highway accidents	The unique relationship between Canaan Fire and the Interstate requires frequent responses to highway accidents which increase considerations for safety. Assuring proper training can increase department preparedness and safety	Ongoing but in need of further consideration
Reduce vulnerability to telecommunications failure	Emergency Management Director, Canaan Fire Chief	2018-2022	Evacuation and Sheltering Exercises	Conduct evacuation drills or exercises and evaluate performance.	Ongoing but in need of further consideration
	Emergency Management Director, Canaan Fire Chief	2017-2019	Evacuation and Sheltering Plans	Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.	Ongoing but in need of further consideration
Reduce vulnerability to telecommunications failure	Emergency Management Director, School Principal, Canaan Fire Chief, NVDA, Selectboard	2017-2018	Maintain Communications and assure plans are coordinated and tested for efficacy	Maintain good communication between school and town officials regarding plans and safety issues, so that any changes are known to all parties. The school emergency notification system can be used for an all-hazards notification system.	Ongoing. Developing the school notification system is in discussion after a recent exercise at the Moore Dam.
	Emergency Management Director, School Principal, Canaan Fire Chief	2017-2022	Monitor Exercises and build on resilience to meet all-hazard-based scenarios	When evacuation drills and other exercises are carried out, monitor coordination between school and town officials. The town should think about scenarios that may not be included in basic school evacuations and include these in future drills.	None at this time
Raise public awareness of	Emergency Management	2017-2022	Residential Programs	Develop and maintain education materials to inform	New

hazards, hazard mitigation and disaster preparedness.	Director; Canaan Fire Chief			property owners on how to protect their homes and businesses through accepted hazard resilience actions (e.g. securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.).	
	Emergency Management Director; Canaan Fire Chief	2017-2022	Family Programs	Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.	Ongoing
	Emergency Management Director; Canaan Fire Chief	2017-2022	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.	Ongoing
	Emergency Management Director; Canaan Fire Chief	2017-2022	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs.	Ongoing
	Emergency Management Director; Canaan Fire Chief, School, Selectboard	2017-2018	Moore Dam Preparedness	Use inundation maps to develop emergency notification procedures in line with those of TransCanada based on likely breach scenarios by using the school system.	In progress

APPENDICES

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

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

Appendix B: Culvert Locator: Canaan(VTrans)

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

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

APPENDIX F: Community Outreach Form

Hazard Mitigation Community Outreach Form

Introduction: Hazard Mitigation Planning is an important facet for any town and a mandatory requirement of FEMA before any FEMA funding can be awarded to the town. By developing an approved plan, the town can earn a greater percentage of state funding during recovery from a disaster and be better prepared to handle a future crisis. Your input is crucial to the planning process and the information you provide will help produce a plan that will serve the town for years to come. Please take the time to share your thoughts on the questions below. Thank you!

Instructions: Please use this form to share your thoughts on the questions below. When completed, please drop off at the Town Clerk's office or mail by _____ to:

Canaan Mitigation Survey

Questions?

Please call the Town Clerk's Office: (802) _____

Community Concerns:

- 1. As a resident, business owner or employee of the Canaan, what are your concerns about emergency events in the town?**

- 2. What do think the community could plan to accomplish to be better prepared, both financially and in health and safety, for the next emergency event?**

What other thoughts or concerns do you have about emergencies, hazards and emergency response in the town? _____
