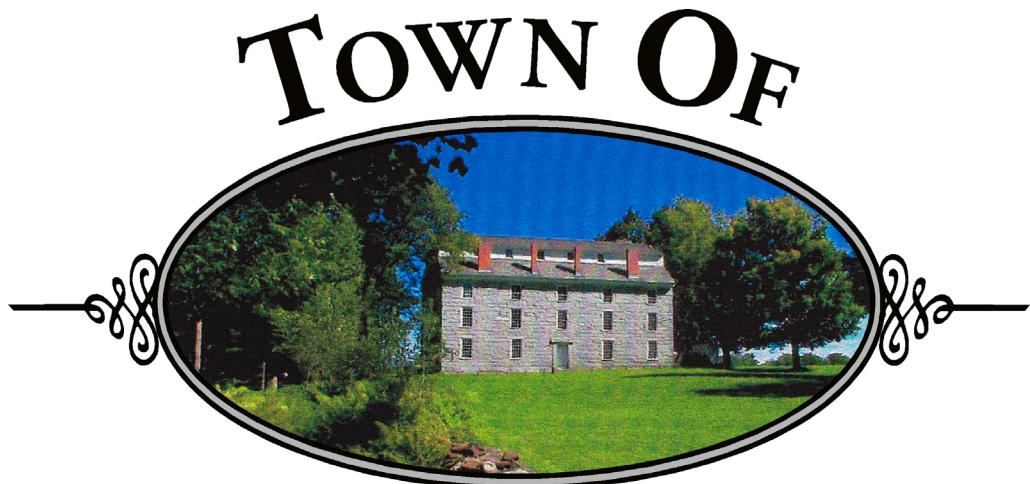


Adopted by the Town of Brownington Selectboard on
-----2016



BROWNINGTON

All-Hazards Mitigation Plan

622 Schoolhouse Rd.
Orleans, VT 05860
802-754-8401
Public Assistance Applicant #: 019-09850-00

Prepared by:
OPHC and the
Town of Brownington, Vermont

CERTIFICATE OF LOCAL ADOPTION

Town of Brownington, Vermont

A Resolution Adopting the All-Hazards Mitigation Plan

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

WHEREAS, the Town of Brownington 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 Brownington Selectboard to formally approve and adopt the Town of Brownington All Hazards Mitigation Plan.

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

Date

Selectboard Chair

Selectman

Selectman

Selectman

Attested to by City Clerk

Executive Summary

In the spring of 2015, the Town of Brownington contracted with OPH Consulting Services (OPHC) to develop the Town of Brownington's Local All-Hazard Mitigation Plan. The results of this work are contained herein and represent the collaborative efforts of the Town of Brownington Hazard Mitigation Planning Team and associated residents, towns and agencies that contributed to the development of this plan. As hazard mitigation is a sustained effort to permanently reduce or eliminate long-term risks to people and property from the effects of reasonably predictable hazards, the town has communicated its efforts related to developing this plan to its residents and surrounding municipalities, providing a formal opportunity to provide input and review relevant sections of the plan. Along these lines, the town has documented the planning process so that future updates can follow an efficient pattern in addition to capturing this important component as means of establishing institutional memory. In realization that eligibility to receive federal hazard mitigation grants and optimize state-level reimburse or "match" dollars during a federally declared disaster is dependent on an 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 a 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 of Brownington
- 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 Brownington and describes the planning process used to develop this plan.

Section 2: Hazard Identification expands on the hazard identification in the Brownington Town Plan (2015) 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 as a means 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 identified hazards for Brownington are broken down in the grid below:

Severe winter storm	Power loss	Flooding
Lightning/High Winds	Gas (heating fuel) interruption	Epidemic (avian/human)

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 Brownington Town Plan that support hazard mitigation and utilizes a current road inventory to formulate a work plan around 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: Evaluate capabilities of existing road and storm water management infrastructure.
Continue and improve highway, culvert and bridge maintenance programs

Action #2: Maintain and improve capabilities of existing and potential public shelters

Action #3: Enhance cold weather resiliency of the town by maintaining and improving current programs for residents

Action #4: Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident

Action #5: Ensure town and school emergency plans are fully coordinated

Action #6: Raise public awareness of hazards, hazard mitigation and disaster preparedness

Action #7: Continue fluvial geomorphology (in coordination with state recommendations and protocol) assessments and develop strategies in response to any identified risk

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 Brownington Planning Commission.

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SECTION 1: INTRODUCTION AND PURPOSE

1.1 Purpose and Scope of this Plan

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

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. According to *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 in order 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 in order 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 as a whole 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 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.

1.6 Town of Brownington Population and Characteristics

Chartered: February 16, 1782
 Coordinates: 72 10'W, 44 50'N
 Altitude ASL: 1,025'

1.6.1 Population:

The Town of Brownington is a small rural community in north-central Vermont. This Orleans county community is part of an area known as the Northeast Kingdom and covers 18,232 contiguous acres. It is located 15 miles from the Canadian border and is composed of forestland interspersed by active farmland and residential property. The 2010 U.S. Census reports a total population of 988 residents, 51% female and 49% male, indicating a population density of about 31 people per square mile acres. Population figures indicate that the number of people residing in Brownington in the 1920's was 741. Between 1920 and 1970 the population declined to a low of 522 persons. A dramatic increase of 35.6% in the 1970's made up for much of the loss. The 1980's saw little change. The latest figures through 2010 show a continued steady increase in population since the 1990s.

Table 1-1 Town of Brownington, selected population characteristics, 2010 Census

Category	Number	%
Total Population	988	100
Median Age	38	--
Population age 65 years and over	100	10.1
Population under 18 years old	269	27.2
Population between 18 and 24	74	7.5
Population between 25 and 44	284	28.8
Population between 45 and 64	260	26.4

1.6.2. Housing:

The bulk of residential development occurs along the major travel routes in town (Frog Pond Hill, Hinman-Settler Road, and Routes 58 and 5) and the three villages in town (Brownington Village, Brownington Center and Evansville). According to the 2010 Census, there are 509 housing units in Brownington, with 110 vacant. Of the vacant housing stock, 85 are for seasonal, recreational and occasional use. Brownington has 399 households, of which 274 are family households. The average household size is 2.48, and the average family size is 2.86. Of the 399 occupied housing units, 357 are owner-occupied. The remaining 42 housing units were renter occupied. At the time of the 2010 Census 880 individuals were living in owner-occupied dwellings, and 108 in renter-occupied dwellings. The main source of household heating energy is fuel oil (67%), wood (24%), bottled, tank, or LP gas (8%) and electricity (1%).

The following shows the types of housing within Brownington, also based on the 2010 U.S. Census data:

Table 1-2 Town of Brownington, selected housing unit data

Category	Number	%
Total Housing Units	509	--
Occupied housing units	447	87.8
Vacant housing units	110	21.6
Owner-Occupied	357	70
Renter Occupied	42	8.2
Population in Renter-occupied	108	11
Population in Owner-occupied	880	89

1.6.3. Income and Employment:

Brownington is considered a bedroom community, indicating that the majority of the town's population in the work force is employed outside of the community. According to most current American Community Survey (ACS) 5-Year averages (2009-2013), about 37% of Brownington residents travel at least 30 minutes to work, which is higher than Orleans County or the state (27% and 29% respectively). About 10% of the population works outside of Orleans County, and 1.9% work outside of the state. Compared to the rest of the Northeast Kingdom, Orleans County has a higher percentage of jobs in services and retail trade, which tend to have lower average wages. According to the ACS 5-year averages, 511 of the Town's residents are in the civilian labor force with 475 employed (63.6%) and 36 unemployed (4.8%). The median household income is \$41,250, 15 which is a little lower than the county median (\$41,953), and considerably lower than the statewide median (\$54,267). About 11.6% of Brownington families had incomes that fell below the poverty line within the past 12 months. People employed in Brownington tend to make their living close to the land, with small businesses connected to farming and agriculture, forestry and logging, agri-tourism, retail of farm and maple sugar products, auto repair, and real estate. The Stonehouse Museum and Orleans County Historical Society offer

educational programs and tours. All enterprises, commercial or non-profit, are on a smaller scale appropriate to the town. The town encourages business appropriate to the culture of farming and agriculture to ensure the rural quality of the community. The most common industries in the town are: furniture and related product manufacturing (21%), agriculture, forestry, fishing and hunting (16%), construction (12%), education services (9%), public administration (6%), automotive parts (4%), metal and metal products (3%).

Source: Brownington Town Plan, 2015

1.6.4. Town Locations:

Notable locations: Will-O-Wood Campground, Athenian Hall, Orleans County Historical Society Museum, Orleans County Historical Society Building, Old Stone House Library, Old Stone House

Hospitals and medical centers near Brownington:

- Maple Leaf Nursing Home (about 9 miles away in Barton, VT)
- Newport Health Care Center (Nursing Home about 10 miles away in Newport, VT)
- Orleans Essex VNA (Home Health Center about 10 miles away in Newport, VT)
- Fletcher Allen Health Care – North Country Dialysis Unit (Dialysis Facility about 10 miles away in Newport, VT)
- North Country Hospital and Health Center (Critical Access Hospitals about 10 miles away in Newport, VT)
- Union House Nursing Home (about 12 miles away in Glover, VT)

Cemeteries: Brownington Village Cemetery, Brownington Center Cemetery, East Cemetery, North Cemetery, East Brownington Cemetery

Lakes and reservoirs: Brownington Pond, Lubber Lake

Streams, rivers, and creeks: Moody Brook, Lord Brook, Dutton Brook, Bassett Brook, Wells Brook, Brownington Branch

Park: Brownington Village Historic District

1.7 Summary of Planning Process

In June of 2015, the town contracted with OPH Consulting Services (OPHC) to draft the plan. The planning team was established and represented the community as best as possible, including the school, long-standing residents, town staff, planners and community-based organizations. The kick-off meeting was held on June 30, 2015. The planning team discussed the planning process and facts related to the town. Additionally, a survey was drafted asking for community input and made available through the town's standard public notification process. The survey introduced the importance and informational needs of a LHMP and asked for more town-specific concerns the resident and/or business owner had. The survey and final planning team roster were approved by the Selectboard in July, 2015. Survey results and feedback from meeting were reviewed by the planning team and inclusion of relevant and necessary input helped to form the basic of specific mitigation actions to be considered by the town. Additionally, the plan captures

results of a 2015 community survey developed as part of the 2015 Brownington Town Plan. Monthly updates on plan development were included in each Selectboard meeting as well during plan development. Following FEMA guidance in Local Mitigation Plan Review Tool Regulation Checklist and FEMA informational resources, the plan was written using data sources that included:

- Surveys collecting public comment
- 2015 Brownington Town Plan
- 2015 Brownington Road Plan (portions of which were created in adjunct to this plan)
- The Vermont State Hazard Mitigation Plan (2013)
- 2013 Vermont State Hazard Mitigation Plan
- Vermont Agency of Natural Resources (ANR) and Transportation (VTrans)
- Vermont Departments of Health (VDH) and Environmental Conservation (DEC)
- FEMA

Based on the information obtained, input from town and state officials, the planning team, state and federal databases, local associations and NVDA, the plan was created. The following list provides those who participated and/or gave information related to the content contained in this plan (**names in bold indicate Planning Team Members**):

- **Leonard Messier, Road Foreman**
- **Beverly White, Selectboard Chair**
- **Cheryl Galipeau, Town Clerk**
- **Bruce Melendy, Emergency Planner, NVDA**
- **Elaine Collins, Principal Brownington School**
- **Terrence Curtis, Selectboard**
- **Tim Cota, Director of Orleans EMS**
- **Sandy Thorpe, Transit Manager for Rural Community Transportation, Inc.**
- **Larry Thompson, Planning Commission**
- **Jan Delaney, Community Member**
- Jennifer Woolard, Prevention Specialist Vermont Office of Local Health
- **Kateri Stokes, Emergency Preparedness Coordinator, Vermont Office of Local Health**
- **Seth DiSanto, Newport City Police Chief and LEPC 10 Chair**
- Ray Walker, EMS Administrator, Vermont Department of Health, EMS Division

While many small communities in Vermont face similar circumstances (e.g. flooding, winter storms and remote residents), each one has unique considerations and opportunities. There was a point made to capture the subtle characteristics of the town, its history and its residents. From this, the specific risks, vulnerabilities and mitigation strategies were developed.

NVDA's role in assisting the entire region with all facets of planning provided crucial information and NVDA's Emergency Management Planning representative attended planning team meetings and provided guidance. While the LEPC provides the best platform to engage representatives from various towns and agencies, all bordering towns to Brownington (Irasburg, Barton, Derby, Charleston, Westmore and Coventry) were contacted with planning objectives and asked to provide input in addition to receiving a draft plan with an invitation to comment.

State agency involvement included the State EMS office with points of contact including both Ray Walker and EMS Data Specialist Jenna Protzko. Vermont's Department of Emergency Management and Homeland Security (DEMHS) also provided information during the development of the plan. DEMHS also has representation at the LEPC meetings and will continue to provide input and guidance as the town moves forward with their mitigation strategies.

On November, 24th, 2015, the town held a warned public meeting to review the identified hazards and associated mitigation strategies. The draft plan was then revised based on input and presented to the town. The majority of input from residents (e.g. survey results) focused on mitigating snow emergencies and resulting consequences (e.g. need for sheltering, heating fuel assistance and implications of losing school lunch program). The revised draft was made available for review at the town office and residents were informed via meeting minutes and the town bulletin board of the ability to review the draft and additional opportunity for formal comment and suggestions. All neighboring town offices were sent the draft for review and comment as well. Minor edits were made to the plan following state recommendations and the final draft was resubmitted to DEMHS and then to FEMA for formal review and approval pending municipal adoption. A resolution of adoption is anticipated following final FEMA approval.

SECTION 2: HAZARD IDENTIFICATION

The planning team looked at three distinct hazard categories and for each, considered prior history, current trends and available data to estimate risk. 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 in adjunct. The following is a discussion of existing and potential hazards in Brownington. The definitions of each hazard, along with historical occurrence and impact, are described. The three hazard categories:

- **Natural Hazards:** weather and 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:** 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 incidents
- **Societal Hazards:** crime, civil disturbance, terrorism, epidemic, mass casualty, food supply crisis, economic downturn, and key employer loss

2.1 Natural Hazards

The number of natural disasters in Orleans County (11) is near the US average (12).

There have been 10 major disasters (Presidential) declared and three emergencies declared. The causes of the natural disasters have been; Floods: 9; Storms: 7; Winds: 2; Heavy Rain; 1 Landslide: 1; Snowstorm: 1; Tropical Storm: 1 (Note: Some incidents may be assigned to more than one category). The following discussion on natural hazards is based upon information from several sources but specific extent data for Brownington was largely not available. However, Orleans County and specifically, nearby Newport City data can be used to capture the extent of natural hazard events for the town. General descriptions are based upon the *2013 Vermont State Hazard Mitigation Plan*. The highest risk hazards (severe winter storm, flooding, lightning, high winds) have been profiled to provide the basis of future mitigation strategies. However, lower risk natural hazards (drought, tornado, tornado, high winds, extreme temperatures, 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.

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 (Orleans County: **Bold**)*

4207	2015	Severe Winter Storm
4232	2015	Severe Storms and Flooding
4178	2014	Severe Storms and Flooding
4163	2014	Severe Winter Storm
4140	2013	Severe Storms and Flooding
4120	2013	Severe Storms and Flooding
4066	2012	Severe Storms, Tornado and Flooding
4043	2011	Severe Storms and Flooding
4022	2011	Tropical Storm Irene
4001	2011	Severe Storms and Flooding
1995	2011	Severe Storms and Flooding
1951	2010	Severe Storm
1816	2009	Severe Winter Storm
1790	2008	Severe Storms and Flooding
1784	2008	Severe Storms, Tornado and Flooding
1778	2008	Severe Storms and Flooding
1715	2007	Severe Storm, Tornado and Flooding
1698	2007	Severe Storms and Flooding
1559	2004	Severe Storms and Flooding
1488	2003	Severe Storms and Flooding
1428	2002	Severe Storms and Flooding

1358	2001	Severe Winter Storm
1336	2000	Severe Storms and Flooding
1307	1999	Tropical Storm Floyd
1228	1999	Severe Storms and Flooding
1201	1998	Ice Storm

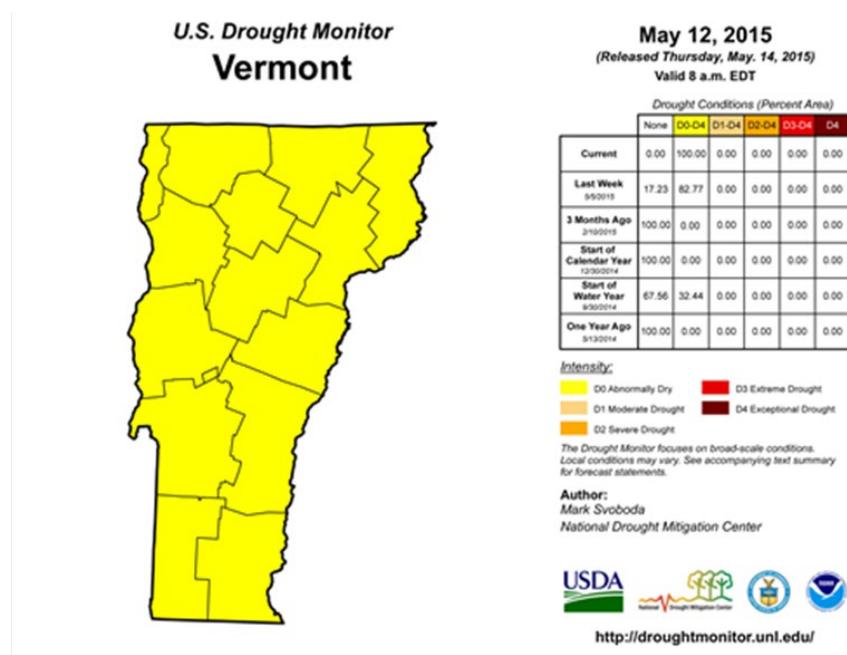
2.1.1. Weather / Climate Hazards

Drought:

Severe droughts are rare in Vermont. Summer is potentially a dry period, but local thunderstorms and moisture from tropical air masses generally prevent serious drought. A severe drought during 1930-36 affected the entire State. The drought of 1960-69 affected the entire State and was the most severe for the Town. The recurrence interval of the drought was greater than 50 years. This drought was regional in scope, encompassing most of the northeastern United States.

Precipitation in the State was less than normal every year during 1960-68, which was the longest continuous spell of deficient precipitation since 1895. Streamflow deficiency was greatest during 1965. In 1969, the drought ended abruptly. Water was trucked in to provide relief to drought-stricken dairy herds. Below is the most recent drought monitor for the entire state. Spring can bring abnormally dry conditions as was evident in early 2015 and Brownington expects the extent of drought to remain as brief periods of abnormally dry conditions in the spring and occasionally, summer months. Table 2-1 below provides recent drought conditions and an explanation of the rating scale used. Data was not available specific to Brownington.

Table 2-1: 2014-2015 Vermont Drought Monitor



Tornadoes, Hurricanes and High Winds

Tornado damage is classified by the Enhanced Fujita scale, ranging from relatively little damage (ef0) to catastrophic damage (ef5). Violent tornadoes (ef3 or greater) are capable of great destruction and loss of life. Objects as sticks, glass, and lawn furniture become deadly missiles when driven by tornadic winds. The number of days with thunderstorms across Vermont and northern New York ranges from 20 to 30 days, with nearly a third of these days experiencing severe weather. According to the National Weather Service (NWS), severe thunderstorms can produce damaging winds in excess of 58 mph, hail one inch in diameter or larger, or even a tornado. Heavy rain and deadly lightning are also likely hazard. The Tornado Project has recorded a total of five tornadoes in Orleans County during the period from May 1962 through May 2012. Tornado damage tends to be localized. The town received no significant damage from any tornado event. No formal hurricane events are recorded for the town.

Table 2-2: Tornado Events and Fujita Scale (F-Scale) for Orleans County, Vermont

ID	Date	Event Num	Time	Dead	Inj	F-Scale	Beg Coor	End Coor	County
183	MAY 20, 1962	2	11:30	0	0	1	44.90 -072.40	00.00	0 19
184	MAY 20, 1962	3	11:45	0	1	1	44.75 -072.37	44.87 -072.25	19
708	AUG 6, 1989	1	16:20	0	0	1	44.67 -072.28	00.00	0 19
1036	SEP 3, 1993	1	18:55	0	0	1	44.82 -072.03	44.83 -071.90	19, 9
529	JUN 5, 2010	1	12:30	0	0	1	44.62 -072.42	44.61 -072.38	19
376759	MAY 29, 2012		13:25	0	0	0	44.70 -072.26	44.69 -072.26	19

Tropical cyclones (storms) are officially ranked on one of five tropical cyclone scales, according to their maximum sustained winds and which tropical cyclone basin are located. Only a few scales of classifications are used officially by the meteorological agencies monitoring the tropical cyclones, but some alternative scales also exist, such as Accumulated cyclone energy, the Power Dissipation Index, the Integrated Kinetic Energy Index, and Hurricane Severity Index. Of most recent importance for Vermont was Tropical Storm Irene in 2011. Irene resulted in the worst Vermont flooding in 83 years. During Irene (August 20th-29th, 2011). While rainfall totals specific to Brownington are not available, Orleans County received 7.4" of rain (NOAA) in a 24-hour period (148% of its 100-year storm expected rainfall total, which was the highest of any Vermont County). The collection of water and subsequent rise of the Willoughby River destroyed the Center Road Bridge which was the greatest single point of destruction from flooding the town has ever seen. With the increase in severe weather events related to rainfall, the town expects greater rainfall events, should they be a result of a tropical storm or smaller storms. However, tornadoes are very unlikely in the region and the town does expect to experience any enhanced threat with this hazard.

Source: http://www.uvm.edu/~transctr/research/trc_reports/UVM-TRC-14-016.pdf54348

High Winds

High wind events do occasionally cause damage for the town, normally in downed power lines. The last recorded high wind event as tracked by the National Weather Service was recorded on 17-18 January 2012. An 81 mph wind gust was measured atop Vermont's highest peak Mount

Mansfield. These strong gusts caused numerous power outages across northern New York and parts of central and northern Vermont. At the peak of the event, over 10,000 people were without power across northern New York, including the Saint Lawrence Valley and over 2,500 people had no power in parts of Vermont. During this event, Orleans County had wind speeds of 30-40 mph (category 1 on the saffir-simpson scale). Specific data for Brownington was not available but town officials recall the 2012 event as being the most severe in memory and the town expects high wind events that may reach category 2 speeds but it is unlikely, based on previous events that a category 3 event will occur in the region. The following table describes the *Saffir–Simpson* hurricane wind scale.

Table 2-3: Saffir–Simpson hurricane wind scale

Category	Wind speeds
Five	$\geq 70 \text{ m/s}$, $\geq 137 \text{ knots}$ $\geq 157 \text{ mph}$, $\geq 252 \text{ km/h}$
Four	58–70 m/s, 113–136 knots 130–156 mph, 209–251 km/h
Three	50–58 m/s, 96–112 knots 111–129 mph, 178–208 km/h
Two	43–49 m/s, 83–95 knots 96–110 mph, 154–177 km/h
One	33–42 m/s, 64–82 knots 74–95 mph, 119–153 km/h
Related classifications	
Tropical storm	18–32 m/s, 34–63 knots 39–73 mph, 63–118 km/h
Tropical depression	$\leq 17 \text{ m/s}$, $\leq 33 \text{ knots}$ $\leq 38 \text{ mph}$, $\leq 62 \text{ km/h}$

Severe Winter Storm:

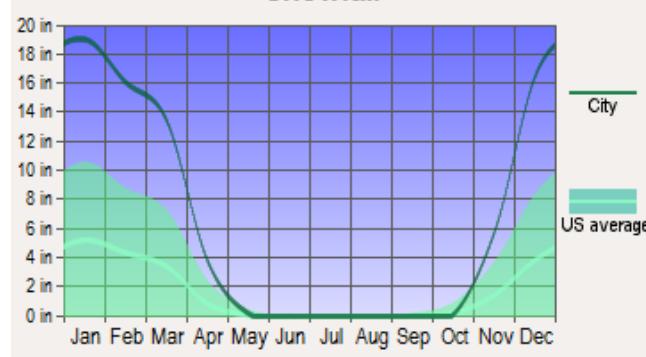
Winter storm frequency and distribution varies from year to year depending on the climatological patterns but snowfall in the town is significantly higher than the national average. The winter of 2010-2011 was the third-snowiest on record with a total of 124.3 inches. The record of 145.4 inches was set in 1970-1971. The potential for a major snowstorm that exceeds the capabilities of town exists every year but with the recent increase in snowfall totals and cold temperature duration, the town realizes that further consideration is required. 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. 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 in Brownington. 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.

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

Table 2-5: Brownington Snowfall vs. U.S. Average Snowfall



Brownington has received PA funding for one major snow event in 2001 for \$3,500. Because such storms are expected during a Vermont winter, the town is well-equipped to deal with snow removal and traffic incidents. The most damaging types of snowstorms are ice-storms caused by heavy wet snow or rain followed by freezing temperatures. This leads to widespread and numerous power and telephone outages as lines either collapse due to the ice weight or are

brought down by falling trees and branches. The winters of 1969-72 produced record snowfalls, and greater than normal precipitation was recorded in 8 of the 11 years during 1969-79. A record breaking continuous snowfall occurred from January 2nd -January 3rd, 2010 producing an excess of 12 inches (RSI of 4), the most on record for the town. 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."

Ice Storm:

Major Ice Storms occurred in January, 1998 and again in December, 2013. Brownington received the most significant damage to forest stands in recorded history and power was disrupted for over seven days. The North American Ice Storm of 1998 was produced by a series of surface low pressure systems between January 5 and January 10, 1998. For more than 80 hours, steady freezing rain and drizzle fell over an area of several thousand square miles of the Northeast, causing ice accumulation upwards of 2" in some areas. Brownington received .5 to 1 inch of ice. On December 13th, 2013, another ice storm hit portions of Orleans County, resulting in the greatest disruption of electric service since 1998 at 96 hours. While there is evidence that supports an increase in weather and precipitation severity, the incidence of ice storms remains fairly spaced out. The town expects to have another ice storm but unlike rain and snow events, the occurrence of a major ice storm is not expected every year.

Lightning:

The greatest concern associated with lightning is the impact on communications, especially communications between emergency responders. Frequency of lightning-caused disruption of communication is considered low in the town. Vermont is ranked # 17th per capita in lightning related deaths (1959 – 2003). Due to the fact that many residents work outside, there is a greater chance of being struck but even with this increased potential, the likelihood is very small. The limited development in the town also reduces the risk associated with infrastructure and/or communication disruption. There was no known record of lightning data specific to Brownington with no known power outages affecting more than a few locations or deaths resulting from lightning strikes. (Source: <http://www.nekweather.net/wxVtclimatology.php>)

Hail:

The town does not consider hail a significant hazard, although hailstorms can have a devastating effect on local farmers. At present there is no historical data on hailstorms in Brownington. Hail storms tend to be very localized and the frequency is low. However, with the recent increases in extreme weather and evidenced by recent hail storms like the one occurring on September 11th, 2013, where record high temperatures were observed in the state, helping to produce a severe wind and hail storm in parts of the Northeast Kingdom, the potential for more frequent hail

storms is certainly a possibility. The following excerpt is from a regional NEK paper concerning the event:

"ST. JOHNSBURY -- Storms rolled into the Northeast Kingdom Tuesday, delivering severe hail, a mudslide, at least one lighting strike, road damage, and tornado warnings. "That's been the biggest news around here, the tornado warning, I think" said meteorologist Lawrence Hayes at Fairbanks Museum & Planetarium in St. Johnsbury. Hayes heard no reports of tornado sightings. He thought chances for a twister by late Tuesday afternoon were slim. "But there will still be rain and some rumbles of thunder," Hayes said at about 5 p.m. The most extreme weather Tuesday hit areas like Lowell, where hail was reported at 1.25 inches in diameter, and Albany and Holland, which both saw hail at an inch in diameter."

(Source: <http://orleanscountyrecord.com/Main.asp?SectionID=14&SubSectionID=113&ArticleID=24859>)

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 Brownington, high temperatures can help to create severe storms as the one evidenced on September 11th, 2013, where record heat helped to produce damaging hail and winds in parts of the NEK and other areas of Vermont and 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 Climatic Data Center whose dataset dates to 1895. Brownington's winter of 2015 was the coldest anyone could remember with a mean temperature of 7.8 degrees Fahrenheit. However, the January of 1994 had a mean temperature of 2.7 degrees Fahrenheit which is the coldest mean temperature since 1930 and January is the statistically coldest month in all of Vermont. Since 1930, January produced temperatures in the negative 20's and 30's consistently for Orleans County with record cold temperatures occurring in 1957 (-38). Cold temperatures are expected in the Northeast but they can pose a serious threat to health and safety, especially as the severity and duration increases in conjunction with other technological (e.g. power outage, fuel oil delivery disruption) and societal (ability to purchase heating fuel) factors. Maintaining a safe living environment for livestock during extreme temperatures, especially cold extremes, is a real concern for farmers in Brownington and the rest of the state and while the temperatures for the town remain within averages seen in the last 85 years, the town expects dangerously cold temperatures every winter. There is no evidence to support concern over increases in high temperatures for the town as it relates to health and human safety at this time.

Climate Change:

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. As a result, climate change in the next century will likely increase the likelihood 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 in the near future. 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 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.

Flooding

Flooding is the most common recurring hazard event in the state of Vermont. June, 2015 broke records across the state for the wettest on record. Brownington, along with other towns in the NEK received 7 to 8 inches of rain in June. Recent history, including the flooding events of 2011 and the records set in 2015 suggest that increases in total rain fall and severity in terms of rainfall per given unit of time are to be expected along the lines seen with the records seen across the state recently.

Flood Vulnerability:

There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding and urban flooding. Flooding has also been known to occur as a result of ice jams in rivers adjoining developed towns and cities. These events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private dams and beaver dams. Rain storms are the cause of most flooding in Brownington but as a whole, the town's infrastructure has not seen nearly as much damage as other areas in the state during major rain events. Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation, and erosion damage to property and infrastructure. All of Brownington is located in the Barton River watershed, a drainage area of approximately 164 square miles. A River Corridor Plan released in 2008 notes mass failures of riverbanks along reaches of the Willoughby River from Churchill Road to Center Road, where deposition of sediment have created steep riffles and flood chutes. The *2013 Vermont State All-Hazards Mitigation Plan* discusses flooding extensively. While that plan is concerned with all of Vermont, the information on flooding is relevant to Brownington in that:

"Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients,

flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability. Urban flooding usually occurs when drainage systems are overwhelmed and damages homes and businesses. This flooding happens in all urban areas, but specifically in Burlington where the downtown area is located at the bottom of a gradient, which adds to the intensity of this localized flooding. ...

...Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.

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

Vermont experienced major floods long before Federal disaster assistance became available. A very destructive event occurred in November of 1927. In the month before the flood, rains in excess of 150% of normal precipitation fell after the ground had frozen. The flood itself was precipitated by 10 inches of rain falling over the course of a few days. The flood inundated parts of many towns and damaged or destroyed numerous bridges in the county. As the history of the flooding cited above bears out, the geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Numerous floods have resulted in Presidentially-declared disasters and an influx of federal disaster assistance. The last two decades have resulted in an increase in flood events for the town. The summers of 1996, 1998 and 2002 saw moderate road damage but the disasters of 2011 created considerably more damage. Damage was largely contained to local back roads due to washouts. During Tropical Stop Irene, the Center Road Bridge (over the Willoughby River) which connects Brownington to Barton on Route 58, was destroyed. The bridge did not reopen until more than a year later in November of 2012. The total cost to replace the bridge was \$986,219.35. Data on the

Willoughby River height increase and discharge rates during Irene is unknown. 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.

Ice Jams:

Ice jams, which can cause rapid and catastrophic flooding, are considered increasingly hazardous in parts of Vermont. In addition to the inundation damage they cause, ice jams can block infrastructure such as roads and culverts. Ice jams are not as much of a concern in Brownington as elsewhere in Vermont. A list of historic ice jams, including municipalities and streams, is maintained by the Vermont Division of Emergency Management and the Vermont Agency of Natural Resources. The US Army Corps of Engineers Cold Regions Research and Engineering Laboratory maintains a more specific database of ice jams, which includes over 819 events in Vermont. However, Brownington has no significant history of ice jams and subsequent concern regarding the threat and risk of destruction resulting from ice jams is low.

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 or located in the town. While there are some beaver dams in town that could potentially pose a flood risk, there is no history of losses or injury related to beaver dams.

Inundation and Floodplains:

Brownington’s floodplains are depicted on a FEMA Flood Insurance Rate Map (FIRM) that was created in 1974 and somewhat revised in 1976. This map depicts the Special Flood Hazard areas, which are floodplains that would likely become inundated during a significant flood known as a “base flood.” The base flood is often referred to as the “100-year flood.” Brownington’s FIRM is not accompanied by any insurance studies or base flood elevations, which would indicate how high the water would rise in a 100-year flood event. Regarding flood inundation issues, the *2013 Vermont State All-Hazards Mitigation Plan* states that:

“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 town 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. Town plans and zoning regulations have generally not identified these stream corridors as areas needing protective setbacks for development or zoning.”

The town does maintain current river corridor maps that include properties located within the river corridor (which may or may not include associated floodplains). Despite some historic damage to roads and bridges, the town remains protected from structures being damaged because of their location within the floodplain and/or river corridor and has no history of receiving major or repetitive damage to municipal buildings, critical facilities or residential property.

Fluvial Erosion:

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of the town's streams and rivers. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides. Most flood damage is associated with fluvial erosion rather than inundation. The *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 20' or longer owned by a municipality or the state. The scour critical rating is based on the structure itself, and does not take into account 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, however, the town does not have a municipal water supply. 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 for all towns in the state. Town bridges suffered the greatest damage in 2011(DR 4022) due the magnitude of water and resulted in the greatest expense to repair. . The 2011 flooding events did result in enhanced erosion, further data was not available to determine the extent of this erosion.

2.1.2. Geological Hazards

Landslides:

Landslides are sudden failures of steep slopes and can cause significant damage to streams, infrastructure, and property. Landslides can be caused by fluvial processes, as discussed above. Landslides can also be caused by slope steepening due to non-fluvial erosion, increased loading on the top of a slope, or pore-water issues. Landslides can destroy or damage structures and infrastructure that lie either above or below the slope. The Willoughby River has areas of steep slopes that have been eroding but due to its remote location, does not pose a threat to public or private property. While the erosion and potential for alterations in the flow of the river due to landslides can affect property downstream, the town has not experienced damage nor does it consider this potential to be a major concern at this point. Further discussion of landslides in the *2013 Vermont State All-Hazard Mitigation Plan* contains the following:

“Overall, the state of Vermont has had a moderate to low incidence of landslides. The USGS defines susceptibility to landslides as the probable degree of response of rocks and soils to natural or artificial cutting or loading of slopes, or to anomalously high precipitation. The U.S. Geological Survey has produced a map entitled “Map showing slope failures and slope-movement-prone areas in Vermont” (Baskerville and Ohlmacher, 2001, 1:250,000 scale). This map identifies about 2.8% of the land area of Vermont as having evidence of slope

movements. This corresponds to a moderate susceptibility as a low incidence is defined as less than 1.5% of the land area involved. The map serves to broadly identify some of the areas susceptible to landslides and the included text provides an excellent description of the types of slides found in the state, but the map is not detailed enough to meet current needs. The map generally does not identify slope failures in unconsolidated material in the valley bottoms....areas along Lake Champlain and the Green Mountains show a high susceptibility and moderate incidence. A moderate incidence is defined as 1.5%-15% of the area is involved. On the national map, none of the significant landslide events in the United States have occurred in Vermont.”

While fluvial erosion can constitute a landslide, there is little in way of historical data on Vermont landslide events. However, following tropical storm Irene in 2011, the magnitude of rain caused widespread damage, including significant scouring of riverbanks and stream channels. The most common types of landslides in Vermont are slides, which take two general forms; rotational slumps and translational slides. The translational slides occur on a wide variety of unstable slopes underlain by weathered, dense till, as well as slopes underlain by sandy to clayey lacustrine deposits, whereas the rotational slumps are more common on unstable slopes underlain by sandy to clayey lacustrine deposits. Both rotational and translational failures imply that the material has internal cohesion; otherwise the material would disintegrate into some sort of flow. An active landslide is one that has moved within the last year. The sides and upper margin of such a landslide are generally sharp and any exposed slide surfaces are bare of vegetation or have only the beginnings of pioneer vegetation on them. An inactive landslide has not moved within the last year, but it is in a setting in which it could be reactivated. One that has been inactive for several years may be largely revegetated, at least with pioneer vegetation. Inactive landslides are common near actively migrating stream meander bends where the site of landslide activity has shifted downstream as the stream meander has shifted downstream. The inactive slides may very well be reactivated if another meander bend migrates down from upstream. We define a relict slide as one where there is no evidence of movement for many years and the likely causative agent is no longer present. An example would be a former stream cut bank formed by stream erosion in early Holocene time. If the stream has since cut down vertically and moved away in such a fashion that it is now trapped by bedrock and would be unable to move back to the old cut bank, that cut bank could be considered relict. Such a feature is generally completely revegetated and the edges have been softened by erosion. The Vermont Geological Society has developed a Protocol for Identification of Areas Sensitive to Landslide Hazards in Vermont (2012). This protocol was used in Chittenden County, Vermont with inclusion into the State Hazard Mitigation Plan. Fourteen potential parameters were considered as to their effect on landslide hazard. These included location with respect to the marine limit of the Champlain Sea, aspect, distance to stream, elevation, hydrologic group, NDVI, profile curvature, roughness, slope angle, slope height, soil type, stream power index, surficial geology, and topographic wetness index. The protocol is applicable to areas in Brownington but currently, there is no data for the town. However, following tropical storm Irene in 2011, the magnitude of rain caused widespread damage, including significant scouring of riverbanks and stream channels

(source: <http://www.anr.state.vt.us/dec/geo/pdfdocs/TechReports/LandslideProtocol2012.pdf>)

Earthquake:

The risk of earthquake is quite low in Vermont. The risk is low enough that it is not prudent to invest in mitigation for earthquakes. The most recent earthquake felt in Brownington occurred in April 2002. This magnitude 5.2 quake occurred 87.4 miles away from town. Information provided by the Vermont Geological Survey, Department of Environmental Conservation, and the Agency of Natural Resources can be helpful in estimating the impact of an earthquake and for Brownington, the risks are quite low as the next recorded quake was in 1983. In each occurrence, no damage resulted.

Radiation (Naturally Occurring):

Radon gas, a naturally occurring radioactive substance that can build up in homes and can cause health problems, is enough of a concern for Vermont that health officials recommend home testing. Brownington has the average predicted level of radon (between 2-4 pCi/L). The most common strategy for dealing with a radon problem is venting of basement areas. With the town being characterized by older housing stock, the risk of natural radiation exposure from an unvented house is low. While Vermont has the highest incidence of melanoma in the country, the cause is thought to be from sun exposure.

2.1.3. Fire Hazards

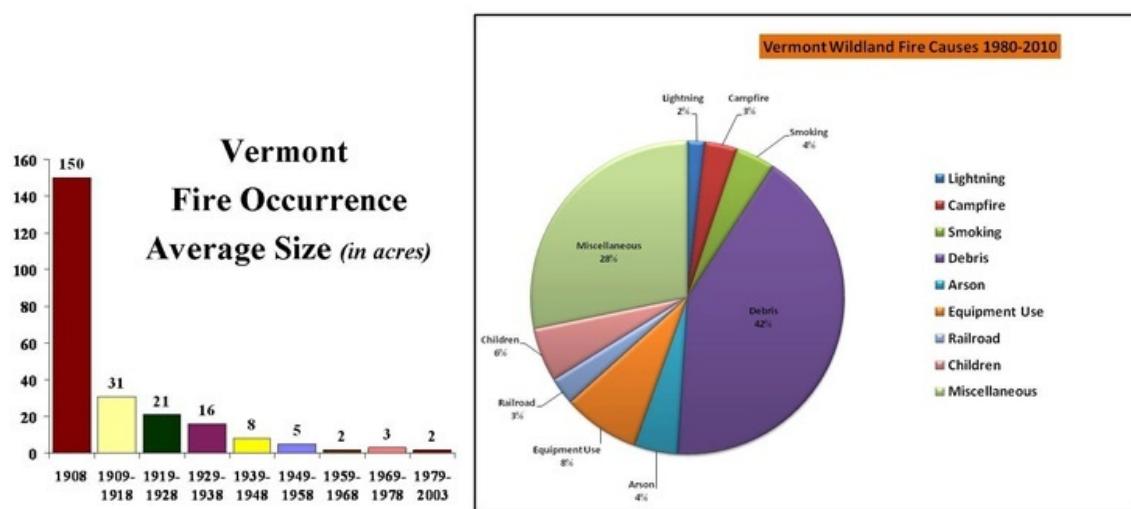
Major Fire – Urban:

While structure fires have been removed from the 2013 *Vermont State All-Hazards Mitigation Plan*, Vermont has one of the highest per capita death rates from fire in the nation. This is the deadliest form of disaster throughout the state. In 2000, there were 831 structural fires in the state, 12 of which resulted in 22 civilian deaths. 20 of those deaths occurred at residences. Although there have been requirements for smoke detectors in rental housing for over 20 years, and requirements for smoke detectors in single family dwellings since 1994, only one building involved in the fatal fires in 2000 had working smoke alarms. For some remote locations, access to water for emergency vehicles has been a factor in controlling an outbreak of fire. Orleans Fire Department responds to one or two structure fires per year in the town but there is no specific characteristic of the town that is believed to increase their risk for structure fires.

Major Fire –non-developed:

Due to its climate and primary vegetation types, Vermont is not considered to be at serious risk for large-scale wildfires. Despite not having had a major wildfire in the last 50 years, fire suppression systems are in place at the local level. These involve burn permits, burn restrictions, prevention, and detection of fires. Isolated homes with single access roads are more vulnerable to wildfires than more heavily populated areas, and the threat is increased during dry periods, especially in the late summer and fall. The primary forms of ‘wildfire’ fire in Brownington are brush and grass fires accidentally started by persons burning trash, leaves or brush. The town has not seen a significant fire to the extent that data has been captured in terms of duration or acreage.

Table 2-6: Vermont Fires: Size and Causes



2.2 Technological Hazards

The following discussion on technological hazards is based upon information from several sources. However, the town lacks any significant investment in utilities.

2.2.1. Utilities

Telecommunications System Failure:

Land-line telecommunications services in town are largely provided by Fairpoint Communications. Fairpoint is responsible for operation, maintenance and repair of telecommunications facilities. While service outages do occur, the frequency and magnitude remains slight. Distribution of phone lines generally follows the same corridor as roads. Weather or other problems interrupting services outside of the town or even outside the State of Vermont have the potential to disrupt service in the town. Service outages that affect emergency communications are of concern to local officials. Cellular phone service remains a challenge in the town due to the varying terrain and lack of proximity to reception towers. The concern over the prospect of a computer virus that could propagate and shut down computer systems, public and private, across the county could certainly impact the town but the likelihood of such an occurrence has not been evaluated. Brownington, due to its rural nature and relative lack of heavy reliance may, in fact, be less vulnerable than a more urban area.

Loss of Electrical and Fuel Service:

Energy resources are available to Brownington in sufficient supply. Vermont Electric Cooperative, Barton Electric, and Citizens Energy supply electricity. Wood, heating oil, and propane gas are all available through local distribution. Gasoline and diesel fuel are available in adjacent towns and through local fuel suppliers. The most significant disruptions to electrical

services are events which cause outages lasting more than a day and those which affect a wide area. Along with the upgrade of the transmissions system, efforts are being made in the county to reduce peak electricity use through energy efficiency measures. Outage history was derived to support a current HMGP generator grant the town has applied for and the majority of events have occurred has a result of high winds during spring or summer storms for less than one day per event. However, on 12/22/13, there was a record outage for approximately 49 hours due to an Ice Storm. The town was able to show a benefit in its application for a generator at the school which poses the greatest concern during a sustained outage due to the reliance on the school as an emergency shelter and as a major source of meals for five days out of the week for all of its students. With 15 documented outage events in 2013, the town expects more events and has already taken steps to mitigate this hazard with a generator grant.

2.2.2. Hazardous Substances

Hazardous Material Storage and Release:

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. Orleans 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 Orleans 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. The only fixed location for hazardous materials is the local grocery store and the gas station. Hazardous material release is a concern for the town of Brownington in relation to a transportation incident due to the clustering of residential property along major travel routes. This, coupled with a 55mph speed limit in the entire town poses a concern. There are no major industries or facilities that pose a concern for the town nor has there been an incident that resulted in injury due to a chemical accident. 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 a substantial amount of as mobile homes comprise 15% of the grand list in town.

Pollution Events:

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.

2.2.3. Transportation Incidents

The most common form of transportation incident or accident is an automotive accident and there are some issues regarding traffic safety aside from infrastructure resilience. The first is the fact that the entire town has a 50mph speed limit. Some feel this is too fast in specific areas. In attempt to address this, stop signs were placed on Hinman Settler Road but improperly zoned and removed. The second is addressed in the Road Improvement Plan and involves a steep slope (Kitchitch Hill Road) that requires paving to ensure maximum safety during slippery driving conditions.

High Accident Locations:

VTrans has identified a high-accident location in the town at the intersection of Routes 58 and 5A.

Road Infrastructure Failure:

The most common consequence to flooding for many Vermont towns is road and bridge (infrastructure) damage and Brownington has sustained infrastructure damage in previously declared disasters. The greatest magnitude of significance in both financial and logistical considerations as was seen in 2011 (DR4022) on the Center Road Bridge over the Willoughby River. The flood damage for this single site was over \$900,000. Secondly, the Pepin Road Bridge incurred \$56,000 in damage during the same disaster and previously that year (DR1995) for a similar amount. Aside from 2011, the town has remained relatively protected from major infrastructure failures resulting from both disaster and non-disaster events. 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. (*Source: Brownington Community Survey*)

2.3 Societal Hazards

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. Overall, the total crime rate for 2015 is expected to be lower than 2012. 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. Recent federal funding will allow Vermont to increase the amount of State Troopers and this will serve to increase protection against potential criminal activity, especially in towns like Brownington that do not have a municipal police force.

Terrorism:

While the potential for terrorist activity is present in every community, rural communities are not the same as major metropolitan areas. A school-based active shooter is a concern for any community and parent with a child in school and the local school has a Crisis Planning Team and a District-Wide Planning Team that includes surrounding towns of Albany, Barton, Irasburg, Orleans, Lake Region and Glover. 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.

Food Supply Crisis:

Some state and local officials have become concerned with the ability of local and regional food systems to adequately feed the population in the event of a fuel shortage or other emergency that

disrupts inter- and intra-state food supply chains. A food supply issue remains a concern because many residents of the town lack the financial resilience to withstand a food supply crisis in longevity. Brownington School (K-8) is a CEP School (Community Eligibility Provision). This USDA program mandates that every child receives free breakfast, lunch and fruit snack each day. There is also a “Warm the children” program that sponsors winter clothing for economically challenged families. An extended school closure, regardless of cause, could result in the inability of families to meet the increased demand for providing food for their school-age children. While there is no history of a food supply crisis, the potential in Brownington exists.

Economic Recession:

The United States formally entered a recession in December 2007, which dramatically accelerated in September 2008. While Vermont is not among the states hardest hit by the recession, the state, including Brownington, has certainly felt the effects of the downturn. According to the Vermont Department of Labor, unemployment in Vermont increased by 2.6% to 6.7% between January 2008 and January 2010, and was above 7% for much of 2009. In 2014, the unemployment rate in Orleans County was 6.4%, second only to neighboring Essex County. The state unemployment rate in 2014 was 4.1%.

SECTION 3: RISK ASSESSMENT

3.1 Designated Hazard Areas

3.1.1. Flood Hazard Areas

All of Brownington is located in the Barton River watershed, a drainage area of approximately 164 square miles. The mainstem of the Barton originates from Tildy’s Pond in Glover, then travels through Barton and the Village of Orleans, on to Lake Memphremagog’s South Bay in Coventry, just bypassing Brownington at its southwest boundary. The Barton River watershed contains one large tributary watershed, the Willoughby River (62 square miles), which drains from Lake Willoughby in Westmore, runs through Evansville and enters the Barton River just north of Orleans Village. The Brownington Branch flows from northeast in Brownington, crossing Chilafoux, Pepin, and Schoolhouse Roads, before joining the Willoughby near Center Road (*Brownington Town Plan, 2015*). Special Flood Hazard Areas are found mostly along the Brownington Branch and along the Willoughby River. The highest concentration of development in a flood hazard area appears to be near Route 58, in Evansville, along the Willoughby River. There are other hazard areas along Day Brook to Brownington Pond, where some development may be affected. Remaining hazard areas have no development and appear to be in state conserved lands.” (*Brownington Town Plan, 2015*). It is difficult to estimate the total number of structures located in designated hazard area because current E911 maps do not correspond accurately to FIRMs. However, there are approximately 20 structures in or close to the flood hazard areas. These structures include road segments and bridges and the most vulnerable, based on prior history are near the Brownington Branch of the Willoughby River.

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. In reality, river channels are constantly undergoing some physical adjustment process. This might be gradual, resulting in gradual stream bank erosion or sediment deposit – or it might be sudden and dramatic, resulting a stream bank collapse. The losses experienced during the May 2011 storms and Tropical Storm Irene were most often related to the latter. In fact, this type of flood-related damage occurs frequently in Vermont, due in part to the state's mountainous terrain. Land near stream banks are particularly vulnerable to erosion damage by flash flooding, bank collapse, and stream channel dynamics. The Vermont Department of Environmental Conservation, Agency of Natural Resources, has identified river corridors, which consist of the minimum area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition. In other words, the river corridor provides "wiggle room" for a stream as its channel changes over time. Keeping development out of the river corridors therefore reduces vulnerability to erosion. (*Brownington Town Plan, 2015*). A River Corridor Plan released in 2008 notes mass failures of riverbanks along reaches of the Willoughby River from Churchill Road to Center Road, where deposition of sediment have created steep riffles and flood chutes. The study noted that one riffle upstream of the Center Bridge Road had directed the majority of flow against a bridge abutment.

Repetitive Loss Properties

The town has no repetitive loss properties (buildings or homes). The Pepin Road Bridge was damaged twice in 2011 and has since remained functional.

3.2 Non-designated Hazard Areas

3.2.1. 1998 Ice Storm Damage

Impacts of the January 1998 ice storm in Brownington were minimal in comparison to other areas of the state.

3.2.2. High Winds and Lightning

Ridgeline and hilltop homes as well as homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. High tension line runs along VT RT 58 and 5A and the Vermont Agency of Transportation works to keep limbs trimmed. As with many Vermont communities characterized by natural terrain, the issue of downed trees creating power loss and property damage is more common compared to urban areas. Historically, these instances are short in duration and have not posed a serious risk for the town or its residents.

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

While the Town of Brownington has had a history of flooding, losses to public infrastructure have intensified in recent years. The summers of 1996, 1998 and 2002 saw moderate road damage throughout the town and in the village areas. Damage was largely contained to local back roads (unpaved) due to washouts. During Tropical Storm Irene, the Center Road Bridge, which connects Brownington to Barton on Route 58, was destroyed. The bridge did not reopen until more than a year later in November of 2012. The total cost to replace the bridge was \$986,219.35. FEMA provided \$806,508.86. The Town received \$44,806.06 from the state, with additional funding from three points on the grand list (\$44,359.81) and a state structures grant (\$78,435). The Town of Brownington shared remaining expenses with neighboring Barton. This repair has been the single greatest expense associated with a natural disaster the town has sustained in recorded history. Whiting Lane was damaged and needed immediate repair to reach an elderly, ill resident and the Pepin Road Bridge received damage twice in 2011 with numerous roads blocked by vegetative debris. The town has been fortunate that its buildings and residential property has remained unaffected by recent disasters. Brownington has received public assistance funding from FEMA for the following natural disasters:

Table 3-1: KEY:

DR	Date	Type
1428	07/12/2002	Severe Storm(s)
1995	06/15/2011	Severe Storm(s)
3167	04/10/2001	Snow
4022	09/01/2011	Hurricane

Table 3-2: Town of Brownington, FEMA-declared disasters and snow emergencies, 2005-2014

Disaster Number	PW #	Application Title	Applicant ID	Damage Category Code	Project Amount	Federal Share Obligated	Total Obligated
3167	149	EMERGENCY PROTECTIVE MEASURES (SNOW REMOVAL ASSISTANCE)	019-09850-00	B – Protective Measures	\$4,667.26	\$3,500.45	\$3,713.28
4022	3	bcorlbro b epm 4022	019-09850-00	B – Protective Measures	\$3,445.62	\$3,101.06	\$3,101.06
4022	207	MEBRC01 Center Road Bridge (TH1,B9) on Willoughby Riv.	019-09850-00	C – Roads & Bridges	\$986,219.35	\$806,508.87	\$806,508.87
4022	325	bcbr c 02 pepin rd bridge 4022	019-09850-00	C – Roads & Bridges	\$56,037.25	\$50,433.53	\$50,433.53
1428	93	ROAD & CULVERT REPAIR	019-09850-00	C – Roads & Bridges	\$3,044.00	\$2,283.00	\$2,421.80
1428	106	ROAD & CULVERT REPAIR	019-09850-00	C – Roads & Bridges	\$16,789.00	\$12,591.75	\$13,357.33
1995	166	NCORLBRO whiting	019-09850-00	C – Roads & Bridges	\$4,785.91	\$3,589.43	\$3,589.43
1995	245	NCORLBRO pepin rd.	019-09850-	C – Roads	\$55,291.48	\$41,468.61	\$41,468.61

		bridge	00	& Bridges			
1995	246	NCORLBRO Dutton rd.	019-09850-00	C – Roads & Bridges	\$24,567.12	\$18,425.34	\$18,425.34
1995	326	NCORLBRO Chalifoux rd.	019-09850-00	C – Roads & Bridges	\$22,235.72	\$16,676.79	\$16,676.79
1995	456	NCORLBRO Ticehurst rd.	019-09850-00	C – Roads & Bridges	\$25,759.08	\$19,319.31	\$19,319.31
1995	457	NCORLBRO hinman-settler rd.	019-09850-00	C – Roads & Bridges	\$23,681.81	\$17,761.36	\$17,761.36

Sources: FEMA and the 2015 Brownington 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. With a recent increase in Amish families living in town, the town maintains additional concern as the Amish only use wood heating systems and have limited means of transportation. With a recent HMGP application for a generator grant for the school, prior history of outages included a near-50 hour outage in December, 2013 from a localized ice storm. 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 2015. This analysis assigns numerical values to a hazard's affected area, expected consequences, and probability. 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 Brownington, the following natural hazards received the highest risk ratings out of a possible high score of 80:

- Severe Winter Storm (40)
- Flooding (48)
- Lightning (24)
- High Winds (24)

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

Brownington Hazard & Risk Analysis: NATURAL HAZARDS		Drought	Flooding	High Winds	Fluvial Erosion	Landslide	Lightning	Multi-Structure	Urban Fire	Wildfire	Winter Storm	Radioactive (Natural)
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	4	1	1	1	2	1	1	3	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		0	1	1	0	1	1	1	1	1	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	2	2	1	1	1	1	1	1	1	
<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	1	2	1	1	2	1	1	1	
<i>Economic Disruption</i>												
Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 3 = Low direct and high indirect costs 4 = High direct and high indirect costs		2	3	1	1	1	1	1	2	2	2	1
Sum of Area & Consequence Scores		7	12	6	5	5	6	6	6	8	5	
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	4	4	1	4	1	1	5	1	
TOTAL RISK RATING		7	48	24	20	5	24	6	6	40	5	
Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence												

3.3.2. Technological Hazards

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

- Power Loss (40)
- Major Transportation Incident (24)
- Gas (heating oil) Fuel loss (28)

Brownington 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, the greatest lasting 50 hours. This duration poses a health and safety risk to residents as well as limiting response capabilities of town staff. With a designated high accident location and a town-wide 55mph speed limit, the concern for a hazardous substance spill resulting from a transportation accident is a concern. 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 hazards risk estimation matrix

Brownington Hazard & Risk Analysis: TECHNOLOGICAL HAZARDS		Gas Service Loss	Hazardous Materials Incident	Power Loss	Radiological Incident	Sewer Service Loss	Telecommunications Failure	Water Service Loss	Major Transportation Incident	Military Ordnance Incident
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	4	1	4	4	0	4	0	1	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	1	1	2	0	1	0	2	2	2
<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	1	1	1	1	0	0	0	1	1	1
<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	0	1	0	2	0	0	0	1	1	1
<i>Economic Disruption</i>										
Key: 0 = No economic impact 1 = Low direct and/or indirect costs 2 = High direct and low indirect costs 3 = Low direct and high indirect costs 4 = High direct and high indirect costs	1	1	2	2	0	1	0	1	1	1
Sum of Area & Consequence Scores	7	5	8	7	0	6	0	6	6	6
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	4	4	5	1	1	1	1	4	1	1
TOTAL RISK RATING	28	20	40	7	0	6	0	24	6	
Total Risk Rating = Sum of Area & Consequence Scores x Probability of Occurrence										

3.3.3. Societal Hazards

According to the updated Hazard and Risk Estimation for Brownington, 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 Brownington 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

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

3.4 Hazard Summary

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

1. Flooding
2. Severe Winter Storm
3. Power Loss
4. Severe Weather (lightning/high winds)
5. Gas Service (heating fuel) interruption
6. Epidemic

It should be noted that two natural hazards on the list; severe winter storm and flooding, could be the cause of the highest-rated technological hazards: power loss and fuel supply interruption. Flooding is the highest rated hazard for Brownington 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. As mentioned, a school closure would result in students needing two meals provided to them per day. Even a few days could strain a family's resilience. 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. Brownington 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.

4.1 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." Table 4-1 identifies critical facilities in Brownington.

Table 4-1 Critical facilities in the Town of Brownington

Facility Type	Number of Facilities
Education Facility	1
Town Office	1
Emergency Shelters	2

Town Garage	1
Historic Buildings	2

All critical facilities in the town are outside the designated flood hazard areas and have no history of damage due to a disaster. In this regard, the town is resilient to critical facility damage during a natural disaster most likely to affect the region.

4.2 Infrastructure

4.2.1 Town Highways

The road system in Brownington consists of a total of approximately 50 miles; the majority of these roadways are class 3 roads (58.6%) which consist of roads of sufficient surface, base, drainage and width to permit winter maintenance and use. The class 2 roads (22%) link to Orleans and carry a majority of the traffic east and west across Brownington and Route 5A which runs north and south and provides a link between Westmore and Charleston. There are several class 4 roads (3%) remaining in Brownington, these roads play an important role as recreational resources. The different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to being washed out in a flood or heavy storm, while traffic incidents are more likely to occur on large, arterial roads.

Table 4-2 Town highway mileage by class, Town of Brownington

Class 1	Class 2	Class 3	Class 4	State Hwy	Fed Hwy	Interstate	Total 1, 2, 3, State Hwy
17.4%	22%	58.6%	3%	0	0	0	50 Miles

Source: data derived from VTrans TransRDS GIS data –Brownington Town Plan 2015

Functional Classification:

1. Arterials

- Interstate I-91: Brownington currently has no direct interstate access and will not seek such access for the foreseeable future
- Route 58: Evansville Road-road link to Orleans for the Town of Brownington and Route 5A
- Route 5A: Willoughby Lake Road-road link to Charleston to the north and Westmore to the south

2. Major Collectors

- Hinman Settler Road: Major north/south collector that funnels traffic into Barton and Derby, much of its length is gravel paved

3. Minor Collectors

- Old Stone House/School House Roads: East/west collector that funnels traffic to Route 5A and Hinman Settler Road, much of its length is gravel paved

4. Connectors

- Parker Road-serves as a connector to Coventry, its entire length is gravel paved
- Frog Pond Road: connector running from the Hinman Settler Road to the Village of Orleans and hard surface paved for its entire length
- Center Road: Connector running from Brownington Center to the Village of Orleans and hard surface paved for its entire length
- Hunt Hill Road: Connector between School House Road and Evansville and Route 58

5. Town Roads (all class three roads)

- North to south, east to west-Moulton Rd., Old Cemetery Ln., Cleveland Rd., TH 17, West Rd., Baxter Ln., Birch Ln., Postman Ln., TH 9, Chapdelaine Rd., Glodgett Ln., Lafoe Ln., Dutton Brook LN., Wildwood Ln., Ticehurst Rd., Gaye Hill Rd., Chilafoux Rd., Pepin Rd., Candle Ln., Pond Ln., TH 32, Old Nadeau Ln., Davignon Ln., TH 35, Stevens Rd., Chase Rd., Ryan Rd., Kittredge Rd., Sawmill Ln., Poirier Ln., Whitting Ln., Whetstone Ln.

The town has identified priority locations as a portion of its Road Erosion Site Inventory (Appendix E).

4.2.2 Bridges, Culverts, and Dams

Bridges:

There are a variety of bridges, culverts and dams (beaver only) located in the town. The following bridges are contained in an inventory maintained by VCGI, VTrans and the NVDA and represent those of greatest concern for the town. This analysis does not take into account the fluvial geomorphology or the elevation of the bridge above the floodplain.

Table 4-4 Inventoried bridges in the Town of Brownington with identified risk

Bridge #	Bridge Status	Risk	Bridge Features	Scour Critical	Located in Floodplain
B3	Short	LOW	Center Rd, Brownington Center, crossing Dutton Brook	3 - Scour Critical	Yes
B6	Short	HIGH	Town HW 6 (pepin Rd, crossing Brownington Branch	no	Yes
B7	Short	HIGH	Town HW 30 (Schoolhouse Rd.), crossing Brownington Branch	no	no
B8	Short	LOW	Hunt Hill, near Rt 58	no	no
B9	Long	HIGH	Center Rd	Yes	Yes
B11	Short	HIGH	Town HW 48 (Parker Rd.) crossing Day Brook	No	No
B13	Short	HIGH	Town HW 16 (Cleaveland Road)	Yes	Yes
B18	Short	LOW	Poirer Lane (temp. str.)	no	no

The entire Bridge Inventory with maps for the town can be found on the state site: <https://vtculverts.org/bridges#list>

According to the risk ranking system developed and displayed on the site: vtculvert.org, the following Brownington bridge locations are considered high risk:

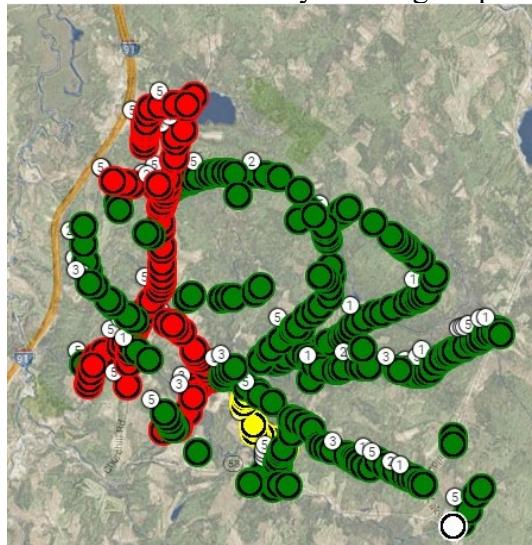
1. Cleveland Rd.
2. Parker Rd.
3. Pepin Rd.
4. School House Rd.

Culverts:

There are currently 364 culverts in the town and are classified in the VOBCIT system. The majority of the culverts are in GOOD condition (73%), 3% are rated as EXCELLENT. The remainder are FAIR (15%) or POOR (6%). 3% are rated as URGENT, CRITICAL, or UNKNOWN. This inventory is updated by the Town. Those that are considered URGENT (meaning that they are failing or likely to fail in the future) can be found on Pepin Road, Lafoe Lane, Gaye Hill, and Ticehurst. VTCULVERTS.ORG also ranks culverts with an interactive map, the following roads contain culverts that are rated high risk (denoted with Red on the map):

1. Hinman Settler Rd.
2. Moulton Rd.
3. Parker Rd
4. Old stone house Rd.
5. Frog Pond Rd.
6. Chase rd. (Medium risk: yellow)

Table 2-4: Vulnerability Ranking Map for Brownington Culverts



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

The Town maintains a culvert inventory that assesses over data on length, overall condition, size and location. This data guides the town's culvert maintenance and replacement plan. All culverts removed from the Town roads become the Town's property. Usable culverts will be reused on Class 4 roads. Less useful culverts are sold on a first come first serve basis and others are sold as scrap metal. The entire Culvert Inventory with maps for the town can be found on the state site: <https://vtculverts.org/map>.

Dams:

There are no man-made dams in Brownington. There are beaver dams that could cause some flooding if they were to breach but because development is so dispersed, damage to property would be minor.

4.2.3 Water, Wastewater and Natural Gas Service Areas

The Town currently has no water, wastewater or natural gas service areas. Water and sewer systems are the sole responsibility of the property owner and they are required to meet state and federal regulatory standards.

4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

High-tension electric transmission lines run through the Town of Brownington along VT RT 58 and 5A. Landline phone service is widely available, however cell phone service is limited in town.

4.3 Estimating Potential Losses in Designated Hazard Areas

With 20 structures, including portions of towns and bridges within the 100-year floodplain, many of which are indicated within the river corridor maps. According to most current American Community Survey 5-Year averages, the median value of an owner occupied housing unit in Brownington is \$143,300. With no repetitive loss properties, the town does not believe that even during a flooding event similar to those of 2011 that there would substantial damage to buildings or residential housing that exceeded 1%. However, given the magnitude of damage to town bridges (Center Road and Pepin Road), the potential for costs exceeding one million dollars to repair exists because it has happened so recently. However, the repairs and upgraded resilience of these locations associated with these prior expenses greatly reduces the potential for a recurrence.

4.4 Land Use and Development Trends Related to Mitigation

The Town of Brownington is comprised of 18,148 acres, more than three-quarters of which is forested. Some pastureland in Brownington may be open land but most is currently not active farm land and is being reclaimed by woods, making the majority of Brownington's land cover forested. The working landscape makes up the vast bulk of the land area of the Town of Brownington and gives the countryside its rural character. Preservation of this working landscape by maintaining forestry, agriculture and outdoor recreation as predominant land uses is the stated goal of the 2015 Town Plan. A recent study published by the Northern Communities Investment Corporation (NCIC) found that Brownington had the second largest amount of prime

agricultural soils of all Orleans communities – more than 2,378 acres. When removing buildings and infrastructure (such as roads and paved areas) from the spatial analysis, Brownington still has 2,282 acres of prime agricultural soils. This total does not include soils of statewide importance, which may also present opportunities for agricultural activity. The town is seeking to be re-designated by the state as “A Village Center” as this can help Brownington achieve many of their land use goals by:

- **Making the Town more competitive for certain state grant programs:** Brownington could benefit from historic preservation grants that help to stabilize or rehabilitate important assets in the Village, such as the Grange Hall, which is currently uninsured due to code compliance issues. Other state programs, such as Municipal Planning Grants (which funded the development of this plan) might be available to help the Town carry out village-specific initiatives that explore ways to identify build-out capacity and promote density in Brownington Village which is out of the SFHA.
- **Tax credits.** The primary benefits of this program are state tax credits for fit-up and Rehabilitation of certain income producing properties built before 1983. If these tax credits are in addition to Federal tax credits for rehabilitation of historic properties, these tax credits can be substantial – and could help a project “cash flow” that otherwise might have not been financially feasible. Credits are awarded on a competitive basis. These credits are not available to churches or government buildings, but non-profits can obtain the tax credits and sell the credits to a bank or insurance company, apply the proceeds to reduce debt load, or parlay the proceeds back to the project as collateral. The Stone House Museum did apply for tax credits when the Village Center designation was still active.

4.4.1. Proposed Land Use

While the town elects to not participate in the NFIP, it is committed to reducing flood risk and vulnerability and increasing the location of new residential and commercial uses in its designated village districts. Residential homes or businesses in the floodplain is not an outstanding concern for the town and the barrier to obtaining mortgages would serve has a deleterious consequence to participating. Also, the level of repetitive flood damage to property in the town is very low.

4.4.2. 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.

4.4.3. 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. The will educate the public on the benefits of Village Center designation and pursue Village Center re-designation for Brownington Village while Monitoring rural residential development trends in order to identify potential Conflicts with long-range land use goals. Additionally, the Brownington Planning Commission will investigate the feasibility of implementing subdivision regulations to preserve open space,

and discourage loss of farmland and, if found appropriate, shall draft such regulations for submission to the Selectboard.

4.4.4 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. With local shopping centers long-established and conveniently located in near-by Derby and Newport coupled with a stable population size and major business being farming, the town does not foresee substantial development occurring.

Housing

The entire population of Brownington is housed, with 880 living in owner occupied dwellings and 108 in renter occupied dwellings. The average family size is 2.8 and the average household size is 2.4. There are a total of 509 households in Brownington with 110 vacant units for seasonal or rental use. According to 2010 Census figures there are 399 occupied housing units in the Town of Brownington of which 357 (89.4%) are owner occupied and 42 (10.5%) are renter occupied. It is dramatically more expensive to rent in Brownington compared to owning a home or renting elsewhere in the county. Gross rent as a percentage of household income was nearly 73% compared to 55% for the county (*American Community Survey Selected Household Characteristics, 2009-2013*). By contrast, mobile home properties account for about 15% of Brownington's grand list. Not all of these properties are necessarily primary residences, but it does appear that mobile home properties are the most prevalent and likely form of affordable housing stock in Brownington. Vermont mobile homes are at an increased risk of damage or destruction during a disaster and losing these properties at 15% could have a significant impact on the town.

Residential Development Patterns

Brownington has no zoning, but a review of about a decade's worth of Wastewater System and Potable Water Supply Permits helps to shed some light on the nature of rural residential Development in Brownington. Since late 2004, there were about 38 permits issued for single-family homes, and one for a duplex. Nearly half of these residential developments occurred on lots greater than 10 acres and 56% were on Class 3 roads. (*Source: Agency of Natural Resources, Department of Environment Conservation, 2004- 2014 Potable Water/Wastewater Permits Issued for Development*)

Housing Goals and Objectives

Brownington is dominated by owner occupied dwellings and will continue to be so for the Foreseeable future. The Planning Commission shall investigate and draft a recommendation Of a subdivision bylaw that would insure village densities increasing to the carrying capacity of the land and thereby lower land costs associated with housing. The Town should encourage retirees to build in Brownington and investigate a possible reduction in property taxes for the elderly (*2015 Brownington Town Plan*).

SECTION 5: MITIGATION STRATEGIES

5.1 Brownington Town Goals and Policies that support Hazard Mitigation

5.1.1. Community Goals

- a. Continue supporting state standards with local, POS water/sewer sources.
- 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. The town is confident that state regulations will serve the town best and adopts to not have zoning at this time.
- b. Maintain and continue a Capital Expense Budget and Program for the purpose of ensuring that Brownington's 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. (See Appendix C).
- d. Utilize best practices in flood-plain management for farm-related development in town (See Appendix D).

5.1.5. Land Use

- a. Work to develop a Flood Hazard Area Overlay District to include all designated flood hazard areas. The purpose of the Flood Hazard Area Overlay District is to (1) protect public health, safety, and welfare by preventing or minimizing hazards to life and property due to flooding, and (2) to ensure that private property owners within designated flood hazard areas are eligible for flood insurance under the National Flood Insurance Program (NFIP). The town has elected not to be part of the NFIP but is dedicated to not encouraging new development in the floodplain. The town has no mobile home parks but has a substantial amount of mobile homes (15% of grand list) and very few residences at risk of flooding with no repetitive loss properties (*Source: Repetitive Losses / BCX Claims Federal Emergency Management Agency: VERMONT*)

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_RiverCorridorEasement_Guide.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 developed in adjunct to this plan (see Appendix E)
- 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.
- f. Continue long term access opportunities to gravel and sand deposits for future road maintenance use.
- g. Consider developing a standard operating procedure (SOP) based on ICS principles for highway department response events where coordination, communication and support are at a heightened level.

5.1.9. Utilities and Facilities Goals

- a. 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 Brownington.

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

5.2 Existing Town of Brownington Actions that Support Hazard Mitigation

The town has done an excellent job at monitoring and addressing transportation issues, engaging in a documented and systematic approach to mitigation actions. The Selectboard has successfully pursued funding to address needs. Exampled by Better Back Roads, Structures Grants and HMGP funding streams, the town has been able to enhance its resilience and overall preparedness. Specifically, the town has received approval for HMGP-funded generator grant for the school pending approval of this plan. 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 grants to address the sites identified as priorities in its Road Erosion Site Inventory. Brownington will earmark the funds necessary to complete one major project each year for the next 5 years and will keep its culvert inventory current to improve its institutional memory. The town has also adopted municipal road and bridge standards (4/2/15) that meet or exceed the 2013 standards and has an approved and adopted Local Emergency Operations Plan and Town Plan (2015). Related to flood resilience goals and strategies, the 2015 Town Plan states:

5.2.1. Flood Resilience Goals:

- Mitigate Brownington's flood hazards in the most cost-effective manner possible
- Minimize the risk exposure and associated expense to Brownington 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 Brownington'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
- Replace undersized and failing culverts
- Develop 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, Town of Brownington

Type of Existing Protection	Description /Details/Comments	Issues or Concerns
Emergency Response		
Police Services	Vermont State Police	None at this time
Fire Services	Orleans VFD	Water access for fire department is problematic; some roads are difficult to access.
Fire Department Personnel		Need for new volunteers remains
Fire Department Mutual Aid Agreements	Northeast International Mutual Aid (19 participants)	None at this time
EMS Services	Orleans	Staffing longevity and community awareness of scope of services
Other Municipal Services		
Highway Services	Town Highway Department	Stabilizing transition of operational structure/staff and assuring equipment longevity
Highway personnel	3 FTE field personnel	MOU's completed with residents to avoid future conflict and liability over culvert and ditching work and other towns to assure equipment availability
Water / Sewer Department	None	None at this time
Planning and Zoning personnel	Town positions filled	None at this time
Residential Building Code / Inspection	No	None at this time
Emergency Plans		
Local Emergency Operations Plan (LEOP)	2015	Assure sheltering plans and contact information is up to date and vulnerable populations are addressed.
School Emergency/Evacuation Plan(s)	2015	Increased collaboration (with town staff, school, LEPC, NVDA), knowledge of roles and drills are next step.
Municipal HAZMAT Plan	None	Not required but enhanced knowledge via HMEP funded transportation study conducted by LEPC would benefit town.
Shelter, Primary	Brownington School	Working with ARC's Shelter Initiative and have obtained certification, training and supplies. Include volunteer staff in planning communication and schedule drills to test efficacy.
Replacement Power, backup generator	HMGP grant approved/award awaiting Hazard Mitigation plan approval	Stay proactive with state and FEMA regarding town interests.
Shelter, Secondary:	Congregational Church	Assure continued communication lines are open and contacts are correct (See LEOP comments)
Replacement Power, backup generator	None	
Municipal Plans		
Town / Municipal Comprehensive Plan	2015	None at this time
Town of Brownington Road Erosion Site Inventory	2015	Created with interim Road Foreman, incorporate identified priorities into formal plan
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	No, the town elects not to Participate.	Residential homes or businesses in the floodplain are not an outstanding concern for the town and the barrier to obtaining mortgages would serve as a deleterious consequence to participating. SFHA mapping update is needed.
Culvert and bridge Inventory	2015	https://vtculverts.org/map https://vtculverts.org/bridges#list Strive to coordinate lists and keep up to date

5.3 Town of Brownington All-Hazards Mitigation Goals

The following goals were developed by the planning team, vetted during a warned community meeting and approved by the Town of Brownington 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

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. Generally, the Town considers its existing capabilities are adequate to address the identified priority hazards in this 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 failure.
- 2) Power Loss – The private service provider which owns and operates the electric utility is responsible for restoring service. Tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. However, the town can incorporate the use of public information to support community resilience during a power outage. As part of the strategies defined in this plan, the town will develop a plan for mass communication via the school's calling system and, if telecommunication lines are down, a method for alerting residents of the alternate means of information dissemination and/or protocol (e.g. shelter logistics).
- 3) 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. 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.
- 4) Major Transportation Incidents – With one high accident location and a 55mph speed limit throughout town, there is concern about a transportation-related chemical spill. With the availability of Hazardous Materials Emergency Preparedness (HMEP) funding available to the local LEPC, there is an opportunity to learn more about what types of chemicals are being transported through the town and what response mechanisms may need to be in place. One site named in Appendix E for improvement is due the slope of the road and paving will serve to reduce risk associated with hazardous driving conditions. Additionally, working with VTrans, the town can move forward with proper speed limit and stop sign alterations.
- 5) Telecommunications Failure – The private service providers, which own and operate landline and cellular services, are responsible for restoring service. As with the electric utilities, tree trimming and vegetation management, coupled with maintaining adequate repair vehicles and personnel are the primary means of mitigation. Pre-disaster public information planning can also mitigate the consequences of a telecommunications failure, where-by residents have important information regarding sheltering, evacuations, supply locations and the like. The town plans to support its resilience during a telecommunications failure by developing a pre-disaster plan that will serve to inform residents of alternative information sources during a failure and protocols for specific actions related to communication.
- 6) Epidemic – In part, the Town relies on epidemic education provided by the state Health Department, Agency of Agriculture and the school. Medical facilities are located in nearby communities. The mitigation action on public awareness of hazards provides an opportunity to address pandemic hazards, preparedness and mitigation.

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: Evaluate capabilities of existing road and storm water management infrastructure.
Continue and improve highway, culvert and bridge maintenance programs
- Action #2: Maintain and improve capabilities of existing and potential public shelters
- Action #3: Enhance cold weather resiliency of the town by maintaining and improving current Programs for residents
- Action #4: Review and modify evacuation and sheltering plans based on the results of drills and Exercises or procedures implemented in an actual incident
- Action #5: Ensure town and school emergency plans are fully coordinated
- Action #6: Raise public awareness of hazards, hazard mitigation and disaster preparedness
- Action #7: Complete fluvial geomorphology (in coordination with state recommendations and Protocol) assessment and develop strategies in response to any identified risk

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

Action #1: Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.

Status: Ongoing

Lead Responsible Entity: Town of Brownington Road Foreman and Selectboard

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

Timeframe: January 2016 – April 2021

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

Progress since 2005: The Road Foreman continually monitors road and storm water management capabilities. All bridges and culverts have been electronically accounted for and the town is diligent in maintaining a comprehensive road plan that serves to guide action. The Town of Brownington Road Erosion Site Inventory (2015-2020) specifies actions, areas of road erosion, estimated costs of repair and future needs. As mentioned, the town has done an outstanding job in acquiring Hazard Mitigation funding to address critical facilities and can begin moving forward when this plan is approved. The town has an updated Local Emergency Operations Plan and has adopted Road and Bridge Standards that exceed previous levels. Lastly, the town has worked successfully with FEMA to acquire public assistance to address major damage to infrastructure caused by flooding and maintains the institutional memory to properly track and document work and expenditures that will support efficiency and viability of future funding opportunities.

Specific Identified Tasks:

- 1) Infrastructure Assessment for Storm water Vulnerability – Continue to assess the vulnerability and operational capability of municipal-owned roads, culverts and other storm water management infrastructure to predicted storm water and snowmelt in areas with a

documented history of recurring problems. The infrastructure will be evaluated regularly prior to replacement or upgrades of the existing infrastructure.

- 2) Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability – Assess the operational capability and vulnerability of municipal-owned roads, culverts, bridges and other infrastructure to fluvial erosion of varying severity as determined by Strategy #1 above.
- 3) Culvert Upgrades – Upgrade culverts and ditching along various roads to mitigate against repeated damages from storm water or spring snowmelt.
- 4) Continued Monitoring of Vulnerable Infrastructure – Monitor various bridges and culvert locations that have erosion and scouring concerns.
- 5) Road Improvements – Within political and financial restraints, consider re-engineering certain sections of roads to lower overall maintenance costs, improving snow plowing speeds and improve overall capability of roads to handle current and projected traffic volumes. Specific projects include: See Brownington Road Erosion Site Inventory (Appendix E).
- 6) Erosion / Landslide Mitigation – Undertake erosion or landslide mitigation projects at various locations where municipal roads regularly incur damage from adjacent rivers/streams and hillsides as applicable.
- 7) Documenting – Develop a methodology that serves to efficiently capture work and expenditures on sites and keep this information at the town office.
- 8) Increase Awareness of Funding Opportunities - Increase understanding of FEMA's HMGP program so that this potential funding source can be utilized.
- 9) 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 basic understanding of ICS will serve the town and at little or no cost. As a requirement for an approved LEOP, municipal ICS-awareness is seen as necessary state-wide. During an emergency event when the Highway Department personnel are required to work beyond normal capacity, increased communication and collaboration between the Highway Department and local entities can be enhanced with a basic SOP. An SOP can also serve to increase institutional memory when there are staff changes at every level as well as provide a template from which tabletops and drills can be based off of.

Action #2: Maintain and improve capabilities of existing and potential public shelters.

Status: Ongoing

Primary Responsible Entities: Town of Brownington; NVDA Emergency Planning services, American Red Cross, POS Shelter staff.

Potential Partner Entities: LEPC 10; Orleans Fire Chief, ARC's Sheltering Initiative Program

Timeframe: January 2016 – April 2021

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

Brownington School has been identified as the primary emergency shelter. The school does not have an emergency generator. However, HMGP grant approved for generator installation and award awaiting Hazard Mitigation plan approval.

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. School staff have committed to staffing the shelter and more formalized training is the logical next step and the ARC’s “Shelter Initiative Program” can be used at no cost to the town to enhance both shelter management knowledge and supply cache.

2) 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 on how to address this potential hurdle.

Rationale / Cost-Benefit Review:

More formalized planning in both staffing and notification procedure, 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: Enhance cold weather resiliency of the town by maintaining and improving current programs for residents

Status: Ongoing

Risk or Hazard Addressed: Community input surveys have brought this problem to light and potential solutions need to be addressed after analysis completed.

Primary Responsible Entities: Town of Brownington, NVDA, Brownington School, local/regional assistance organizations.

Potential Partner Entities: Vermont EMS, LEPC

Timeframe: January 2016 – April 2021

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) Work with the school and residents to determine magnitude of problem. Identify current resources available identified at-risk population and engage in outreach to alert those in need of assistance of the resources available.

Rationale / Cost-Benefit Review:

Now that this issue has been raised through the public outreach portion constituting this plan, the town should look into what can be done. The financial strain resulting from a prolonged school closure due to severe winter weather places strain on residents’ ability to afford adequate heating supply.

Action #4: Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident.

Status: Ongoing

Primary Responsible Entities: Town of Brownington, Orleans Fire Chief, NVDA, LEPC and ARC

Timeframe: January 2016-April 2021

Funding Requirements and Sources: Implementation through existing programs, contingent on available resources and funding. ARC resources come at no cost and opportunities exist for work in this category to be completed with EMPG, LEPC and HMEP (if evacuation exercise uses chemical event as scenario) funding.

Progress: The town has updated their Local Emergency Operations Plan (LEOP) and is open to working with the regional LEPC and the DEMHS on trainings and/or exercises related to evacuation and notification protocol.

Specific Identified Tasks:

Evacuation and Sheltering Exercises – Conduct evacuation drills or exercises and evaluate performance.

Evacuation and Sheltering Plans – Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents.

Rationale / Cost-Benefit Review:

Town officials note that residents are resistant to evacuation. However, familiarity with evacuation and sheltering could potentially significantly reduce the loss of life and psychological and social impacts of a disaster.

Action #5: Ensure town and school emergency plans are fully coordinated.

Status: Ongoing

Primary Responsible Entities: Town of Brownington, Brownington School Principal, Orleans Fire Chief, NVDA.

Timeframe: January 2016-April 2021

Funding Requirements and Sources: Implementation through existing programs

Progress: School-based crisis planning has seen substantial improvement in the last decade and Brownington School has a planning team that also participates in regional planning group. Coupled with a state-wide template for the Local Emergency Operations Planning, enhanced resource opportunities and exercise assistance, there is ample opportunity for increased collaboration.

Specific Identified Tasks: Utilizing the LEPC, town and/or school meetings as a platform, coordinate presentations on each entities emergency plan and provide formal opportunity for input from other participants. Scheduled drills should involve town and school staff together.

Maintain Communications – Maintain good communication between school and town officials regarding plans and safety issues, so that any changes to plans are known to all parties.

Monitor Exercises – When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.

Rationale / Cost-Benefit Review: Improved coordination could potentially significantly reduce the loss of life and property damage. In the event of a disaster where the need for pre-planned, coordinated action regarding public health and safety is needed, these actions can serve to mitigate health and safety risk to the public. EMPG funding to NVDA can serve this work as well as DEMHS Exercise Planners.

Action #6: Raise public awareness of hazards, hazard mitigation and disaster preparedness.

Status: Ongoing

Lead Responsible Entities: Town of Brownington, Orleans Fire Chief, LEPC, NVDA.

Timeframe: January 2016 – April 2021

Progress since 2005: The Volunteer 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) School Programs – Continue school programs to raise student awareness of hazards, safety, preparedness and prevention.
- 2) Family Programs – Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention.
- 3) Fire Prevention Programs – Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention.
- 4) Other hazard awareness programs – Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate as directed by the state Department of Health and the Agency of Agriculture.
- 5) Hazard Resilience for Property Owners- Develop and maintain education materials to inform property owners on how to protect their homes and businesses through accepted hazard resilience actions (e.g. securing their structures from high winds, elevating their electrical equipment/furnaces in basements, protecting from lightning strikes by grounding electrical outlets, etc.)

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.

Status: Ongoing

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

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

Timeframe: 2016 – 2021

Progress: The Vermont Agency of Natural Resources as established a Stream Geomorphic Assessment Data Management System (<https://anrweb.vt.gov/DEC/SGA/default.aspx>). With

Basin ID 17, including the Black, Barton and Clyde rivers, 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 - Funding permitting, continue fluvial geomorphic assessments on streams and waterways in Brownington. If using PDM funding, individual municipalities may select only a subset of streams upon which to perform these assessments and therefore may choose to assess only those sections of streams wherein the history of flood and erosion damage, the history of channel management, and the proximity of existing or potential development or public infrastructure to the active channel makes an assessment a priority. Justification should be provided for streams, watersheds, or stream reaches not selected for fluvial assessment. Fluvial assessments shall be conducted as guided by the VT ANR Fluvial Geomorphic Assessment Protocols.
- 2) Fluvial Erosion Hazard Mapping - Within a year of completed geomorphic assessments for a waterway, funding permitting, a GIS provider (NVDA) should rate the fluvial erosion hazard for each assessed reach, and develop a fluvial erosion hazard map for the waterway, 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 should be created. This data will undergo town review and QA/QC by VT ANR before a final map is drawn.
- 3) River Corridor Management Plans – River Corridor Management Plans (RCMP) are encouraged for waterways where Phase I and Phase II assessments have been completed. Creating such a plan requires additional fieldwork and work with local landowners to identify acceptable reach-based management options that enable stream systems to reach equilibrium conditions. Management measures may include stream corridor buffer planting, culvert replacement and roadway improvements, berm removal, and corridor easements. Under Act 110, the Agency of Natural Resources will be identifying best management practices for shore lands and river corridors, and will be providing financial incentives, such as grants and pass-through funding. While the town relies on state regulations for zoning and other regulations, incorporating a RCMP into the Town Plan will only serve to increase the town's awareness in this crucial facet of mitigation planning. Using current river corridor maps, the town should consider developing a strategic plan that creates information and resources for residents within and in close proximity to the defined river corridor.
- 4) Fluvial Erosion Hazard Mitigation Implementation - Within five years of completing the final fluvial erosion hazard map, the town will draft strategies to avoid or mitigate losses from the identified fluvial erosion hazards. These strategies may include the adoption and implementation of programs, mechanisms or regulations to prevent endangerment of persons and property in riparian corridor areas from fluvial adjustment processes. Efforts could range from a relatively simple, public information campaign about the map to the adoption of a municipal ordinance or by-law that restricts development in such hazard areas.

Rationale / Cost-Benefit Review:

Continuing this project will require a sustained succession of grants, state appropriations and other funding to complete assessments in Brownington. 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 Brownington. 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

Descriptions of specific projects, where available, are listed in Table 5-3 below. Because of the difficulties in quantifying benefits and costs, it was necessary to utilize a simple "Action Evaluation and Prioritization Matrix" in order to effect a simple prioritization of the mitigation actions identified by the jurisdiction. The following list identifies the nine 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).

Criteria List:

1. *Does the action respond to a significant (i.e. likely or high risk) hazard?*
2. *What is the likelihood of securing funding for the action?*
3. *Does the action protect threatened infrastructure?*
4. *Can the action be implemented quickly?*
5. *Is the action socially and politically acceptable?*
6. *Is the action technically feasible?*
7. *Is the action administratively realistic given capabilities of responsible parties?*
8. *Does the action offer reasonable benefit compared to its cost of implementation?*
9. *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, as many projects are not fully scoped out at this time. The highest possible score is 45. 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 mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

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	Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.	5	4	5	2	5	3	3	4	4	35
1	Maintain and improve capabilities of existing and potential public shelters.	2	5	5	4	5	5	4	5	2	37
5	Enhance cold weather resiliency of the town by maintaining and improving current programs for residents	4	2	5	2	3	3	2	3	1	25
4	Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident	3	3	5	2	5	3	2	5	1	29
3	Ensure town and school emergency plans are fully coordinated	3	5	4	4	5	4	3	5	1	34
1	Raise public awareness of hazards, hazard mitigation and disaster preparedness	3	5	5	4	5	5	4	5	1	37
6	Complete fluvial geomorphology (in coordination with state recommendations and protocol) assessment and develop strategies in response to any identified risk	2	2	2	2	2	1	1	1	3	16

Table 5-2: Brownington Action Evaluation and Prioritization Matrix

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 Brownington 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.

Action	Primary Responsible Entity	Task	Brief Description	Progress
Continue to use fluvial geomorphology assessments and develop strategies in response to identified risk.	NVDA, VT ANR	Fluvial Geomorphic Assessments	Continue Phase I and Phase II fluvial geomorphic assessments on streams and waterways in Brownington as suggested by ANR	Willoughby River has had hydrology and hydraulics study to determine Center Road Bridge sizing
	NVDA, VT ANR	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.	Basin ID 17 and 8 (Winooski) has been designated and information is available on ANR's Stream Geomorphic Assessment Data Management System https://anrweb.vt.gov/DEC/SGA/default.aspx
	TBD, determined by funding	River Corridor Management Plans	Where Phase I and II assessments are complete, develop a River Corridor Management Plan.	River Corridor Maps have been completed and town plan acknowledges river corridor planning.
	Brownington Planning Commission, NVDA	Fluvial Erosion Hazard Mitigation Implementation	Develop strategies to mitigate losses from identified fluvial erosion hazards.	Major infrastructure enhancement has occurred.
	Brownington Planning Commission, NVDA	River Corridor Property outreach and analysis	Using updated river corridor mapping, develop an identification and outreach methodology to property owners and inform of opportunities and resources for improving flood resilience.	Mapping drafts have been completed
Evaluate capabilities of existing road and storm water management infrastructure. Continue and improve highway, culvert and bridge maintenance programs.	Road Foreman/Selectboard	Infrastructure Assessment for Stormwater 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.
	Road Foreman/Selectboard	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	Culvert Upgrades	Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt.	Town has developed a Road Erosion Site Inventory with problem, priority and estimated budget. VOBCIT Culvert and Bridge Inventory has been populated.

Action	Primary Responsible Entity	Task	Brief Description	Progress
continued	Road Foreman/Selectboard /VTrans District Rep	Continued Monitoring of Vulnerable Infrastructure	Building on current Emergency Operations Plans for the Highway Department and Road Commission, an SOP can help clearly define expectations, roles and responsibilities. Develop understanding of eligibility criteria for HMGP projects.	New road foreman is being selected and hired for 2015
	Road Foreman	Road Improvements	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. Work with town clerk to track and document all work on a site-by-site basis	ongoing
	Road Foreman	Erosion/Landslide Mitigation	Undertake erosion or landslide mitigation projects where roads regularly incur damage from adjacent rivers/streams and hillsides.	ongoing
Maintain and improve capabilities of existing and potential public shelters	Emergency Management Director/Selectboard Chair	Maintain and Improve Existing Shelter Capability	Maintain and improve on capabilities of existing emergency shelter capability, including emergency generator.	The town has applied for an HMGP-funded generator grant for the school. Explore other sheltering options and secure funding for emergency power if required.
	Emergency Management Director	Investigate Alternate Shelters	Investigate capabilities of other buildings sufficient to serve as smaller shelters.	See above
Enhance cold weather resiliency of the town by maintaining and improving current programs for residents	Brownington Planning Commission/Brownington School/local and regional organizations	Develop resource list and contingency plans for food, clothing and heating fuel acquisition. Outreach to inform of resources.	High unemployment and reliance of school meal programs coupled with high cost of heating fuel and trend of extreme cold creates enhanced risk for many residents	Clothing, food and heating assistance is available along with forthcoming generator at primary shelter.

Action	Primary Responsible Entity	Task	Brief Description	Progress
Review and modify evacuation and sheltering plans	Emergency Management Director, Selectboard, Fire Chief and school	Evacuation and Sheltering Exercises	Conduct evacuation drills or exercises and evaluate performance.	Ongoing but in need of further consideration
	Emergency Management Director, School, Fire Chief	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
Ensure town and school emergency plans are fully coordinated	Emergency Management Director, School Principal, Fire Chief	Maintain Communications and integrate plans where appropriate	Maintain good communication between school and town officials regarding plans and safety issues, so that any changes are known to all parties. Develop school emergency notification system to handle all-hazards.	Ongoing but in need of further consideration.
	Emergency Management Director, School Principal, Fire Chief	Monitor Exercises	When evacuation drills and other exercises are carried out, monitor coordination between school and town officials.	
Raise public awareness of hazards, hazard mitigation and disaster preparedness.	Emergency Management Director, Selectboard, Fire Chief and school	Develop an outreach and communication Strategy with specific populations	Continue school programs to raise student awareness of hazards, safety, preparedness and prevention. Use grand list to notify mobile home occupants of recommendations and resources. Work to identify vulnerable populations and integrate mitigation actions into evacuation plans	Ongoing
	Emergency Management Director, Selectboard, Fire Chief	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, Selectboard, Fire Chief	Fire Prevention Programs	Continue National Fire Prevention Week and other programs to raise public awareness	Ongoing
	Emergency Management Director, Selectboard, Fire Chief	Other hazard awareness programs	Develop public awareness programs, based on all-hazards needs.	Ongoing

APPENDICES

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

Appendix A: Community Reports: Town of Brownington (Flood Ready Vermont)

Appendix B: Culvert Locator: Town of Brownington (VTrans)

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

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

Appendix E: Town of Brownington Road Erosion Site Inventory

Town of Brownington – Road Erosion Site Inventory July 2015						
Site #2: Center Road (2)						
Site Location: Shoulder Slope on Center Road						
Priority #2						
Nearest Body of Water	Willoughby River					
Distance to Body of Water:	Base of slope is the literal edge of river					
Current Condition:	Fair: Current slope is slowly sliding towards the river					
Proposed Solution:	Key riprap in at edge of river and then redo riprap on slope (easiest). Or, relocate road from slope (this would require RFP and aligned with state specs (more difficult).					
Estimated Costs to Improve/Repair (easiest)						
Culvert, Ditching and Bank Stabilization						
Materials	riprap	Cost	--			
Materials	Land acquisition: 2acres estimated	Cost	--			
Materials		Cost				
Materials		Cost				
Materials		Cost				
Machinery	Excavator and trucks	Cost	--			
Labor		Cost				
Total Culvert, Ditching and Bank Stabilization Costs:						
Crowning and Re-grading Roads						
Materials	Crushed gravel for base (1.5")	Cost	--			
Materials	Crushed gravel for top	Cost	--			
Materials	Guard rail	Cost	--			
Materials		Cost				
Materials		Cost				
Machinery		Cost				
Labor		Cost				

Total Crowning and Re-grading Roads Costs:								
Total Costs: Project scope would require comprehensive state involvement: specific cost breakdown TBD		1,000,000.00						
Town of Brownington – Road Erosion Site Inventory July 2015								
Site #1:Center Road (1)								
Site Location: Shoulder Slope on Center Road								
Priority #1								
Nearest Body of Water	Willoughby River							
Distance to Body of Water:	Base of slope is the literal edge of river							
Current Condition:	Fair: Current slope is slowly sliding towards the river							
Proposed Solution:	Key riprap in at edge of river and then redo riprap on slope							
Estimated Costs to Improve/Repair								
Culvert, Ditching and Bank Stabilization								
Materials	Riprap	Cost	\$75,000					
Materials	Fabric	Cost	\$16,000					
Materials	Culvert (2')	Cost	770.00					
Materials	Gravel for culvert	Cost	\$168.00					
Materials	Sand for culvert	Cost	\$70.00					
Machinery	Excavator and 4 trucks	Cost	\$75,000					
Labor	Town	Cost						
Total Culvert, Ditching and Bank Stabilization Costs:			\$167,000.00					
Crowning and Re-grading Roads								
Materials	3" crushed gravel for base	Cost	\$2,500.00					
Materials	1.5" crushed gravel for top	Cost	\$1,500.00					
Materials	Guard rail	Cost	\$5,000.00					
Materials	Pavement	Cost	\$10,000.00					

Materials		Cost	
Machinery	Grader (town-owned) and excavator	Cost	\$1,200.00
Labor		Cost	
Total Crowning and Re-grading Roads Costs:		\$202,000.00	
Total Costs:		\$369,000.00	

Town of Brownington – Road Erosion Site Inventory July 2015

Site #3: Hunt Hill			
Site Location: Hunt Hill Road: Starting at end of bridge #8 and going north			
Priority: #3			
Nearest Body of Water	Willoughby River		
Distance to Body of Water:	500ft.		
Current Condition:	Poor: Culvert has failed		
Proposed Solution:	Replace culvert		

Estimated Costs to Improve/Repair

Culvert, Ditching and Bank Stabilization			
Materials	30" culvert and band	Cost	\$1350.00
Materials	Gravel (base and top)	Cost	\$250.00
Materials	Stone for ditching	Cost	\$125.00
Materials	Sand	Cost	\$136.00
Materials	Seed, mulch, etc.	Cost	\$450.00
Machinery	Excavator, trucks and compactor	Cost	\$2,000.00
Labor	Town	Cost	\$550.00
Total Culvert, Ditching and Bank Stabilization Costs:		\$5,000.00	
Crowning and Re-grading Roads			
Materials	Removal of old pavement	Cost	\$11,000.00
Materials	BCP	Cost	\$64,125.00

Materials		Cost	
Materials		Cost	
Materials		Cost	
Machinery	Loader, grader and trucks-town	Cost	
Labor		Cost	
Total Crowning and Re-grading Roads Costs:			\$77,125.00
Total Costs:			\$80,000.00

Town of Brownington – Road Erosion Site Inventory July 2015

Site #4: School House Road	
Site Location: 1.5 miles up from town clerk's office	
Priority: #4	
Nearest Body of Water	Willoughby River
Distance to Body of Water:	1.5 miles
Current Condition:	Good but there are no installed culverts in a 1,800' length of road
Proposed Solution:	Install culverts and enlarge ditch

Estimated Costs to Improve/Repair

Culvert, Ditching and Bank Stabilization			
Materials	Culverts	Cost	\$1,000.00
Materials	Sand	Cost	\$270.00
Materials	Gravels (top and base)	Cost	\$675.00
Materials	Seed, mulch, etc.	Cost	\$200.00
Materials	Excavator, trucks and compactor	Cost	\$8,800.00
Machinery		Cost	
Labor	town	Cost	\$495.00
Total Culvert, Ditching and Bank Stabilization Costs:			\$11,440.00
Crowning and Re-grading Roads			
Materials	600 yards crushed gravel	Cost	\$7,200.00

Materials		Cost	
Machinery	Town grader	Cost	--
Labor		Cost	
Total Crowning and Re-grading Roads Costs:			\$7,200.00
Total Costs:			\$18,640.00

Town of Brownington – Road Erosion Site Inventory July 2015

Site #5: Kittredge Hill Road	
Site Location: Intersection of Kittredge Hill and state Rte 58	
Priority: #5	
Nearest Body of Water	Willoughby River
Distance to Body of Water:	200'
Current Condition:	Dangerous curve (blind) on slope with high accident risk.
Proposed Solution:	Pave the road

Estimated Costs to Improve/Repair

Culvert, Ditching and Bank Stabilization			
Materials		Cost	
Machinery		Cost	
Labor		Cost	
Total Culvert, Ditching and Bank Stabilization Costs:			

Crowning and Re-grading Roads			
Materials	200' of asphalt	Cost	\$75,000.00
Materials		Cost	
Machinery	Included in contracted price	Cost	--
Labor	Included in contracted price	Cost	--
Total Crowning and Re-grading Roads Costs:			
Total Costs:			\$75,000.00

Town of Brownington – Road Erosion Site Inventory July 2015						
Site #6: School House Road						
Site Location: 2.25 miles from town clerk office						
Priority: #6						
Nearest Body of Water	N/A					
Distance to Body of Water:						
Current Condition:	Good: Ditches are full and roadway is soft					
Proposed Solution:	Resurface road and ditch-work					
Estimated Costs to Improve/Repair						
Culvert, Ditching and Bank Stabilization						
Materials		Cost				
Materials		Cost				
Materials		Cost				
Materials		Cost				
Materials		Cost				
Machinery		Cost				

Labor	Excavator and trucks	Cost	\$2,200.00
Total Culvert, Ditching and Bank Stabilization Costs:			
Crowning and Re-grading Roads			
Materials	50 yards crushed gravel	Cost	\$600.00
Materials		Cost	
Machinery		Cost	
Labor	Grader-town	Cost	--
Total Crowning and Re-grading Roads Costs:			\$600.00

APPENDIX F: Community Outreach Form

Brownington 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 August 17th, 2015 to:

**Town of Brownington Mitigation
Survey
622 Schoolhouse Rd. Orleans,
VT 05860**

Questions?

Please call the Town Clerk's Office: **(802) 754-8401**

Community Concerns:

- 1. As a resident, business owner or employee of the Town of Brownington, 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?
