# TOWN OF UNDERHILL, Vermont
# 2017 All-Hazards Mitigation Plan

# Annex 16 to the
# 2017 Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan

**Prepared by:**

**The Chittenden County Regional Planning Commission**

**and the**

**Town of Underhill, Vermont**

*Adopted by the Town of Underhill Selectboard on May 23, 2017*

*Approved by FEMA on July 11, 2017*

## Executive Summary

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 purposes of this updated Local All-Hazards Mitigation Plan are to:

- Identify specific natural, technological and societal hazards that impact the Town of Underhill;
- Prioritize hazards for mitigation planning;
- Recommend town-level goals and strategies to reduce losses from those hazards; and
- Establish a coordinated process to implement the plan, taking advantage of a wide range of resources.

This plan is a local annex to the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan*. **In order to become eligible to receive various forms of Federal hazard mitigation grants, a Chittenden County municipality must formally adopt its Local All-Hazards Mitigation Plan along with the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan*, or develop and adopt an independent, stand-along Local All-Hazards Mitigation Plan.**

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

Section 2: Hazard Identification expands on the hazard identification in the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan* with specific municipal-level details on selected hazards.

Section 3: Risk Assessment discusses identified hazard areas in the municipality 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 top three Hazards by type with the most risk in Underhill are:

| | |
|---|---|
| Natural Hazards: | Severe Winter Storm, Flooding and Severe Rainstorm |
| Technological Hazards | Power Loss and Telecommunications Failure |
| Societal Hazards | Economic Recession and Epidemic |

Section 4: Vulnerability Assessment discusses buildings, critical facilities and infrastructure in designated hazard areas, vulnerable populations and the issue of estimating potential losses.

Section 5: Mitigation Strategies is the heart of this All Hazards Mitigation Plan. This section begins with an overview of goals and policies in the *2015 Underhill Town Plan* that support hazard mitigation. This is followed by an analysis of existing municipal actions that support hazard mitigation, such as planning and zoning and public works. This section presents the following municipal all-hazards mitigation goals:

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 and as identified generally in the Chittenden County Multi-Jurisdictional 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 stormwater management and the planning and development of various land uses.
5) Maintain existing municipal plans, programs, regulations, bylaws 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 municipality's/town's bylaws, regulations and ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.
7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans and infrastructure, utilities, highways and emergency services.

This section includes the following Mitigation Actions planned by the Town:

**Category A: Address risks to structures and infrastructure from Fluvial Erosion**

- Action A-1: Develop zoning district & bylaws to reduce risk from Fluvial Erosion

**Category B: Upgrade Existing Road and Stormwater Management Infrastructure**

- Action B-1: Culvert Upgrades
- Action B-2: Drainage Improvements
- Action B-3: Road Improvement
- Action B-4: Develop Stormwater Master Plan

**Category C: Implement Road Stormwater Management Plan consistent with Vermont Municipal Roads General Permit (MRGP)**

- Action C-1: Obtain MRGP and develop Road Stormwater Management Plan
- Action C-2: Implement Road Stormwater Management Plan and file annual reports

Finally, this section includes an Implementation Matrix to aid the municipality in implementing the Mitigation Actions and annual monitoring and evaluation of this Plan.

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[ Note: See appendices of Chittenden County Multi-Jurisdictional AHMP for weblinks to the various data sources used to generate many of the tables noted above.]

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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 reduce the impacts of those hazards. The plan also seeks to coordinate the mitigation efforts of this municipality with those outlined in the *Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan* as well as efforts of quasi-governmental organizations such as Local Emergency Planning Committee, District #1 and the Chittenden County Regional Planning Commission.

**This annex, when used with the appropriate sections of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan, constitutes an All-Hazards Mitigation Plan for the Town of Underhill.** Community planning can aid in significantly 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 Chittenden County.

## 1.2 Hazard Mitigation

The *2013 Vermont State All-Hazards Mitigation Plan* 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, Mitigation Response and Recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where they are most severe and to identify actions that can be taken to 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.

## 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 have to 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.

- Flood Mitigation Assistance Grant Program (FMAGP) funds will be available only to communities that have adopted a local Plan
- 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.
- Under Vermont's Emergency Relief Assistance Fund rules, contributions from the State to cover the non-Federal share of a municipality's FEMA Public Assistance project costs varies depending on whether a community has a plan. A community without a plan would have to cover 17.5% of the overall project cost, but a community with a plan would have to cover only 7.5% to 12.5% of the cost.

## 1.4 Benefits

Adoption and maintenance of this 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.
- Ease 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 has been ranked.
- Connect hazard mitigation planning to community planning where possible, such as in emergency operations plans, comprehensive plans (aka "town plans"), capital improvement plans and budgeting, open space plans, and stormwater master plans.

## 1.5 All-Hazards Mitigation Plan Goals

The Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan establishes the following general goals for the county as a whole and its municipalities:

1) Hazard mitigation planning should take into account the multiple risks and vulnerabilities of the significant hazards in the County due to its mixed urban-suburban-rural nature, its economic importance to the State and its significant presence of public and private infrastructure.
2) Promote awareness amongst municipalities, residents and business in the county of 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 stormwater management and the planning and development of various land uses.

3) Ensure that regionally-initiated mitigation measures are consistent with municipal plans and the capacity of municipalities to implement them.
4) Encourage municipalities to formally incorporate their individual Local All-Hazards Mitigation Plan into their municipal plan as described in 24 VSA, Section 4403(5), as well as incorporate their proposed mitigation actions into their various bylaws, regulations and ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.
5) Encourage municipalities to formally incorporate elements of their Local All-Hazards Mitigation Plan, particularly their recommended mitigation strategies, into their municipal operating and capital plans and programs, especially, but not limited to, as they relate to public facilities and infrastructure, utilities, highways and emergency services.
6) Educate regional entities on the damage to public infrastructure resulting from all hazards and work to further incorporate hazard mitigation planning into the regional land use and transportation planning program conducted by the Chittenden County Regional Planning Commission.
7) Maintain existing mechanisms, develop additional processes, or explore funding mechanisms and sources to foster regional cooperation in hazard mitigation, specifically and emergency management planning, generally.

## 1.6 Town of Underhill: Demographics and Development Characteristics

Underhill (cf. Figure 1.1) is located in the northeastern corner of Chittenden County and is adjacent to the following towns in Chittenden County: Westford, Essex, Jericho, and Bolton. Underhill also borders two towns outside Chittenden County, Cambridge, and Stowe. The town encompasses 51.29 square miles. The town was first chartered June 8, 1763 (New Hampshire Grant). Based on U.S. Census data, the University of Vermont's Center for Rural Studies reports a municipal population of 3,016 people in 2010. Selected population characteristics are as follows:

*Table 1-1 Town of Underhill, selected population characteristics, 2010*

| Category | Number | % |
|---|---|---|
| Total Population | 3,016 | -- |
| Median Age | 43.5 years | -- |
| Population (and %) age 65 years and over | 304 | 10.1 |
| Population (and %) under 10 years old | 366 | 12.1 |
| Population (and %) in group quarters | 0 | 0.0 |

*U.S. Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts*

Types of housing within Underhill, also based on the 2010 U.S. Census data, are below:

*Table1- 2 Town of Underhill, selected housing unit data, 2010 Census*

| Category | Number | % |
|---|---|---|
| Total Housing Units | 1,199 | -- |
| Occupied housing units | 1,133 | 94.5 |
| Vacant housing units | 66 | 5.5 |
| Vacant housing units used for seasonal, recreational or occasional use | 36 | 3.0 |
| Detached 1-unit housing units | 1,000 | 91.9 |
| Housing units with 5 or more units in structure | 6 | 0.6 |
| Mobile homes | 25 | 2.3 |
| Housing structures built in 1939 or earlier | 221 | 20.3 |

*U.S. Census Bureau, 2010 Census of Population and Housing, Population and Housing Unit Counts*

Underhill's population is focused in the valleys and low-lying areas (cf. Figure 1.2). Growth in the future is anticipated to continue this pattern of low-density residential.

*Table 1-3 Town of Underhill, Historic Population Trends*

| Year | Population |
|---|---|
| 1980 | 2,172 |
| 1990 | 2,799 |
| 2000 | 2,980 |
| 2010 | 3,016 |
| 2014 | 3,067 |
| Source: US Census Bureau: April 1 Census Counts 1980-2010, July 1 ACS Estimates for 2014 | |

## 1.7 Summary of Planning Process

As noted above, the update of this municipal All Hazard Mitigation Plan (AHMP) was part of the planned update of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan and the municipal AHMPs that are annexes to the Multi-Jurisdictional Plan. The CCRPC, with funding provided by the State of Vermont via a FEMA Hazard Mitigation Grant, began this update process in the spring of 2015.

### 1.7.1 Development of the 2017 Underhill All Hazards Mitigation Plan

CCRPC staff met several times with various Town staff and officials during the course of the development of this plan. Initial Meetings focused on the following issues:

1. Reviewing the matrix used in 2011 to identify and prioritize hazards facing Underhill, and determining whether the overall scoring still makes sense
2. Discussing any newly significant hazards in Underhill and identifying any new actions that could be taken to address them.
3. Discussing any progress that has been made on the strategies and tasks from the 2011 plan.

In September 2015, CCRPC Staff met with the former Planning and Zoning Administrator (Rachel Fifield), the Road Foreman (Nate Sullivan), the Town Clerk (Sherri Morin) and the Finance Director (Mona Sheppard). CCRPC Staff met separately with the Underhill Jericho Fire Department (Harry Schoppman) in September 2015.

Based on this meeting, CCRPC Staff developed memos for Underhill's Selectboard and Planning Commission outlining proposed changes to the 2011 materials and summarizing the reported progress. The memos also clearly stated how CCRPC staff could be reached for comment. The Planning Commission reviewed the draft during September and October and Selectboard discussed the draft at their meeting held on 11/24/15. The meeting was open to the public and was duly warned in compliance with the Vermont Open Meeting Law *(1 V.S.A. §§ 310-314).* The memos, as meeting materials, were also available to the public. Members of the public who attended the meeting were able to review the memo and provide comments on the development of the plan. The Planning Commission and Selectboard offered changes regarding the ranking of hazards and the prioritization of mitigation strategies, which were incorporated into the plan.

In addition, the following materials were reviewed and information incorporated into the Plan from:

1. The 2013 Vermont All-Hazards Mitigation Plan
2. The 2015 Underhill Town Plan
3. River corridor plan for the Browns River
4. Information on previous disasters from FEMA
5. Information from Vermont Agency of Natural Resources on fluvial erosion hazards and flood hazards
6. Information from the Vermont Agency of Transportation on town roads, bridges, culverts and high crash locations.
7. Information from the Vermont Department of Emergency Management and Homeland Security on prior disaster and hazardous materials reporting.

Demographic information for this Plan was updated by a CCRPC interns in 2015. New information, relative to the 2011 AHMP, from review of the Land Development regulations and the Comprehensive Plan was incorporated into Section 5. Information on prior disasters, fluvial erosion hazards and flood hazards and various transportation data was incorporated into Sections 2, 3 and 4. Throughout the plan development process CCRPC staff sent rough drafts of the plan to numerous town staff to review for accuracy and conferred with these same staff regularly via phone and email. CCRPC staff produced new versions of the 2011 maps and also produced new maps desired in this 2017 update.

### 1.7.2 Opportunities for involvement in the planning process and formal public review and governing body approval

Emergency management planners are obligated to provide opportunities for the general public, neighboring communities, local, regional and state agencies, development regulation agencies and other interests to be involved in the review and development of Hazard Mitigation Plans. Additionally, the CCRPC, as a public agency is obligated to provide public notice and

opportunities for input into its programming and processes. With regard for public involvement in the develop of the first drafts of this Municipal AHMP *prior to release of public drafts*, there was no formal solicitation process to recruit or invite the public to come to staff level meetings wherein the first process of updating data in the old 2011 Plan. That being said, however, the public has been free to review the 2011 Plans on the CCRPC website since they were first posted in 2011. Additionally as noted in Section 1.10.2.4 of the Multi-Jurisdictional AHMP, in the period before the first municipal draft AHMPs were publicly released in August 2016 (see below) there were twelve public meetings held by the CCRPC Board and the Plan Update Committee wherein the overall Hazard Mitigation planning process was discussed including the content and purpose of the local, Municipal AHMPs as well as the planned timeline for their development starting in 2015 and extending well into 2016. *[ Note that opportunities for public review and development of the Multi-Jurisdictional AHMP are described in Section 1.10.2 of the that document.]*

Commencing with a August 5, 2016 press release and with a comment deadline of August 19, 2016, the CCRPC repeated the public notice process note above to solicit and receive comments on the second draft Chittenden County Multi-Jurisdictional AHMP. On August 5, 2016, emails to the same state agency staff and executive directors of neighboring Regional Planning Commissions as noted above, were also sent to encourage their review and comment. The public, agency staff and RPC staff were directed to provide comments to Dan Albrecht, Senior Planner at the CCRPC.

With regards to opportunities for public involvement and input from neighboring communities in development of individual Local All-Hazards Mitigation Plans including this Plan for the **Town of Underhill,** opportunities were as follows:

a) On August 5, 2016, the CCRPC posted all the first drafts of the 18 local AHMPs on the CCRPC website and via various means (press release, electronic newsletter, etc) made the public aware of the opportunity to comment. The public was advised to send comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.
b) On August 5, 2016 the CCRPC staff sent direct emails to the Agency staff noted above notifying them as well of the opportunity to review the 18 local AHMPs posted on the CCRPC website and encouraging them to send any comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.
c) On August 5, 2016 direct emails were also sent to the municipal Mayors/ Managers/ Administrators and/or Clerks of the abutting 12 communities outside of Chittenden County (South Hero, Georgia, Fairfax, Cambridge, Stowe, Waterbury, Duxbury, Fayston, Lincoln, Starksboro, Monkton and Ferrisburgh) that abut the County notifying them of the opportunity to review the 18 local AHMPs posted on the CCRPC website and encouraging them to send any comments directly to Dan Albrecht, CCRPC Senior Planner by August 19, 2016.
d) After FEMA Region One provided notice to CCRPC that an individual local AHMPs was "Approved pending Adotion", as a general matter of course, the general public was provided public notice of all public meetings held by municipal bodies such as governing bodies (Selectboards, Town councils, trustees) and planning and/or conservation

committees as per the standard procedure of each municipality wherein this municipal Plan was either discussed and/or considered for adoption.

Based upon the solicitation process above, one set of comments was received on the first draft of the Town of Underhill AHMP. These comments can be summarized as follows: Brian Bigelow, Town Administrator, made several clarifications about statements made in the plan.

In response to these comments, Section 4.4.2 was changed to clarify that although one housing unit was shown as being built in the Special Flood Hazard Area between 2011-2014, only part of the parcel is located in SFHA and the house as permitted was built outside of the SFHA.

1.7.3 Review and adoption process

On July 31, 2016 the first draft of this local Town of Underhill AHMP was sent to the Vermont Department of Emergency Management and Homeland Security (VDEMHS) for review.

Comment and required revisions were received from VDEMHS on August 8, 2016.

CCRPC staff, working in concert with municipal staff, then made revisions to the Plan to address the required revisions.

The revised final draft annex was submitted to VDEMHS and FEMA for formal review and approval pending municipal adoption on March 17, 2017. On April 25, 2017 FEMA Region One issued a notice that the Town of Underhill AHMP was approved pending adoption by the relevant municipal governing body. CCRPC staff provided the final versions of the Multi-Jurisdictional Plan and this Municipal Annex to the Town Administrator for distribution to the Town of Underhill Selectboard members on May 4, 2017. CCRPC also provided draft language for a resolution of adoption to be discussed at a regularly scheduled and properly warned Town of Underhill Selectboard meeting on May 23, 2017.

The revised annex was adopted by the Selectboard on May 23, 2017 and a copy of the resolution sent to VDEMHS and FEMA Region One on June 20, 2017. On July 11, 2017 FEMA issued a letter that the Town of Underhill Plan was approved.

1.7.4 Monitoring, Evaluation and Updating of the Plan

Section 6 of the Multi-Jurisdictional AHMP document provides extensive details on the role each municipality and the Chittenden County RPC will play to be certain that progress on the implementation of this local AHMP is monitored and evaluated and that the AHMP is updated as needed and no later than its anticipated expiration in early 2022. In short, the Town of Underhill will:

- in the fall of 2017 and each fall thereafter, the municipal departments as noted in Section 5.5 as the conclusion of this document shall respond to CCRPC's questionnaire seeking information on the status (progress, problems if any, etc.) of each identified mitigation strategy detailed in Section 5;

- in the fall of 2018 and the fall of 2020, provide information to aid CCRPC in its more comprehensive review of the Multi-Jurisdictional AHMP and this local AHMP which will address issues such as goals, risks, resources, implementation problems, and partners; in partnership with the municipalities, the CCRPC will make the public aware of the availability of these review documents (via press releases, posting on the CCRPC website, electronic newsletters, one formal announcement in a paper of general circulation in the County, and other mechanisms) and provide detailed instructions on how to provide comment on these reviews;
- provide at least one representative of the municipality to participate as a member of the Chittenden County Multi-Jurisdictional All-Hazards Mitigation Plan Update and Review Committee which, after the current Plan update process is completed, to resume meeting in 2018; and
- participate in the Plan update process (assumed to commence in 2020 and conclude by early 2022).

Finally, it should be reemphasized that the Town of Underhill may review and update their own programs, initiatives and projects more often by working directly with the State Hazard Mitigation Officer (SHMO) based on changing local needs and priorities. Formal changes to individual municipal annexes may be made at any time by each municipality's governing body in order to reflect changing conditions, priorities, and opportunities during the 5-year life cycle of their single jurisdiction plan.

# SECTION 2: HAZARD IDENTIFICATION

Detailed descriptions of the natural, technological, and societal hazards affecting the municipalities of Chittenden County are contained in Section 2 of the *Multi-Jurisdictional All-Hazards Mitigation Plan*. Designated and non-designated hazard areas are described in Section 3 of this annex. Vulnerability of structures and infrastructure to hazards is also described in Section 4 and depicted in Figure 4.1.

2.1.1 Profiled Hazards

This Plan profiles six (6) Natural Hazards: Severe Winter Storm, Flooding, Fluvial Erosion, Severe Rainstorm, Extreme Temperatures and Wildfire. Prior to this discussion of Hazards and the subsequent analysis of Risk and Vulnerability, it will be first helpful to summarize the general state of knowledge regarding Location, Extent and Impact in the Town of Underhill for these hazards:

| **Hazard** (section of MJAHMP where discussed) | **Is Location data available?** | **Is Extent data available?** | **Is Impact data available?** |
|---|---|---|---|
| **Severe Winter Storm (2.1.1.1)** | No, occurs across the municipality and not mapped | No, only long-term data is at single point of National Weather Service station in South Burlington | Yes, if FEMA declares disaster. See 3.3 below. |
| **Flooding (2.1.1.3)** | Yes, 100 & 500 year flood areas delineated in the municipality (See Figure 2.1) | *Yes but only at a few discrete locations with gauge data such as U.S. Army Corps of Engineers for Lake Champlain or the USGS gauge on the Winooski River | Yes, if FEMA declares disaster but co-mingled with fluvial erosion and severe rainstorm hazards events. See 3.3 below. |
| **Fluvial Erosion (2.1.1.4)** | Yes, fluvial erosion hazards areas (now termed river corridor protection areas) are mapped in the municipality (See Figure 2.1) | Though fluvial erosion is considered a significant hazard in the municipality, the number of feet-acres of soil lost in any one event has not been recorded nor is there a record with such data. | Yes, if FEMA declares disaster but data co-mingled with flood and severe rainstorm events. See 3.3 below. |
| **Severe Rainstorm ( 2.1.1.2 )** | No, occurs across the municipality and not | *Yes but only long-term data is at single | Yes, if FEMA declares disaster but |

| | | | |
|---|---|---|---|
| | mapped. Damage locations are mapped but damages can just as easily be a function of poorly designed road and/or driveway drainage as it is a function of heavy rain exceeding infrastructure capacity. | point of National Weather Service station in South Burlington. | data co-mingled with flood and fluvial erosion events. See 3.3 below. |
| **Extreme Temperatures (2.1.1.5)** | No, occurs across the municipality and not mapped. | *Yes but only at single point of National Weather Service station in South Burlington | †Data not systematically collected on impacts. |
| **Wildfire (2.1.1.6)** | No, occurs across the municipality and not mapped. | Some compiled data on a countywide basis as shown in the Multi-Jurisdictional Plan but no systematic data collected after 2010. | ‡Data not systematically collected on impacts. |

** It is useful to note that while this NWS data is reliable it represents one discrete location in a county that has an area of 620 square miles in area. Likewise, while there are likely other systematic point-specific records being collected by individuals, business or organizations these data do not appear to be easily accessible. Finally, even if such data were accessible, only if the data was collected by mutually compatible means would it be useful.*

*†An intensive search of municipal public works records may reveal documentation of some prior repair or labor costs associated with frozen or burst sewer and/or water pipes caused by Extreme Cold. However, such analysis would show where past events happened not the location of inadequately buried pipes which might be vulnerable to future events.*

‡ *An intensive search of fire department records may reveal documentation of locations and acres burned caused by Wildfire. However, such analysis would show where past events happened but would not show the location of areas susceptible to future events (warnings by the US Forest Service and local fire departments are not location-specific) nor the location of individuals who are likely to unwisely burn trash or leaves or fail to extinguish a campfire during dry conditions.*

**This Plan profiles several Technological Hazards**. Prior to this discussion of Hazards and the subsequent analysis of Risk and Vulnerability, it will be first helpful to summarize the general state of knowledge regarding Location, Extent and Impact in Town of Underhill for these hazards:

| **Hazard** (section of MJAHMP where discussed) | **Is Location data available?** | **Is Extent data available?** | **Is Impact data available?** |
|---|---|---|---|
| **Water Pollution ( 2.2.1 )** | Streams with water quality concerns are identified in | Phosphorus-loading for general locations is known but non- | Annual budgetary impacts to individual municipalities are |

| | | | |
|---|---|---|---|
| | Tactical Basin plans. | point sources are varied and dispersed. A road erosion inventory was performed in 2016 but data analysis is not yet complete and projects have not yet been prioritized or scoped | significant but vary depending upon location and whether they are an MS4 permitted community. Underhill is not an MS4 community, but the municipality is subject to the requirements of the pending Municipal Roads General Permit. |
| **Hazardous Materials Incident ( 2.2.2 )** | Storage locations are known (see listing below of addresses). Incidents occurring during transportation could occur anywhere but risk is higher on transportation routes to and from the Ethan Allen Firing Range. | Rough estimates of spill amounts are recorded. | No formal data readily available on cleanup costs. |
| **Power Loss ( 2.2.3 )** | Outage locations not mapped | During an actual outage some data is recorded on duration although typically this is stated as "x,000 customers within the power company's service area". | Outage data is broad and refers to total customers within a county. |
| **Invasive Species ( 2.2.4 )** | Several species known to occur in upland and agricultural areas, but no systematic mapping has taken place. | No formal damage has been documented to date | No formal damage has been documented to date |
| **Multi-Structure Fire ( 2.2.5 )** | Could happen anywhere within | Data not formally collated across | Data not formally collated across |

| | | | |
|---|---|---|---|
| | the more developed portions of the municipality | agencies | agencies |
| **Major Transportation Incident ( 2.2.6 )** | Depending upon type of incident, could happen anywhere | No formal database of damages. | Varies depending upon type of incident. |
| **Water Supply Loss ( 2.2.7 )** | Water distribution systems are mapped. Water service is available for a small part of town. Most residences and businesses use private wells | Data not formally collated across agencies | Data not formally collated across agencies |
| **Sewer Service Loss ( 2.2.8 )** | Residences and businesses use private septic systems | N/A | N/A |
| **Natural Gas Service Loss ( 2.2.9)** | Natural gas service is available only in the Underhill Flats area. | Information for this rare occurrence not publicly available. | No formal damage has been documented to date. |
| **Telecommunications Failure ( 2.2.10 )** | Depending upon type of incident, could happen anywhere | Information for this rare occurrence not publicly available. | No formal damage has been documented to date |
| **Other Fuel Service Loss ( 2.2.11 )** | Distribution points of fuels such as firewood, fuel oil and propane are individual addresses and not mapped nor publicly available. | No formal loss of service has been documented. | No formal damage has been documented to date |

**The following discussion of societal hazards** is based upon qualitative information from discussions with Chittenden County law enforcement professionals as well as quantitative data from the State of Vermont.

| **Hazard** (section of MJAHMP where discussed) | **Is Location data available?** | **Is Extent data available?** | **Is Impact data available?** |
|---|---|---|---|
| **Crime ( 2.4.1.1 )** | Significant incidents could | Data collection is not standardized across | Significant socio-economic impacts |

| | | | |
|---|---|---|---|
| | happen anywhere in the municipality. | municipalities. | |
| **Economic Recession ( 2.4.1.2 )** | Would occur across the community. | Historic data on unemployment levels & poverty rates | Longer lasting impacts hard to measure below county level |
| **Terrorism ( 2.4.1.3 )** | The FBI does not share a list of potential targets. | Unknown but assumed to be significant if incident occurs | Unknown but assumed to be significant if incident occurs |
| **Civil Disturbance ( 2.4.1.4)** | County-wide. Significant incidents can happen anywhere. The likelihood of an event may not be geographically likely but rather related to the type of event (political event, sporting event, protest, etc.) | No formal damage has been documented to date | No formal damage has been documented to date |
| **Epidemic ( 2.4.1.5 )** | Could happen anywhere | Data not formally collated across agencies | Other than 1917 Influenza epidemic no formal damage has been documented to date |
| **Key Employer Loss ( 2.4.1.6 )** | Depending upon type of employer | No formal database of damages. | No formal database of key employer loss is maintained |

# SECTION 3: RISK ASSESSMENT

## 3.1 Mapped Hazard Areas

### 3.1.1 Flood Hazard Areas

Underhill began participating in the National Flood Insurance Program (NFIP) in 1988. The Town has been issued official FEMA Floodplain maps, including most recently issuance of Digital Flood Insurance Rate Maps (DFIRM) by FEMA in 2011. The town is participating in the regular NFIP as of January 2017.

A simple GIS intersection analysis reveals that portions of town roads are also located within the 100-year floodplain as well as culverts and bridges and utility poles. Unfortunately, this level of analysis does not take into account the fluvial geomorphology (volume, velocity, direction, etc.) nor, most critically, does it factor in the elevation of the road relative to flood elevation. Analysis also reveals farmland located within the floodplain, however, without detailed studies at each location it is not currently possible to predict how many cubic yards of productive soils would be a net loss during a flood event.

Figure 2.1 shows the current extent of the FEMA-FIRM flood hazard area in Underhill, as well as structures, infrastructure, and critical facilities located in the flood hazard area.

### 3.1.2 Fluvial Erosion Hazard and River Corridor Areas

During development and adoption of both the 2005 and 2011 Multi-Jurisdictional Plan and the municipal AHMPs, threats from stream erosion were identified as Fluvial Erosion Hazard (FEH) Areas through the analytical lens of Stream Geomorphic Assessment (SGA). The SGA approach is still used by the Vermont Agency of Natural Resources but the Vermont General Assembly adopted two related terms that are now used in managing fluvial erosion hazards. ANR now identifies and maps:

- *River Corridor*, which is the land area adjacent to a river that is required to accommodate the dimensions, slope, planform, and buffer of the naturally stable channel and that is necessary for the natural maintenance or natural restoration of a dynamic equilibrium condition, as that term is defined in 10 V.S.A. §1422, and for minimization of fluvial erosion hazards, as delineated by the Agency in accordance with the ANR Flood Hazard Area and River Corridor Protection Procedures.
- *River Corridor Protection Area,* which is the area within a delineated river corridor subject to fluvial erosion that may occur as a river establishes and maintains the dimensions, pattern, and profile associated with its dynamic equilibrium condition and that would represent a hazard to life, property, and infrastructure placed within the area. The river corridor protection area is the meander belt portion of the river corridor without an additional allowance for a riparian buffer to serve the functions of bank stability and slowing flood water velocities in the near-bank region.

SGA work has been completed on the Browns River and parts of Stevensville, Clay and Roaring Brooks in Underhill. Phase 2 SGA based River Corridor Protection Areas (formerly Fluvial Erosion Hazard Areas) were developed for those portions of streams where SGA was completed. Map 3 shows the progress of geomorphic assessments and identified Phase 2 SGA based River Corridor Protection Areas (RCPA) in Underhill. Additional portions of Stevensville, Clay and Roaring Brooks, as well as The Creek, that did not have Phase 2 SGA

work, but have a watershed area greater than 2 sq. miles, would also be included in the River Corridor Protection Area and/or River Corridor. Map 3 indicates all portions of the streams in Underhill that would be captured by the RCPA and/or RC.

### 3.1.3 Repetitive Loss Properties and National Flood Insurance Program

Repetitive loss properties are public or private buildings insured under the National Flood Insurance Program that have made at least two insurance claims of more than $1,000 each during a ten year period.

According to the National Flood Insurance Program there is one such property located in the Town of Underhill—a single family home along the Roaring Brook.

The status of the town participation's in the National Flood Insurance Program is as follows:

| Initial Flood Hazard Boundary Map | Initial Flood Insurance Rate Map | Current effective Map Date | Date of joining Regular NFIP | Date of most recent Community Assistance Visit |
|---|---|---|---|---|
| 5/31/74 | 6/15/88 | 7/18/11 | 6/15/88 | 6/22/00 |

The Town Zoning Administrator and the Town's Development Review Board (DRB) monitor compliance with the National Flood Insurance Program. The DRB reviews and adjudicates applications for development within the floodplain including any proposed new construction in the SFHA which is highly regulated. The Town also works with DEC to respond to any local requests for Floodplain identification including questions about mapping.

## 3.2 Other Information

The following hazards are not formally analyzed nor mapped with any consistency, often due to the random nature of where such damage occurs. However, they either occur with some frequency or represent potential hazards and therefore are discussed here.

### 3.2.1 1998 Ice Storm Damage

Generally speaking, the Town of Underhill was not affected by the 1998 Ice Storm. Some areas of downed trees were reported along the eastern boundary of the town. Some smaller winter storm events have occurred since then, including most recently DR-4163, declared in January 2015. However, mapping the locations of potential future events is not feasible as their occurrence is a function of numerous climatic variables.

### 3.2.2 Severe Rainstorms

In prior versions of this Annex and the County Plan, damage to roads, culverts and bridges from thunderstorm events was discussed as either the result of flooding or fluvial erosion. It was assumed that overflowing nearby streams, rivers or lakes were the cause of the damage. Analysis has shown that this damage is caused by intense, localized thunderstorms which cause excessive and rapid water flows on and over paved and gravel roads, roadside ditches, driveway culverts, stormwater systems, etc. In many cases, damaged infrastructure is located nowhere near a formally mapped Floodplain or Fluvial Erosion Hazard Area or River Corridor. This was the

case in more recent FEMA-declared disasters in the summer of 2013 and 2015. Because of this new information, CCRPC has decided to add "Severe Rainstorm" to the 2016 Update to the County Plan and its annexed local AHMPs. While past damage locations can sometimes be mapped (depending upon the degree and accuracy of data collection efforts) this may or may not provide any degree of predictability of the potential locations for future events.

The Town of Underhill's road infrastructure as well as the driveways of private homes and businesses consist primarily of gravel and/or dirt and are therefore susceptible to damage from intense thunderstorms. Damage occurring in DR #4120 (noted below) included significant damage from severe rainstorms.

Ridgeline and hilltop homes, utility lines, and homes located in the midst of mature forests are the most vulnerable to damage from falling trees and tree limbs. In particular, homes along Pleasant Valley Road are susceptible to high winds. Eight high wind events have been specifically identified as affecting Underhill by the National Climatic Data Center. One of these was one of the few instances of hurricane-force winds occurring in Chittenden County. According to the National Climatic Data Center, lightning has struck and damaged structures once in Underhill since 1990, although local officials indicate that many more lightning incidents have occurred in that timeframe.

### 3.2.3 High Crash Locations

In other municipal annexes, high accident locations are discussed, but there are no high accident locations located in Underhill, according to the Vermont Agency of Transportation.

### 3.2.4 Road Infrastructure Failure

Of the 10 bridges inventoried by VTrans for Underhill, 3 are rated functionally deficient, and 2 are considered structurally deficient. These ratings do not mean that the bridges are in imminent danger of collapse, however. None of the bridges in Underhill are rated Scour Critical with regards to fluvial undermining of bridge structure.

### 3.2.5 Hazardous Substances

Hazardous material release is discussed as a possible hazard in the Multi-Jurisdictional All-Hazards Mitigation Plan. According to Vermont Emergency Management, there are several reported hazardous material storage sites in Underhill. Sites that contain large amounts of fuel or store what VEM calls Extremely Hazardous Substances are more likely to cause significant problems in a hazardous materials incident.

According to the 2014 hazardous materials data obtained from VEM, the following sites in Underhill stored either fuel in excess of 10,000 lbs or extremely hazardous substances.

*Table 3-1 Town of Underhill, fuel storage sites in excess of 10,000 lbs.*

| Owner / Facility | Type of Substance |
|---|---|
| 426 VERMONT ROUTE 15 LLC | GASOLINE |
| S. B. COLLINS, INC -(WELLS CORNER MARKET) | FUELS, GASOLINE |

| | |
|---|---|
| VERIZON WIRELESS UNDERHILL NORTH | SULFURIC ACID |
| PROCTOR MAPLE RESEARCH | LABORATORY CHEMICALS |

*Source: Vermont Emergency Management*

*Table 3-2 Town of Underhill, Extremely Hazardous Substances storage sites*

| Owner / Facility | Type of Substance |
|---|---|
| FAIRPOINT UNDERHILL DIAL OFC (VT474806) | LEAD ACID BATTERIES |

*Source: Vermont Emergency Management*

While these locations are mapped, data on the extent, frequency and cleanup costs of hazardous substances releases is difficult to obtain.

## 3.3 Previous FEMA-Declared Natural Disasters and Snow Emergencies

### 3.3.1 Public Assistance

Since 1990, Underhill has received public assistance funding from FEMA for the following natural disasters:

*Table 3-3 Town of Underhill, FEMA-declared disasters and snow emergencies, 1990-2016.*

| Date (FEMA ID#) | Type of Event | Total repair estimates |
|---|---|---|
| April 1990 (DR 990) | flooding | $55,626 |
| January 1995 (DR 1063) | flooding | $228,075 |
| January 1996 (DR1101 | flooding | $9,434 |
| July 1998 (DR 1228) | flooding | $357,985 |
| April 2001 (EM3167) | snow emergency | $9,614 |
| June 2011 (DR 1995) | flooding | $101,217 |
| June 2013 (DR 4120) | flooding | $312,358 |
| August 2013 (DR 4140) | flooding | $23,388 |
| December 2014 (DR 4207) | Severe winter storm | $24,842 |
| June 2015 (DR 4232) | severe storm and flooding | $ 4,654 |

*Sources: Vermont Department of Housing & Community Affairs; Vermont Agency of Transportation.*
*Dollar value figures represent the total estimated repair costs for damages suffered to municipal resources. This table does not include damage claims submitted to FEMA by non-municipal organizations or by private individuals or businesses.*

The Town of Underhill was reimbursed at a rate of 75 percent by FEMA for the estimated repair costs. Funds provided in response to these natural disasters were used as follows:

- April 1990: General road repairs to Mountain Road.
- January 1995: Major washout of Mountain Road, an area repeatedly affected by rain or snowmelt. Funds were used for new gravel and for paving large portions of roadway.
- January 1996: Repairs to Cilley Hill Road and Meadow Lane focusing on gravel surfacing and ditching.
- July 1998: Funds were generally spent on gravel and culverts. Highlights include 10ft x 12ft Box culvert at Barrett Lane, 8.33 ft x 11ft multi plate culvert at Irish Settlement Road. Funds were also spent on upgrading driveway culverts from 12" to 18", a 6.5ft x 9 ft culvert at I.S. Road, and additional individual culverts such as 3ftx4ft, 48" plastic, 52"

metal. Several houses on Meadow Lane were affected by this disaster, mostly with flooded basements. Several road crossing culverts and driveway culverts were upgraded on Irish Settlement Road. Driveway culverts were upgraded on Upper English Settlement Road as well.

- June 2011: Money was spent on gravel roadway, ditches and culvert repair on Lower English Settlement Road, Poker Hill Road, Stevensville Road, Deane Road, Mountain Road, Barrett Road, New Road, Sugar Hill Road, Park Street, Sam Ward Road, Harvey Road, Krug Road, Paul Cook Road, Irish Settlement Road, Upper English Settlement Road, Maple Ridge Road, Maple Leaf Road. Money was also used to fund general protective measures. The Jericho Underhill Fire Department also received funding to pay for the costs of emergency calls answered during the disaster.
- June 2013: Money was spent on gravel roadway, ditches and culvert repair on Tupper Road, Doon Road, Barrett Lane, Downes Road, Cilley Hill Road, Poker Hill Road, Repa Road, Sam Ward Road, Daudelin Road, Mountain Vista Road, Irish Settlement Road, North Underhill Station Road, Bill Cook Road, Lower English Settlement Road, Gerts Knob Road, and Sand Hill Road, as well as to cover general administrative costs.
- August 2013: Money was used to repair gravel roadway, ditches and culverts on Barrett Lane, Maple Ridge Road, Meadow Lane and Lower English Settlement Road. The Jericho Underhill Fire Department also received funding to pay for the costs of emergency calls answered during the disaster.
- December 2014: Money was used for town-wide emergency protective measures and for debris removal.
- June 2015: Culvert repair on Page Road.

See *Figure* 3.1. to see locations where repairs funded in part with FEMA Public Assistance took place for disasters between 2001 and 2016. As the map shows, damage has tended to be concentrated in upland areas. Note that some Debris Removal and Protective Measures locations are shown at the location of the municipal office. This indicates assistance was at various locations throughout the municipality, not that damages were incurred at the office.

### 3.3.2 Individual Assistance funds

As noted in Section 3.3 of the County Plan, due to privacy concerns, the individual homes or businesses which received Individual Assistance funds are not public information. However, the names of the streets of such homes or businesses from which claims are filed is available as are the funds provided. With regards to the Town of Underhill, data indicate that six individual assistance claims were approved following the June 2011 disaster and two were approved after Tropical Storm Irene in September 2011. These streets are shown in Figure 3.1.1.

*Table 3-4 Town of Underhill, location of individual assistance claims, Spring 2011 flood & Tropical Storm Irene, September 2011*

| Disaster | Damaged Address City | Damaged Address Street | Registrations | IHP Amount |
|---|---|---|---|---|
| June 2011 | UNDERHILL | PARK ST | 1 | $7,550.98 |

| | | | | |
|---|---|---|---|---|
| June 2011 | UNDERHILL | ROMAR DR | 1 | $3,796.94 |
| June 2011 | UNDERHILL | S HILL | 1 | $1,190.37 |
| June 2011 | UNDERHILL | SNYDER RD | 1 | $16,068.09 |
| June 2011 | UNDERHILL | SUGAR HILL RD | 1 | $2,438.37 |
| June 2011 | UNDERHILL CENTER | SNYDER RD | 1 | $16,068.09 |
| Tropical Storm Irene | UNDERHILL | CILLEY HILL RD | 1 | $6,584.16 |
| Tropical Storm Irene | UNDERHILL CENTER | MOUNTAIN RD | 1 | $204.50 |

## 3.4 Future Events

Although estimating the risk of future events is far from an exact science, CCRPC staff 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 Fall 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 county, and serves as a rough method of identifying which hazards hold the greatest risk. CCRPC staff applied the following scoring system:

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.

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

As explained in detail in Section 3.4 of the Multi-Jurisdictional Plan, for the 2011 Plan, the following Hazards were considered to occur or have the potential to occur with sufficient frequency and/or severity to be profiled for Risk Estimation in that Plan:

**Natural Hazards:**

- Drought
- Flooding
- Fluvial erosion
- High winds
- Landslide
- Lightning
- Multi-structure urban fire
- Radiological (natural)
- Wildfire
- Winter storm

**Technological Hazards:**

- Gas service loss
- Hazardous materials incident
- Major transportation incident
- Military ordnance incident
- Power loss
- Radiological incident
- Sewer service loss
- Telecommunications failure
- Water service loss

**Societal Hazards:**

- Crime
- Civil disturbance
- Economic recession
- Epidemic
- Key employer loss
- Terrorism

For the 2016 update, the CCRPC and its All-Hazards Mitigation Plan Update Committee made slight changes to this list by consolidating some hazards or delineating hazards with more specificity as follows:

**Natural Hazards:**
- Flooding
- Fluvial erosion
- Severe Rainstorm
- Wildfire
- Winter storm
- Extreme temperatures

**Technological Hazards:**
- Hazardous materials incident
- Major transportation incident
- Multi-structure fire
- Natural gas service loss
- Water pollution
- Power loss
- Sewer service loss
- Telecommunications failure
- Water service loss
- Other fuel service loss
- Invasive Species

**Societal Hazards:**
- Crime
- Civil disturbance
- Economic recession
- Epidemic
- Key employer loss
- Terrorism

3.4.1 Natural Hazards

For the 2011 Hazard and Risk Estimation analysis for Underhill, the following natural hazards received the highest risk ratings out of a possible high score of 80:
- Severe Winter Storm (55)
- Flooding (28)

For the 2017 update, the following natural hazards received the highest risk ratings out of a possible high score of 80 (see Table below):
- Severe Winter Storm (55)
- Flooding (50)
- Severe Rainstorm (45)
- Fluvial Erosion (36)

While flooding, severe rainstorms and fluvial erosion are likely to have a significant impact over a smaller area, severe winter storms tend to affect the entire town and are more common, hence the higher rating.

*Table 3-5 Natural hazards risk estimation matrix, Underhill*

| | Risk Characteristic | Winter Storm | Flooding | Severe Rainstorm | Fluvial Erosion | Wildfire | Extreme Temperatures |
|---|---|---|---|---|---|---|---|
| | 0 = No developed area impacted | | | | | | |
| **Area** | 1 = Less than 25% of developed area impacted | | | | | 1 | 1 |
| **Impacted** | 2 = Less than 50% of developed area impacted | | 2 | 2 | 2 | | |
| | 3 = Less than 75% of developed area impacted | | | | | | |
| | 4 = Over 75% of developed area impacted | 4 | | | | | |
| | | | | | | | |
| **Health and** | 0 = No health and safety impact | | | 0 | 0 | | 0 |
| **Safety** | 1 = Few injuries or illnesses | 1 | 1 | | | 1 | |
| **Consequences** | 2 = Few fatalities but many injuries and illnesses | | | | | | |
| | 3 = Numerous fatalities | | | | | | |
| | | | | | | | |
| | 0 = No property damage | | | | | | 0 |
| **Property** | 1 = Few properties destroyed or damaged | | | | | 1 | |
| **Damage** | 2 = Few destroyed but many damaged | 2 | 2 | 2 | 2 | | |
| | 2 = Few damaged and many destroyed | | | | | | |
| | 3 = Many properties destroyed and damaged | | | | | | |
| | | | | | | | |
| | 0 = Little or no environmental damage | | | | | | 0 |
| **Environmental** | 1 = Resources damaged with short-term recovery | | | | | 1 | |
| **Damage** | 2 = Resources damaged with long-term recovery | 2 | 2 | 2 | 2 | | |
| | 3 = Resources destroyed beyond recovery | | | | | | |
| | | | | | | | |
| | 0 = No economic impact | | | | | | |
| **Economic** | 1 = Low direct and/or indirect costs | | | | | 1 | 1 |
| **Disruption** | 2 = High direct and low indirect costs | 2 | | | | | |
| | 2 = Low direct and high indirect costs | | | | | | |
| | 3 = High direct and high indirect costs | | 3 | 3 | 3 | | |
| | | | | | | | |
| | **TOTAL SCORE** | 11 | 10 | 9 | 9 | 5 | 2 |
| | | | | | | | |
| | 1 = Unknown but rare occurrence | | | | | | |
| **Probability of** | 2 = Unknown but anticipate an occurrence | | | | | | |
| **Occurrence** | 3 = 100 years or less occurrence | | | | | | |
| | 4 = 25 years of less occurrence | | | | 4 | 4 | 4 |
| | 5 = Once a year or more occurrence | 5 | 5 | 5 | | | |
| | | | | | | | |
| | **TOTAL RISK RATING** | 55 | 50 | 45 | 36 | 20 | 8 |

### 3.4.2 Technological Hazards

In the 2011 Hazard and Risk Estimation analysis for Underhill, the following technological hazards received the highest risk ratings out of a possible high score of 80:

- Power Loss (45)
- Telecommunications Failure (28)
- Hazardous Materials Incident (18)

For the 2017 update, the following technological hazards received the highest risk ratings out of a possible high score of 80 (see Table below):

- Power Loss (45)
- Telecommunications Failure (24)

Underhill is vulnerable to power loss and telecommunications failure because the population is dispersed and repairing utility infrastructure in rural areas can take more time. Only a limited portion of Underhill has public water service, and town residents and businesses rely on well water. Consequently, it should be noted that a power loss also results in a water service loss.

Power loss and telecommunications failure were both identified as the most significant technological hazards in the 2011 plan. Though cellular service is somewhat more reliable than it was five years ago, both issues remain significant for residents of rural areas.

*Table 3-6 Technological hazards risk estimation matrix, Underhill*

| | Risk Characteristic | Power Loss | Telecommunications Failure | Hazardsous Materials Incident | Invasive Species | Other Fuel Service Loss | Major Transportation Incident | Water Service Loss | Pollutoin (algal, etc.) | Gas Service Loss | Multi-Structure Urban Fire | Sewer Service Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0 = No developed area impacted | | | | | | | | | | | 0 |
| **Area** | 1 = Less than 25% of developed area impacted | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | |
| **Impacted** | 2 = Less than 50% of developed area impacted | | | | | | | | | | | |
| | 3 = Less than 75% of developed area impacted | | 3 | | | | | | | | | |
| | 4 = Over 75% of developed area impacted | 4 | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Health and** | 0 = No health and safety impact | | | | 0 | | | | | | | |
| **Safety** | 1 = Few injuries or illnesses | | 1 | 1 | | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| **Consequences** | 2 = Few fatalities but many injuries and illnesses | 2 | | | | | | | | | | |
| | 3 = Numerous fatalities | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 0 = No property damage | | 0 | | 0 | | | 0 | | 0 | | 0 |
| **Property** | 1 = Few properties destroyed or damaged | 1 | | 1 | | 1 | 1 | | 1 | | 1 | |
| **Damage** | 2 = Few destroyed but many damaged | | | | | | | | | | | |
| | 2 = Few damaged and many destroyed | | | | | | | | | | | |
| | 3 = Many properties destroyed and damaged | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 0 = Little or no environmental damage | 0 | 0 | | | 0 | | 0 | | 0 | 0 | |
| **Environmental** | 1 = Resources damaged with short-term recovery | | | | | | 1 | | | | | 1 |
| **Damage** | 2 = Resources damaged with long-term recovery | | | 2 | 2 | | | | 2 | | | |
| | 3 = Resources destroyed beyond recovery | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | 0 = No economic impact | | | | | | | | | | 0 | 0 |
| **Economic** | 1 = Low direct and/or indirect costs | | | 1 | | | | 1 | | 1 | | |
| **Disruption** | 2 = High direct and low indirect costs | 2 | 2 | | 2 | 2 | 2 | | 2 | | | |
| | 2 = Low direct and high indirect costs | | | | | | | | | | | |
| | 3 = High direct and high indirect costs | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | **TOTAL SCORE** | 9 | 6 | 6 | 5 | 5 | 6 | 3 | 7 | 3 | 3 | 2 |
| | | | | | | | | | | | | |
| | 1 = Unknown but rare occurrence | | | | | | | | | | | 1 |
| **Probability of** | 2 = Unknown but anticipate an occurrence | | | | | | 2 | | | 2 | 2 | |
| **Occurrence** | 3 = 100 years or less occurrence | | | 3 | 3 | 3 | | 3 | | | | |
| | 4 = 25 years of less occurrence | | 4 | | | | | | 1 | | | |
| | 5 = Once a year or more occurrence | 5 | | | | | | | | | | |
| | | | | | | | | | | | | |
| | **TOTAL RISK RATING** | 45 | 24 | 18 | 15 | 15 | 12 | 9 | 7 | 6 | 6 | 2 |

3.4.3 Societal Hazards

In the 2011 Hazard and Risk Estimation analysis for Underhill, the following societal hazards received the highest risk ratings out of a possible high score of 80:

- Economic Recession (32)
- Epidemic (21)

For the 2017 update, the following societal hazards received the highest risk ratings out of a possible high score of 80 (see Table below):

- Economic Recession (32)
- Epidemic (21)

Economic recession is highly ranked for both its direct impacts and its secondary effects on health, safety, and the environment. In a recession, property owners may not be able to maintain their properties, which are then more vulnerable to natural hazards. The likelihood of an epidemic is difficult to gauge, but given Underhill's lack of medical facilities, its consequences could be severe. Epidemic and economic recession were both identified as threats in the 2011 plan, and the risk of them remains low but still exists.

*Table 3-7 Societal hazards risk estimation matrix, Underhill*

| | Risk Characteristic | Economic Recession | Epidemic | Crime | Civil Disturbance | Terrorism | Key Employer Loss |
|---|---|---|---|---|---|---|---|
| | 0 = No developed area impacted | | | | | | |
| **Area** | 1 = Less than 25% of developed area impacted | | | 1 | 1 | 1 | 1 |
| **Impacted** | 2 = Less than 50% of developed area impacted | | 2 | | | | |
| | 3 = Less than 75% of developed area impacted | | | | | | |
| | 4 = Over 75% of developed area impacted | 4 | | | | | |
| | | | | | | | |
| **Health and** | 0 = No health and safety impact | | | | | | 0 |
| **Safety** | 1 = Few injuries or illnesses | 1 | | 1 | 1 | 1 | |
| **Consequences** | 2 = Few fatalities but many injuries and illnesses | | 2 | | | | |
| | 3 = Numerous fatalities | | | | | | |
| | | | | | | | |
| | 0 = No property damage | 0 | 0 | | | | 0 |
| **Property** | 1 = Few properties destroyed or damaged | | | 1 | 1 | 1 | |
| **Damage** | 2 = Few destroyed but many damaged | | | | | | |
| | 2 = Few damaged and many destroyed | | | | | | |
| | 3 = Many properties destroyed and damaged | | | | | | |
| | | | | | | | |
| | 0 = Little or no environmental damage | | 0 | 0 | 0 | 0 | 0 |
| **Environmental** | 1 = Resources damaged with short-term recovery | 1 | | | | | |
| **Damage** | 2 = Resources damaged with long-term recovery | | | | | | |
| | 3 = Resources destroyed beyond recovery | | | | | | |
| | | | | | | | |
| | 0 = No economic impact | | | | | | |
| **Economic** | 1 = Low direct and/or indirect costs | | | 1 | 1 | | |
| **Disruption** | 2 = High direct and low indirect costs | 2 | | | | 2 | 2 |
| | 2 = Low direct and high indirect costs | | | | | | |
| | 3 = High direct and high indirect costs | | 3 | | | | |
| | | | | | | | |
| | **TOTAL SCORE** | 8 | 7 | 4 | 4 | 5 | 3 |
| | | | | | | | |
| | 1 = Unknown but rare occurrence | | | | | 1 | 1 |
| **Probability of** | 2 = Unknown but anticipate an occurrence | | | | 2 | | |
| **Occurrence** | 3 = 100 years or less occurrence | | 3 | | | | |
| | 4 = 25 years of less occurrence | 4 | | 4 | | | |
| | 5 = Once a year or more occurrence | | | | | | |
| | | | | | | | |
| | **TOTAL RISK RATING** | 32 | 21 | 16 | 8 | 5 | 3 |

### 3.4.4 Hazard Summary

According to the risk estimation analysis, the highest rated hazards by type for Underhill are:

Natural Hazards
- Severe Winter Storm (55)
- Flooding (50)
- Severe Rainstorm (45)

Technological Hazards
- Power Loss (45)
- Telecommunications Failure (24)

Societal Hazards
- Economic Recession (32)
- Epidemic (21)

It should be noted that the four natural hazards on the list—flooding, fluvial erosion, severe rainstorm and severe winter storm—could be the cause of the highest-rated technological hazards, power loss and telecommunications failure. Winter storms are the highest rated hazard for Underhill, due in large part to their widespread nature and frequent occurrence.

# SECTION 4: VULNERABILITY ASSESSMENT

As discussed in Section 4 of the County Plan, typical vulnerabilities from the County's common hazards consist primarily of:

- Damage to public infrastructure especially roads and culverts;
- Temporary closures of roads and bridges including from debris;
- Temporary loss of power and/or telecommunications
- Temporary isolation of vulnerable individuals such as the elderly or those in poverty.

More specifically, these vulnerabilities typically occur in association with the Profiled Natural Hazards as follows:

*Table 4-1 Town of Underhill: Natural Hazards and typical vulnerabilities*

| **Hazard** | **Typical vulnerabilities** | **Occasional additional vulnerability** |
|---|---|---|
| **Severe Winter Storm** | -temporary closures of roads and bridges including from debris;<br>-temporary loss of power and/or telecommunications, and<br>-temporary isolation of vulnerable individuals | -budget impacts from debris cleanup |
| **Flooding** | -temporary closures of roads and bridges including from debris;<br>-temporary loss of power and/or telecommunications, and<br>-temporary isolation of vulnerable individuals<br>-damage to public infrastructure | -budget impacts from road/bridge closures and repairs to public infrastructure<br>-damages to individuals' properties and businesses |
| **Fluvial Erosion** | -temporary closures of roads and bridges including from debris;<br>-temporary loss of power and/or telecommunications, and<br>-temporary isolation of vulnerable individuals<br>-damage to public infrastructure | -budget impacts from road/bridge closures and repairs to public infrastructure<br>-damages to individuals' properties and businesses |
| **Severe Rainstorm** | -temporary closures of roads and bridges including from debris;<br>-temporary loss of power and/or telecommunications, and<br>-temporary isolation of vulnerable individuals<br>-damage to public infrastructure | -budget impacts from road/bridge closures and repairs to public infrastructure<br>-damages to individuals' properties and businesses |
| **Extreme Temperatures** | -damage to public infrastructure<br>-loss of water service | -budget impacts due to needed repairs |
| **Wildfire** | -damage to private property | |

**Relative to the County as a whole the Town of Underhill has a higher vulnerability to:**

- Severe Rainstorms, Fluvial Erosion due to high amount of gravel roads and mountainous terrain.
- Flooding due to the presence of the Browns River and its tributaries.

Vulnerabilities with regard to Technological Hazards are harder to project as these incidents occur with less frequency and less predictability.

*Table 4-2 Town of Underhill: Technological Hazards and typical vulnerabilities*

| **Hazard** | **Typical vulnerabilities** | **Occasional additional vulnerability** |
|---|---|---|
| **Major Transportation Incident** | -temporary closures of transportation infrastructure<br>-injuries, deaths | -if major event, potential long term closure of infrastructure. |
| **Power Loss** | -temporary loss of electrical service<br>-temporary impacts to vulnerable individuals<br>-damage to public infrastructure | -if extended event, damage to perishable goods or business income.<br>-if extensive loss, potential budget impacts to service providers. |
| **Hazardous Materials Incident** | -temporary closures of roads and bridges during cleanup. | -if large event, potential high cleanup costs.<br>-injuries to persons |
| **Water Service Loss** | -temporary loss of service<br>-temporary impacts to vulnerable individuals | -if extensive loss, potential budget impacts to service providers. |
| **Gas Service Loss** | -temporary loss of service<br>-temporary impacts to vulnerable individuals | -if extensive loss, potential budget impacts to service providers. |
| **Telecommunications Failure** | -temporary loss of service<br>-temporary impacts to vulnerable individuals | -if extensive loss, potential budget impacts to service providers. |
| **Other Fuel Service Loss** | -temporary loss of service<br>-temporary impacts to vulnerable individuals | -if extensive loss, potential budget impacts to service providers. |
| **Sewer Service Loss** | NOT APPLICABLE. No sewer service in Town. | |
| **Water Pollution** | -ongoing budgetary impacts due to | -if repeat events, |

| | | |
|---|---|---|
| | permit requirements. | impacts to tourism-based businesses |
| **Invasive Species** | -small but ongoing cost to monitor level of occurrence | -unknown at this point. |

**Relative to the County as a whole the Town of Underhill has a slightly higher vulnerability to:**

- Power Loss and Telecommunications Failure due to its mountainous terrain

With regard to Societal Hazards, vulnerabilities are typically more dispersed among individuals and societal sectors compared to the natural environment and to technology which is fixed.

*Table 4-3 Town of Underhill: Societal Hazards and typical vulnerabilities*

| **Hazard** | **Typical vulnerabilities** | **Occasional additional vulnerability** |
|---|---|---|
| **Crime** | -increased demands on police services and social services | -injuries<br>-deaths |
| **Epidemic** | -temporary closures of schools, businesses, places of assembly<br>-increased demand on medical services | -if an epidemic is widespread and long-lasting, impact could be severe |
| **Key Employer Loss** | -loss of economic activity<br>-loss of portion of tax base<br>-increased demands on social services | -effects increased if employer is of significant size |
| **Economic Recession** | -loss of economic activity<br>-increased demands on social services<br>-some loss of tax revenue | -effects increased if event is of extended duration |
| **Civil Disturbance** | -injuries to persons<br>-damage to public and private property | -budget impacts to police services depending upon severity of event<br>-deaths |
| **Terrorism** | -injuries to persons<br>-damage to public and private property | -budget impacts to police services depending upon severity of event<br>-deaths |

**Relative to the County as a whole there are insufficient data to conclude whether the Town is more vulnerable to one of the six Societal Hazards noted above.**

With regard to the vulnerability of critical facilities, infrastructure and vulnerable populations, quantitative and locational data for the Town are available as follows.

## 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." Figure 1.4 shows the geographic distribution of some critical facilities and utilities. Table 4-1 identifies critical facilities in Underhill, excluding critical facilities designated as hazardous materials and petroleum storage sites, which shown in Section 3.2.5. This list includes all critical facilities, not only the facilities located in designated hazard areas.

*Table 4-4 Critical facilities in the Town of Underhill*

| Facility Type | Number of Facilities |
|---|---|
| Education Facility | 1 |
| Fire Station | 1 |
| Emergency Shelters | 1 |
| Emergency Operations Center | 1 |
| Government and Military | 2 |
| Mail and Shipping | 2 |
| Water Supply and Treatment | 2 |

*Source: VCGI*

None of these facilities are located in mapped Flood Hazard Areas.
None of these facilities are located in mapped River Corridors.
None of these facilities are located in mapped River Corridor Protection Areas.

## 4.2 Infrastructure

### 4.2.1 Town Highways

The following is a statistical overview of roads in the Town of Underhill. These tables show the range of road types within the town, state highway to unimproved unpaved roads. The different road types have different hazard vulnerabilities. Unpaved roads are more vulnerable to washing out in a flood or storm, while traffic incidents are more likely to occur on large, arterial roads.

Municipal highways, bridges and dams are well mapped in Chittenden County. The following three tables show the diversity of municipal highways and road surface in the Town of Underhill

The Vermont Agency of Transportation divides municipal (town) highways into various classes as follows:
Class 1 town highways are subject to concurrent responsibility and jurisdiction between the municipality and VTrans. Class 1 town highways are state highways in which a municipality has assumed responsibility for most of the day to day maintenance (pot hole patching, crack filling,

etc.). The state is still responsible for scheduled surface maintenance or resurfacing. In Chittenden County Class 1 highways are generally paved.

Class 2 town highways are primarily the responsibility of the municipality. The state is responsible for center line pavement markings if the municipality notifies VTrans of the need. The municipality designates highways as Class 2 with approval from VTrans. These are generally speaking the busier roads in a given town second to Class 1. In Chittenden County, most Class 2 highways are generally paved although in the more isolated areas these are gravel roads.

Class 3 town highways are the responsibility of and designated by the municipality. These are to be maintained to an acceptable standard and open to travel during all seasons. In Chittenden County, Class 3 roads are both paved or gravel.

Class 4 town highways are all other highways and the responsibility of the municipality. However, pursuant to Vermont State Statutes, municipalities are not responsible for maintenance of Class 4 town highways. These are generally closed during the winter and minimally maintained and almost exclusively dirt.

*Table 4-5 Town highway mileage by class, Town of Underhill*

| Class 1 | Class 2 | Class 3 | Class 4 | State Hwy | Fed Hwy | Interstate | Total 1, 2, 3, 4 State Hwy |
|---|---|---|---|---|---|---|---|
| | 8.750 | 43.79 | 6.41 | 4.944 | | | 57.426 |

*Source: derived from VTrans TransRDS GIS data – surface class and arc length*

*Table 4-6 Town highway mileage by surface type, Town of Underhill*

| Paved | Gravel | Soil or Graded | Unimproved | Impassable | Legal Trail | Total |
|---|---|---|---|---|---|---|
| 19.998 | 32.971 | 9.426 | 0.14 | 1.359 | 0.55 | 64.444 |

*Table 4-6, continued*

| Total Known | Total Unpaved | % Paved | % Unpaved |
|---|---|---|---|
| 63.894 | 43.896 | 31.3% | 68.7% |

*Legal Trail Not Included*
*Source: derived from VTrans TransRDS GIS data – surface class and AOTmiles*

See Figure 3.2 for locations of paved vs. gravel and/or soil roads.

4.2.2 Bridges, Culverts, and Dams

There are a variety of bridges and culverts located in the municipality. The following bridges are contained in an inventory maintained by VCGI, VTrans and the CCRPC. A GIS intersection was performed to determine which bridges are located in the designated flood hazard area (aka Special Flood Hazard Area or 100-year floodplain.) and /or the River Corridor Protection Area (aka Fluvial Erosion Hazard Area).

*Table 4-7 Bridges Located in Special Flood Hazard Area and River Corridor Protection Area*

| # of Structures in RCPA (FEH) | # of *Insufficient* Structures in RCPA | # of Structures in River Corridor | # of *Insufficient* Structures in RC | # of Structures inSFHA | # of *Insufficient* Structures inSFHA |
|---|---|---|---|---|---|
| 20 | 1 | 19 | 0 | 19 | 1 |
| A structure could be a bridge, culvert or arch.<br>Data came from ANR DMS. A structure is insufficient if its % bankfull width is 50% or less. | | | | | |

As noted in Section 4 of the County Plan, a large portion of the County's stream have had detailed Phase II Stream Geomorphic Assessments conducted. With regards to Underhill, studies identify specific stream reaches where fluvial erosion is a concern as well as where infrastructure, primarily culverts, as noted in the table below is at risk.

*Table 4-8 Culverts with a geographic compatibility rating of "Mostly Incompatible" or "Incompatible"*

| Bankfull Width | Compatibility Score | Town | Location | Road Name | Stream Name |
|---|---|---|---|---|---|
| 17.65 | 5 | Underhill | South Irish Settlement Rd. | FULLER RD | Unnamed |
| 23.33 | 6 | Underhill | .25 Miles W Poker Hill Rd. | MULLEN RD | Unnamed |
| 33.33 | 7 | Underhill | .3 Miles W Poker Hill Rd. | N UNDERHILL STATION RD | Beaver Meadow Brook |
| 41.33 | 7 | Underhill | Junction with Corbett Rd. | SAGE RD | Unnamed |
| 39.44 | 8 | Underhill | .6 Miles E Pleasant valley Rd. | BEARTOWN RD | Unnamed |
| 38.46 | 8 | Underhill | Junction with Bill Cook Rd. | POKER HILL RD | Unnamed |
| 55.56 | 8 | Underhill | | POKER HILL RD | Beaver Brook |
| 56.45 | 8 | Underhill | .2 Miles S Irish Settlement Rd. | FULLER RD | Unnamed |
| 41.33 | 8 | Underhill | .1 Mile W Maple leaf Rd. | STEVENSVILLE RD | Unnamed |
| 61.76 | 9 | Underhill | | POKER HILL RD | Beaver Brook |
| 55.56 | 9 | Underhill | | POKER HILL RD | Beaver Brook |
| 25.83 | 9 | Underhill | Just south of Junction with Sand Hill rd. | IRISH SETTLEMENT RD | Unnamed |
| 26.67 | 9 | Underhill | .25 Miles E Corbett Rd. | | Unnamed |
| 56.99 | 10 | Underhill | | BEARTOWN RD | Steinhour Brook |
| 37.18 | 10 | Underhill | | NO UHILL STATION RD | Beaver Brook |
| 37.50 | 10 | Underhill | At driveway #253 | PLEASANT VALLEY RD | Unnamed |
| 16.67 | 10 | Underhill | .1 Miles W State Park entrance | MOUNTAIN RD | Unnamed |
| 34.29 | 10 | Underhill | Just E of driveway to house #165 off Mountain Rd | MOUNTAIN RD | Unnamed |
| 33.33 | 10 | Underhill | .6 Miles N Upper English Settlement Rd. | POKER HILL RD | Unnamed |
| 30.67 | 10 | Underhill | .75 Miles S Butler Rd | IRISH SETTLEMENT RD | Unnamed |
| 28.00 | 10 | Underhill | Next to Driveway # | BILL COOK RD | Unnamed |

| | | | | | |
|---|---|---|---|---|---|
| | | | 49 | | |
| 28.89 | 10 | Underhill | .1 Mile E Poker Hill Rd. | PAGE RD | Unnamed |
| 18.79 | 10 | Underhill | .5 Miles N Pleasant Valley Rd. | NEW RD | Unnamed |
| 43.16 | 10 | Underhill | .3 Miles E Pleasant Valley Rd | HARVEY RD | Unnamed |
| 30.56 | 10 | Underhill | .75 Miles E VT-15 | CILLEY HILL RD | Unnamed |
| 23.81 | 10 | Underhill | .3 Miles S of Sand Hill Rd. | IRISH SETTLEMENT RD | Unnamed |
| 36.00 | 10 | Underhill | .25 Miles E Maple Leaf Rd. | STEVENSVILLE RD | Unnamed |
| 39.66 | 10 | Underhill | Driveway Of House # 56 off Bill Cook Rd. | DW off Bill Cook Rd | Unnamed |
| 43.30 | 10 | Underhill | Just E Pleasant Valley Rd. | MACOMBER PL | Unnamed |
| 23.81 | 10 | Underhill | Driveway of house #331 off Poker Hill Rd. | DW off Poker Hill Rd | Unnamed |

***Mostly incompatible*** *5<GC<10*
*% Bankfull Width + Approach Angle scores < 2*

*Structure mostly incompatible with current form and process, with a moderate to high risk of structure failure. Re-design and replacement planning should be initiated to improve geomorphic compatibility.*

***Fully incompatible*** *0<GC<5*
*% Bankfull Width + Approach Angle scores < 2* ***AND*** *Sediment Continuity + Erosion and Armoring scores < 2*

*Structure fully incompatible with channel and high risk of failure. Re-design and replacement should be performed as soon as possible to improve geomorphic compatibility.*

Information on dams is available from two sources: a database of dams regulated by the Vermont Department of Environmental Conservation and the National Dam Inventory maintain by the U.S. Army Corps of Engineers. There are neither such dams in Underhill.

### 4.2.3 Water, Wastewater and Natural Gas Service Areas

The town participates in the Jericho-Underhill Water District, which supplies water to residents and businesses in the village area at the southern boundary of the town. Vermont Gas recently extended natural gas lines into the Underhill Flats section of town near Route 15, but gas service remains unavailable in most of the town (cf. Figure 1.4)

Other than those participating in the Jericho-Underhill Water District, all residents receive water from wells and dispose of wastewater through septic systems. Most have individual systems, although homes in some of the newer subdivisions utilize a community well and/or septic system. No more than two lots share the same septic system in subdivisions, however.

### 4.2.4 Electric Power Transmission Lines and Telecommunications Land Lines

One high tension power line runs through Underhill along Route 15. Power distribution and telecommunications lines run along the various roads and then to individual house lots (cf. Figure 1.4).

## 4.3 Estimating Potential Losses in Designated Hazard Areas.

A simple GIS intersection of e-site data with the 2010 FIRM floodplain data (cf. Figure 2.1) indicates the following with regards to structures located in mapped flood hazard areas:

- There are 1,255 structures in the town of Underhill.
- There are 18 residential structures and 1 commercial/industrial structure located within the 100-year floodplain. Based on the 2014 median grand list values, the estimated potential loss due to a major flood event inundating the floodplain is $4,208,215.
- This estimate only takes structures into account. It does not account for personal property or business losses.

A simple GIS intersection of esite data with the 2016 River Corridor Protection Area data (cf. Figure 2.1) indicates the following with regards to structures vulnerable to Fluvial Erosion.

- There are 1,255 structures in the town of Underhill.
- There are 14 residential structures and 1 commercial/industrial structure located within the river corridor protection area. The estimated potential loss due to an event in a river corridor protection area is lower: $3,286,936.
- Note that this estimate only takes structures into account, however. It does not account for personal property or business losses.

At this time, a more detailed analysis of potential losses to structures, infrastructure, and agricultural lands cannot be made. Such an analysis would require individual site visits and analysis conducted by both river geomorphologists and structural engineers which is beyond the capacity of the CCRPC due to funding limitations.

## 4.4 Vulnerable Populations

Like most of the County's rural communities, census data more detailed than the town boundaries is not available to see if there are concentrations of either elderly populations or low-income populations. In other words, the town's boundaries form one single census tract. Demographic information on the relative percentages of vulnerable populations is as follows:

*Table 4-9 Vulnerable populations, Underhill*

| | Underhill | Chittenden County | Vermont | National |
|---|---|---|---|---|
| Percent Minority (non-white)[1] | 1.8% | 7.7% | 4.8% | 26.7% |
| Children <18 in poverty[1] | 2.2% | 11.1% | 14.8% | 21.6% |
| Families w/children in poverty[1] | 2.7% | 10.5% | 13.4% | 17.8% |
| Families w/ female householder, no husband present w/children in poverty[1] | 7.3% | 37.0% | 37.4% | 40% |
| Population, age 65+ in poverty[1] | 3.9% | 6.5% | 7.5% | 13.4% |

[1]*US Census Bureau, 2010-2014 5-Year Estimates, American Community Survey*

Given the coarseness of the available data, CCRPC is not able to determine specific locations with a concentration of vulnerable individuals within individual municipalities. However, a useful analysis known as a Social Vulnerability Analysis has been prepared by the Vermont Department of Health. Data for the Town is shown in *Figure 4.1*.

The Social Vulnerability Index (SVI) draws together 16 different measures of vulnerability in three different themes: socioeconomic, demographic, and housing/transportation. The 16 individual measures include poverty, unemployment, per capita income, educational attainment, health insurance, children/elderly, single parent households, disability, minority, limited English, location of apartment buildings, mobile homes, crowding, no vehicle access, and population living in group quarters. The measures are combined to create relative vulnerability index. For every vulnerability measure, census tracts above the 90th percentile, or the most vulnerable 10%, are assigned a flag. The vulnerability index is created by counting the total number of flags in each census tract. It is important to remember that this Social Vulnerability Index is just a first step in screening for populations that may be more or less vulnerable to a variety of hazard. Depending on the situation, different measures could be more or less important and should be looked at more closely. These data are NOT saying that one census tract is more vulnerable than another. Rather it is saying that there is a higher concentration of various vulnerable populations living within a tract and seeks to identify the conditions that make a population vulnerable.

## 4.5 Land Use and Development Trends Related to Mitigation

As noted in the Introduction, Underhill's land use is primary residential and agricultural. An analysis of GIS data shows the following percentages for land use and the percentages of land allocated to each zoning district.

*Table 4-10 Structures compared to zoning, Town of Underhill*

| **Underhill Structures** | Percent | | **Underhill Zoning** | Percent |
|---|---|---|---|---|
| Residential and Agriculture | 96.10% | | Mt. Mansfield Scenic Preservation | 6.89% |
| Commercial | 1.04% | | Rural-Residential-Agricultural | 32.33% |
| Industrial | 0.16% | | Soil And Water Conservation | 52.06% |
| Institutional / Infrastructure | 0.56% | | Underhill Flats Village Center | 0.77% |
| Mass Assembly | 0.40% | | Water Conservation | 7.95% |
| Leisure / Recreation | 0.00% | | | |
| Natural Resources | 0.48% | | | |

*Source: 2015 e911 Data and 2013 Town of Underhill Zoning Regulations, Note: The structure categories relate to the Land Based Classification System (LBCS) used in the 2011 AHMP not E-911 site types. E-911 site types were assigned to each LBCS category to create synergy between the 2011 AHMP and 2017 AHMP.*

### 4.5.1 Conserved or Undevelopable Parcels

There are a number of conserved parcels in Underhill. Most parcels have been conserved for their scenic, agricultural or natural resource values.

*Table 4-11 Conserved Land, Town of Underhill*

| Acres | Acres of Public Land | Percent Public | Acres of Conserved Land | Percent Conserved | Total Public & Conserved | Percent Conserved Land |
|---|---|---|---|---|---|---|
| 32,820.98 | 5,952.27 | 18% | 1,717.78 | 5% | 7,670.23 | 23% |

*Source: VLT Data and ANR Public Lands*

The Jericho-Underhill Land Trust is a private, non-profit organization that conserves land in both Jericho and Underhill. The trust is funded only by donations. Additionally, as noted below in Table 5.1, the Town's zoning bylaws include a Flood Hazard Overlay District, which precludes the construction of new homes or businesses in the flood plain and effectively act as conserved lands.

### 4.5.2 Recent and Future Development

At present and for the foreseeable future the current development pattern will continue: some residential and commercial growth in the Village Center District and continued, dispersed residential growth on 3, 5, 10 and 15 acre lots in the Rural Residential, Water Conservation, Mt. Mansfield Scenic Preservation and Soil and Water Conservation districts. At this time, the main way CCRPC has to predict future development is by analysis of municipal zoning bylaws. As the municipality participates in the NFIP, zoning bylaws heavily regulate development in designated flood hazard areas. Additionally, the Town also regulates development near other waterbodies and wetlands. As a result, little to no development is likely to take place in flood hazard areas or river corridor protection areas. These zoning requirements effectively mitigate damages from Flood and Fluvial Erosion hazards to future structures.

From 2011 through 2014, the municipality has seen 19 housing units (in single family and multi-family structures) and no new commercial/industrial buildings constructed. None of these units or structures were constructed in the Special Flood Hazard Area nor in the River Corridor Protection Area. (While GIS analysis shows two new units located in the SFHA in Underhill, analysis of building permits revealed that while parts of the parcels in question are located in the SFHA, the buildings themselves are not.

As best can be ascertained based upon data maintained by the Chittenden County RPC and the Town of Underhill, since the adoption of the last municipal AHMP in 2011, development activity in the Town has not significantly increased vulnerability. Additionally, through at least 2021, there is no known or projected development of new buildings or infrastructure anticipated to be constructed in areas known to be particularly vulnerable to Natural Hazards.

# SECTION 5: MITIGATION STRATEGY

The Town considered a range of mitigation actions across the categories of Planning and Regulations, Structure and Infrastructure Projects, Natural Systems Protection, and Education and Awareness Programs. As is demonstrated in the discussion that follows the Town carries out numerous efforts as part of its day-to-day operations that fit within these categories and address and serve to mitigate the impacts of various hazards. The section concludes within an analysis of which vulnerabilities need additional attention and therefore stipulates discrete tasks to be carried out by the Town during the 5-year period this Plan is in effect to address these vulnerabilities.

## 5.1 Existing 2015 Underhill Town Plan Implementation Tasks That Support Hazard Mitigation

These tasks are described in the 2015 Underhill Town Plan. The following selected excerpts illustrate how mitigation planning and activities is formally promoted and supported through the Town Plan.

### *Natural Resources*

*Policy: Control impacts from stormwater runoff.*

1. *Study and address the contribution of town roads to storm water runoff. Both the* Lamoille River Watershed Basin *and the* Browns River Corridor Management Plans *identify culverts and bridges in Underhill in need of improvement. Blend the recommendations of these plans with the assessment of the Town's road crew on needed improvements of the town's infrastructure in the development of capital budgets.*
2. *Continue to require through road and land use regulations that all new roads and driveways are properly constructed to minimize erosion and scouring. Road improvements should follow the 2013 VTrans Road and Bridge standards as adopted by the Selectboard.*
3. *Assure that all new construction employs effective erosion control measures as required in the associated permit.*
4. *Consider adding low impact development regulations for stormwater control*

*Policy: Protect floodplains, fluvial erosion hazard areas, and lands adjacent to streams, wetlands, and upland forests; encourage restoration of these areas as needed; and plan for flood emergency preparedness and response.*

1. *Inventory the number of existing structures within mapped floodplains.*
2. *Review the current Flood Hazard Area Regulations and determine whether or not they need to be strengthened to prohibit new structures within the Special Flood Hazard Area.*
3. *Complete a fluvial geomorphology assessment for streams and waterways and develop strategies in response to identified risk. Develop a River Corridor Management Plan.*
4. *Evaluate capabilities of existing road and stormwater management infrastructure. Continue and improve highway culvert and bridge maintenance programs.*
5. *Plan culvert replacements for any undersized culverts in conjunction with roadway improvement projects*

6. *Review the All Hazards Mitigation Plan on a regular basis and follow-up on identified strategies.*

*Land Use*
*Policy: The Town's floodplain regulations should be compliant with federal flood insurance program requirements.*

1. *Consider amending the regulations to strengthen floodplain protection to improve resilience to future flood Impacts, and to ensure the greatest percentage of public financial assistance from the State for natural disaster recovery.*

*Policy: Investigate and make a decision about adding fluvial erosion hazard areas as an additional overlay district to the zoning map and what regulations would be appropriate for this area.*

1. *Review the fluvial erosion hazard area map from the Chittenden County Regional Planning Commission. This map will allow the Planning Commission to see the extent of the hazard area and the extent of additional environmental protection it shall afford.*
2. *Consult with the Conservation Commission on the FEH.*
3. *Based on the map and using models from other towns, state agencies, or planning organizations, propose regulations for a fluvial erosion hazard area.*
4. *Hold informational meetings with the public, in particular affected landowners, to get their feedback on the proposed regulation/zoning overlay district.*
5. *Based on community feedback and scientific information, the Planning Commission may decide to add a fluvial erosion hazard area to town regulations.*

## 5.2 Existing Town of Underhill Actions That Support Hazard Mitigation

The following table illustrates how mitigation activities and plans are carried out by various municipal departments, and whether such capabilities are adequate to address hazard vulnerabilities and whether the department, if needed, has the ability to improve policies and programs and programs to unmitigated vulnerabilities.

*Table 5-1 Existing municipal capabilities addressing hazard mitigation, Town of Underhill*

| **Types of Programs & Policies** | **Description / Details** | **1) Adequacy of municipal capabilities to address hazards 2) and ability to expand upon or improve policies & programs** |
|---|---|---|
| Highway Services | Town Highway Department | 1) Generally adequate with regards to mitigating the impacts of common hazards.<br>2) However, the Highway Department, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution. |
| Highway personnel | 4 FTE field personnel, 4.5 FTE in winter | 1) Generally adequate with regards to mitigating the impacts of common hazards.<br>2) However, the Highway Department, through the strategies noted below is taking on a stronger role to mitigate against damages caused by Severe Rainstorm, Fluvial Erosion and Water Pollution. |
| Water / Sewer | The Riverside area is served | 1) Generally adequate with regards to mitigating the impacts of |

| | | |
|---|---|---|
| Department | by the Jericho-Underhill Water District | common hazards.<br>2) No Sewer Service or Department |
| Water / Sewer Personnel | 1.5 FTE water personnel. | 1) Generally adequate with regards to mitigating the impacts of common hazards..<br>2) No need to expand upon or improve policies & programs with regard to hazards under its purview. |
| Planning and Zoning personnel | 1.4 FTE Town Planner and Zoning Administrator | 1) Generally adequate with regards to mitigating the impacts of common hazards..<br>2) No need to expand upon or improve policies & programs with regard to hazards under its purview. |
| Residential Building Code / Inspection | No local building code. | 1) Generally adequate with regards to mitigating the impacts of common hazards.. New construction must obtain a zoning permit.<br>2) No need to expand upon or improve policies & programs with regard to hazards under its purview.<br>3) Note that commercial properties open to the public and all multi-family buildings of 3 units are more must be inspected and permitted by the Vermont Division of Fire Safety. |
| Town / Municipal Comprehensive Plan | 2015 | 1) As noted at the start of Section 5, several elements of the municipal Comprehensive Plan promote Hazard Mitigation.<br>2) The Town will be updating its Plan in 2020 and will be referencing this 2017 AHMP accordingly. |
| Zoning Bylaws and Subdivision Regulations | 2014 | 1) Generally adequate with regards to mitigating the impacts of common hazards..<br>2) No need, at this time, to expand upon or improve policies & programs with regard to hazards under its purview. |
| Hazard Specific Zoning (slope, wetland, conservation, industrial, etc.) | Soil/water conservation, water conservation, Mt. Mansfield Scenic Preservation | 1) Generally adequate with regards to mitigating the impacts of common hazards..<br>2) No need, at this time, to expand upon current flood hazard bylaws.<br>3) Over the next five years, Town may consider adoption of River Corridor or River Corridor Protection Area zoning regulations. |
| Participation in National Flood Insurance Program (NFIP) and Floodplain/ Flood Hazard Area Ordinance | Yes / Yes | 1) New DFIRMS adopted in 2011<br>The Town Zoning Administrator and the Town's Development Review Board (DRB) monitor compliance with the National Flood Insurance Program. The DRB reviews and adjudicates applications for development within the floodplain.<br>2) No need, at this time, to expand upon NFIP participation |
| Open Space Plans; Conservation Funds | Jericho Underhill Land Trust: JULT has conserved parcels for | 1) Yes<br>2) Municipality considers regulatory programs and voluntary conservation efforts as adequate to address any hazard mitigation concerns. However, various areas may be conserved in the future by the use of the Fund but as of now, specific parcels conducive to |

| | | |
|---|---|---|
| | scenic, natural resources, agricultural and recreational values. | hazard mitigation have not yet been targeted. |

The following table illustrates how Emergency Preparedness, Response & Recovery actions are carried out in the Town.

*Table 5-2 Existing municipal emergency services & plans, Town of Underhill*

| **Type of Existing Protection** | **Description /Details/Comments** |
|---|---|
| **Emergency Services** | **Emergency response personnel may have overlapping responsibilities with other town response organizations.** |
| Police Services | Vermont State Police, Traffic through the Chittenden County Sheriff's Department |
| Police Department Personnel | VSP and County Sheriff personnel |
| Fire Services | Underhill Jericho Fire Department |
| Fire Department Personnel | 2 FTE duty officers, 44 volunteers |
| Fire Department Mutual Aid Agreements | Various |
| EMS Services | Essex Rescue (private). One member of the Underhill Jericho FD is also trained in EMS services. |
| EMS Personnel | Essex Rescue personnel |
| EMS Mutual Aid Agreements | Various throughout VT EMS District #3 |
| **Emergency Plans** | |
| Local Emergency Operations Plan (LEOP) | 2016 |
| Primary Shelter | Underhill Central School |
| Replacement Power, backup generator | Yes |
| Secondary Shelter | Underhill ID Elementary School, Underhill Town Hall |
| Replacement Power, backup generator | Yes |

## 5.3 Town of Underhill All-Hazards Mitigation Goals

The following goals were first approved by the Town in its 2005 and 2011 AHMPs and approved by Town of Underhill officials during the development of this 2017 annex.

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 and as identified generally in the *Chittenden County Multi-Jurisdictional 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 stormwater management and the planning and development of various land uses.

5) Maintain existing municipal plans, programs, regulations, bylaws 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 municipality's/town's bylaws, regulations and ordinances, including, but not limited to, zoning bylaws and subdivision regulations and building codes.

7) Consider formal incorporation of this Local All-Hazards Mitigation Plan, particularly the recommended mitigation actions, into the municipal/town operating and capital plans & programs especially, but not limited to, as they relate to public facilities and infrastructure, utilities, highways and emergency services.

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan into the Town's Comprehensive Plan, as required by Vermont law, municipalities must update their Comprehensive Plans every eight years. During any update process undertaken while this Plan document is in effect, the Town will review the recommended Actions detailed below to see if formal incorporation within the Comprehensive Plan (or any Plan implementation tasks) is warranted. Note that the Town will be updating its comprehensive plan in 2020.

Additionally, as the CCRPC is tasked with also reviewing and approving each such municipal comprehensive plan for consistency with various requirements in state statute and consistency with the Chittenden County Regional Plan (aka the *ECOS 2013 Plan*). This review includes a detailed staff critique with recommendations for improvement. This CCRPC review provides another opportunity to formally integrate elements of this local AHMP into the Town's Comprehensive Plan.

With regard to a more formal process by which the Town will integrate the requirements of this mitigation plan while developing the Town's annual capital improvement plans/budgets, for periods, the Town will review the recommended Actions detailed below to see if formal incorporation within these annual capital plans is warranted prior to annual review and voting by Town residents. Additionally, CCRPC staff can assist the town with drafting grant applications to fund mitigation projects.

## 5.4 Mitigation Actions

The table below records the strategies from the 2011 Plan and progress on their implementation. This table also encapsulates the Town's decision making with regards to which Actions to continue, which to establish as new actions and which to discontinue. During the development of this Municipal AHMP and its parent Multi-Jurisdictional AHMP, FEMA staff indicated to the CCRPC a need to separate out or remove strategies which are more properly considered to be Preparedness, Response or Recovery strategies rather than Mitigation. Additionally, upon revisiting and reviewing the 2011 actions and devising action for this 2017 local AHMP, CCRPC and municipal staff thought it would be best to focus on known and likely actions with a high likelihood of implementation versus consideration of more expansive but largely aspirational strategies.

*Table 5-3 Progress on the actions of the 2011Underhill All-Hazards Mitigation Plan*

| **Action**<br><br>**Primary Responsible Entity** | **Task** | **Brief Description** | **Progress since 2011 and recommendations for 2017 Plan** |
|---|---|---|---|
| **#1 Complete fluvial geomorphology assessment and develop strategies in response to identified risk** | | | |
| TBD, determined by funding. | River Corridor Management Plans | Where Phase I and II assessments are complete, develop a River Corridor Management Plan. | SGA work has been completed on the Browns River and parts of Stevensville, Clay and Roaring Brooks in Underhill. Phase 2 SGA based River Corridor Protection Areas (formerly Fluvial Erosion Hazard Areas) were developed for those portions of streams where SGA was completed. ANR has issued a River Corridor Plan for the Browns River.<br><br>A River Corridor Plan has been created for the Browns River and tributaries<br><br>**COMPLETED, REMOVE FROM 2017 PLAN** |
| Town Administrator, Town Planner | Fluvial Erosion Hazard Mitigation Implementation | Implement strategies from above referenced Corridor Management Plan to mitigate losses from identified fluvial erosion hazards. | **NOT YET COMPLETED, INCLUDE IN 2017 PLAN** |
| Town Administrator, Town Planner | Flood Insurance Rating Map Updates | Review draft FIRM data. Develop strategies to mitigate losses from identified flood hazards. | **COMPLETED, REMOVE FROM 2017 PLAN** |
| **#2 Evaluate capabilities of existing road and stormwater management infrastructure** | | | |
| Road Foreman | Infrastructure Assessment for Stormwater Vulnerability | Assess the vulnerability and operational capability of municipal roads, culverts and stormwater infrastructure. | A culvert analysis was undertaken in 2014. Vulnerability assessment is ongoing and undertaken by the road crew.<br><br>**ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN** |

| | | | |
|---|---|---|---|
| Road Foreman | Infrastructure Assessment for Fluvial Erosion/Landslide Vulnerability | Assess the vulnerability and operational capability of municipal roads, culverts, bridges and other infrastructure to fluvial erosion. | Infrastructure assessment by the road crew is ongoing.<br>**ASSESSMENT IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN** |
| Road Foreman | Culvert Upgrades | Upgrade culverts and ditching along roads to mitigate against repeated damages from stormwater or spring snowmelt. | Culverts are upgraded regularly and all replacements or new installations now use metal, rather than plastic.<br>60-70 culverts have been upgraded since 2011. Significant examples include those on Gerts Knob Road, North Underhill Station Road, Poker Hill Road, Harvest Run and Park Street.<br>A box culvert on Deane Road was replaced in 2015.<br>**CONTINUE FOR 2017 PLAN** |
| Road Foreman | Continued Monitoring of Vulnerable Infrastructure | Monitor bridges and culverts with erosion and scouring concerns. | Monitoring is ongoing on the Stevensville Bridge and Blakey Bridge<br>**MONITORING IS NOT CONSIDERED MITIGATION. REMOVE FROM NEW PLAN** |
| Road Foreman | Road Improvement | Consider paving 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. | Road improvement is ongoing.<br>**CONTINUE FOR 2017 PLAN** |
| Road Foreman | Erosion/Landslide Mitigation | Undertake erosion or landslide mitigation projects where roads regularly incur damage from adjacent rivers/streams and hillsides. | Improvement of roads to mitigate against erosion is ongoing.<br>**RENAME AS DRAINAGE IMPROVEMENTS FOR 2017 PLAN** |

### 5.4.1 Current Capabilities and Need for Mitigation Actions

The Town Comprehensive Plan's policies and programs that support hazard mitigation and the progress noted above demonstrate the variety of policies and actions forming the foundation of this All Hazards Mitigation Plan. As detailed in the Table below, generally, the Town considers its existing capabilities, regulatory structure and programs as adequate to address its vulnerabilities however continuation of existing mitigation actions or the implementation of new actions are warranted for the 5-year period this Plan is in effect.

*Table 5-4 Town of Underhill: Capabilities to address vulnerabilities from natural hazards*

| **Hazard** | **Adequacy of Municipal Capabilities to address associated vulnerabilities ( Excellent, Good, Average, Below Average)** | **Additional expansion or improvement in policies & programs needed to address hazard given long-term vulnerability** |
|---|---|---|
| **Severe Winter Storm** | Excellent | No |
| **Flooding** | Excellent | **Yes, see actions below.** |
| **Fluvial Erosion** | Good | **Yes, see actions below** |
| **Severe Rainstorm** | Good | **Yes, see actions below.** |
| **Extreme Temperatures** | Good | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Wildfire** | Excellent | No, rare occurrence and extent, impact & vulnerabilities are limited. |

*Table 5-5 Town of Underhill: Capabilities to address vulnerabilities from technological hazards*

| **Hazard** | **Adequacy of Municipal Capabilities to address vulnerabilities ( Excellent, Average, Below Average)** | **Additional expansion or improvement needed to address hazard given long-term vulnerability** |
|---|---|---|
| **Major Transportation Incident** | Good<br>+ State agencies provide support | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Power Loss** | Average.<br>Private utilities are primarily responsible | No given that events are limited in duration and vulnerabilities are short-lived. |
| **Hazardous Materials Incident** | Good<br>+ State agencies provide support | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Water Service Loss** | Excellent. | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Gas Service Loss** | Average.<br>Private utility is primarily responsible. | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Telecommunications Failure** | Private utilities are primarily responsible | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Other Fuel Service Loss** | Private businesses are primarily responsible | No, rare occurrence and extent, impact & vulnerabilities are limited. |
| **Sewer Service Loss** | No Utility | N/A |
| **Water Pollution** | Good | **Yes, see actions below** |
| **Invasive Species** | Average | No, rare occurrence and extent, impact & |

| | | |
|---|---|---|
| | | vulnerabilities are limited. |

*Table 5-6 Town of Underhill: Capabilities to address vulnerabilities from societal hazards*

| **Hazard** | **Adequacy of Municipal Capabilities to address vulnerabilities ( Excellent, Average, Below Average)** | **Additional expansion or improvement in policies & programs needed to address hazard given long-term vulnerability** |
|---|---|---|
| **Crime** | No municipal police. | N/A |
| **Economic Recession** | Good<br>+State Agencies provide support | No<br>Diversity of county economy mitigates vulnerabilities. The Town considers its municipal plan as also supportive of the goal of economic diversification. |
| **Terrorism** | No municipal police. | No, rare occurrence. |
| **Civil Disturbance** | No municipal police. | N/A |
| **Epidemic** | Average<br>+State & Federal agencies provide support | No, rare occurrence. The Town's abilities to mitigate an epidemic are limited<br>The Town relies on state and school efforts related to epidemic preparedness, prevention and mitigation, and medical facilities and services in neighboring communities for response. |
| **Key Employer Loss** | Good<br>+State agencies provide support | No. Diversity of employers in municipality mitigates vulnerabilities. |

Note that this Plan does not recommend a discrete mitigation action regarding "future development." Our justification for this is as follows:

- The municipality's regulations, programming and staffing have prevented and will prevent new buildings and infrastructure being constructed in areas vulnerable to hazards. As documented in detail in section 4.6.2, despite active residential and commercial development, no structures and infrastructure subject to municipal regulation, have been constructed in either the Special Flood Hazard Areas or mapped River Corridor Protection Areas.
- For the next five years, there are NO known or anticipated plans for the construction of municipal infrastructure in areas vulnerable to hazards.
- There is no evidence that unwise or poorly regulated development in the municipality has been a significant contributor to putting people or property in harm's way.

**Therefore, the reader will note that the proposed Mitigation Actions for the next five years represent a much more focused and achievable list of actions focused on those hazards (e.g. Severe Rainstorm, Flooding, Fluvial Erosion, Water Pollution, etc.) that cause more**

**frequent if less dramatic damages.** It is these more mundane damages of erosion along road beds, damaged small culverts and the ongoing struggle to maintain and improve water quality (which cost the municipality and its taxpayers both time and money) that deserve the most attention rather than hazards that could hypothetically cause damage but which are rare and wherein the benefit-to-cost ratio for potential mitigation actions is weak (e.g. Major Transportation Incident, Hazardous Material Incident, Terrorism). No new discrete action is recommended with regards to Education & Awareness as the Town does not have adequate funds or staff to undertake such an effort nor is such an effort warranted given the identified vulnerabilities. **Lastly, it is also worthwhile to note that in comparison to the 2011 Plan the priorities for this 2017 Plan have not changed. The hazards and vulnerabilities remain the same as well. Indeed, the only real change is that there is a more heightened awareness due to the severity of recent disasters starting in 2011 to the present.**

### 5.4.2 Specific Mitigation Actions

The Town plans to conduct the following mitigation actions during the 5 year period this Plan is in effect.

**CATEGORY A: Address risks to structures and infrastructure from Fluvial Erosion**

Hazards Addressed: Fluvial Erosion

Vulnerabilities Addressed: Damage to new/existing public infrastructure and buildings; temporary closures of roads and bridges including from debris; temporary loss of power and/or telecommunications and temporary isolation of vulnerable individuals such as the elderly or those in poverty.

Status: Ongoing

Primary Responsible Entity: Town of Underhill Highway Foreman

Timeframe: Month 2017 through March 5, 2022 (update after FEMA approval date)

Funding Requirements and Sources: FHWA grants; VTrans grants; Municipal Operating and Capital budgets only if sufficient. Contingent on available resources and funding.

Rationale/Cost-Benefit Review: Because of past work to identify fluvial erosion hazard (FEH) zones and to map river corridors, Underhill now has a better understanding of the hazard areas in the community, where they are located and what structures or infrastructure are impacted by them. Devising a River Corridor/Fluvial Erosion Hazard Zone is a relatively low-cost, highly effective strategy to mitigate fluvial erosion hazards.

**Specific Identified Actions:**

**Action A-1: Develop zoning district & bylaws to reduce risk from Fluvial Erosion**

The Underhill Selectboard and Planning Commission will continue their work to develop a River Corridor/Fluvial Erosion Hazard Zone overlay zoning district to restrict development/disturbance in areas threated by fluvial erosion.

**CATEGORY B: Improve capabilities of existing road and stormwater management infrastructure**

Hazards Addressed: Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution

Vulnerabilities Addressed: Damage to new/existing public infrastructure and buildings; temporary closures of roads and bridges including from debris; temporary loss of power and/or telecommunications and temporary isolation of vulnerable individuals such as the elderly or those in poverty.

Status: Ongoing

Lead Responsible Entities: Town of Underhill Highway Foreman; Underhill Town Planner

Potential Partner Entities: VT ANR; Vermont Agency of Transportation (VTrans); CCRPC

Timeframe: Month 2017 through March 5, 2022 (update after FEMA approval date)

Funding Requirements and Sources: Various Federal and State grants; municipal operating funds only if sufficient. Contingent on available resources and funding.

Rationale/Cost-Benefit Review: These areas suffer low-level but consistent damage during heavy rains and snowmelt. Mitigating these problems would reduce short and long term maintenance costs and improve the flow of traffic for personal and commercial purposes during damage events.

**Specific Identified Actions:**

**Action B-1: Culvert Upgrades**

Upgrade culverts and ditching along various roads to mitigate against repeated damages from stormwater or spring snowmelt. Culverts are upgraded as needed when replaced. Additionally, all new installed culverts are metal rather than plastic. Town anticipates installing at least 10 culverts every summer.

**Action B-2: Drainage Improvement**

Funding and staff resources permitting, assess the vulnerability and operational capability of municipal-owned roads, culverts and other stormwater management infrastructure to predicted stormwater 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. Separate analyses of all infrastructure in each municipality is not intended or warranted.

- The road crew prioritizes and completes repair and replacement priorities based on the sections with the most risk

**Action B-3: Road Improvement**

Funding and staff resources permitting, 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 #2 above. Specific bridges to be assessed include:

- The Stevensville Bridge
- The Blakey Bridge

**Action B-4: Develop Underhill Stormwater Master Plan**

In January 2017 the Town and the Chittenden County RPC secured a small grant to develop a Stormwater Master Plan for the Town. Primary goals of the plan are first, identify needed upgrades to aging stormwater infrastructure in the "village" area; second, scope designs and cost estimates for four Green Stormwater Infrastructure projects to treat stormwater runoff and last, identify erosion concerns on gravel roads. This work is anticipated to conclude in late 2017 or early 2018.

## CATEGORY C: Implement Roads Stormwater Management Plan

Hazards Addressed: Water Pollution, Fluvial Erosion, Severe Rainstorm,
Vulnerabilities Addressed: damage to public infrastructure especially roads and culverts; impairment of local waterways and Lake Champlain, budgetary impacts

Status: Ongoing

Lead Responsible Entities: Town of Underhill Highway Foreman

Potential Partner Entities: VT ANR; Vermont Agency of Transportation (VTrans); CCRPC

Timeframe: Month 2017 through March 5, 2022 (update after FEMA approval date)

Funding Requirements and Sources: Various Federal and State grants especially VAOT Better Roads Grants and VANR Ecosystem Restoration Grants; municipal operating and capital budget funds if necessary.

Rationale / Cost-Benefit Review: The Vermont Clean Water Act, signed into law in the summer of 2015, authorized the development of a new Municipal Roads General Permit (MRGP) to lessen erosion from roads that have "hydrologically-connected" segments. This action is required by the Act. Additionally, the plans and their implementation will assist municipalities in mitigating erosion of connected infrastructure.

**Specific Identified Actions:**

**Action C-1 Develop Roads Stormwater Management Plan**

The CCRPC has already conducted an inventory of Underhill's in the summer of 2016 of so-called Priority Road Segments (PRS)[ aka "hydrologically-connected" road segments currently meeting and not meeting MRGP standards. For 2016 into 2017, the CCRPC has hired a consultant to begin to develop cost estimates for various erosion-reduction projects. The Town will then apply for MRGP coverage starting in July 2018. After issuance of the permit by the State, the Town will then work to use this information to develop a formal Roads Stormwater Management Plan for submission to the VT-DEC in 2019. The Plan will include a remediation plan (capital budget) and implementation schedule for each site not currently meeting standards.

**Action C-2 Begin Roads Stormwater Management Plan implementation**

Obtain funding for and complete projects as identified in the Roads Stormwater Management Plan. Submit annual reports to DEC, documenting progress in remediation efforts towards meeting schedule to be in compliance with the MRGP. Reports will briefly describe which segments have been improved, practices installed, and whether segments now meet MRGP standards. The MRGP standards must be implemented on all priority road segments as soon as possible, but no later than 20 years from permit issuance.

5.4.3 Prioritization of Mitigation Strategies

The above mitigation actions were listed in order of priority. Descriptions of specific projects, where available, are listed in Section 5.4.2 and 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 questions (criteria) considered in the matrix so as to establish an order of priority. Each of the following criteria was rated according to a numeric score of "1" (indicating poor), "2" (indicating below average or unknown), "3" (indicating good), "4" (indicating above average), or "5" (excellent).

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

The ranking of these criteria is largely based on best available information and best judgment, as many projects are not fully scoped out at this time. The highest possible score is 45.

It is anticipated that, as municipalities begin 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, all proposed FEMA mitigation projects will undergo a benefit-cost analysis using a FEMA BCA template and approved methodology.

Based on feedback from FEMA, CCRPC Staff have concluded that several strategies previously identified in 2011 by the Town of Underhill as mitigation strategies are more accurately classified as preparedness, response and recovery strategies. These strategies are not intended to mitigate against the hazards identified in Section 3, and should not be evaluated as such. As such, these strategies are not included in the prioritization below. However, they are discussed at the end of the plan to serve as a record of the strategies being undertaken by the Town in order to prepare for, respond to and recover from damage caused by those hazards.

Other than the reclassification of some strategies as non-mitigation strategies, there have not been significant changes in the prioritization of strategies between 2011 and now, with one notable exception. Strategies related to landslide assessment have been removed from the plan. CCRPC and municipal staff, in consultation with FEMA, have concluded that landslides are not a discrete threat in Chittenden County and are adequately captured in the plan's discussion of fluvial erosion. Additionally, further work on the development of a Vermont-specific landslide risk estimation protocol has not progressed making landslide-specific strategies inappropriate at this time for inclusion in the County plan and its annexes.

Note that these priorities are within categories as this is more appropriate rather than ranking project that address different hazards.

*Table 5-7 Underhill action evaluation and prioritization matrix*

| Mitigation Category & Actions | Responds to significant (likely or high risk) hazard | Likelihood of funding | Protect threatened infra-structure | Implemented quickly | Socially / Politically acceptable | Technically Feasible | Administra-tively Realistic | Reasonable cost to benefit | Environmen-tally sound | TOTAL SCORE |
|---|---|---|---|---|---|---|---|---|---|---|
| **CATEGORY A: Address risks to structure and infrastructure from Fluvial Erosion** | | | | | | | | | | |
| **Action A-1: Develop zoning district & bylaws to reduce risk from Fluvial Erosion** | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | **44** |
| **CATEGORY B: Upgrade existing road and stormwater management infrastructure** | | | | | | | | | | |
| **Action B-1: Culvert Upgrades** | 5 | 3 | 5 | 3 | 4 | 4 | 3 | 3 | 5 | **35** |
| **Action B-2: Drainage Improvement** | 4 | 3 | 4 | 3 | 5 | 3 | 3 | 4 | 5 | **34** |
| **Action B-3: Road Improvement** | 4 | 3 | 4 | 3 | 5 | 3 | 3 | 4 | 5 | **34** |
| **Action B-4: Develop Stormwater Master Plan** | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 5 | **33** |
| **CATEGORY C: Implement Roads Stormwater Management Plan** | | | | | | | | | | |
| **Action C-1: Develop Roads Stormwater Management Plan** | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 5 | **33** |
| **Action C-2: Begin Roads Stormwater Management Plan implementation** | 4 | 3 | 4 | 3 | 4 | 3 | 3 | 4 | 5 | **33** |
| *5 = Excellent; 4=Good; 3=Average; 2=Below Average or Uknown; 1=Poor* | | | | | | | | | | |

## 5.5 Implementation and Monitoring of Mitigation Strategies

The following Table is intended to aid municipal officials in implementing their mitigation actions and to facilitate the annual monitoring & evaluation of the plan as outlined in Section 1.7.4 above.

*Table 5-8 Underhill All-Hazards Mitigation Plan Implementation Matrix*

| | |
|---|---|
| **CATEGORY A: Address risks to structures and infrastructure from Fluvial Erosion and associated vulnerabilities of:**<br>• Damage to new/existing public infrastructure and buildings<br>• Temporary road and bridge closure<br>• Budgetary impacts<br>• Temporary loss of power and/or telecommunications<br>• Temporary isolation of vulnerable individuals | |
| **Action**<br>**(Primary Responsible Entity)** | **Report on Progress since Plan adoption**<br>*See Section 5.4 for details on locations identified during Plan development.* |
| **Action A-1: Develop zoning district & bylaws to reduce risk from Fluvial Erosion**<br>(Town Administrator & Town Planner) | -note progress on adopting River Corridor Bylaws |
| **CATEGORY B: Upgrade existing road and stormwater management infrastructure to mitigate Severe Rainstorm, Flooding, Fluvial Erosion and Water Pollution and their associated vulnerabilities of:**<br>• Damage to new/existing public infrastructure and buildings<br>• Temporary road and bridge closure<br>• Budgetary impacts<br>• Temporary loss of power and/or telecommunications<br>• Temporary isolation of vulnerable individuals | |
| **Action**<br>**(Primary Responsible Entity)** | **Report on Progress since Plan adoption**<br>*See Section 5.4 for details on locations identified during Plan development.* |
| **Action B-1: Culvert Upgrades**<br>(Town Road Foreman) | -note annual # of culvert upgrades & on which roads |
| **Action B-2: Drainage Improvements**<br>(Town Road Foreman) | -note year and road location of drainage improvements such as ditching, rock lining, etc. |
| **Action B-3: Road Improvement**<br>(Town Road Foreman, VTrans, Consultant) | -note any options scoped/costed out<br>-note any sections of roads paved |
| **Action B-4: Develop Stormwater Master Plan**<br>(Town Administrator & CCRPC) | -note progress on plan development<br>-note progress on implementation of recommended projects. |

| **CATEGORY C: Implement Roads Stormwater Management Plan to mitigate Severe Rainstorm, Fluvial Erosion and Water Pollution and their associated vulnerabilities of:**<br>• Damage to new/existing public infrastructure<br>• Impairment of local waterways and Lake Champlain<br>• Budgetary impacts | |
|---|---|
| **Action**<br>**(Primary Responsible Entity)** | **Report on Progress since Plan adoption**<br>*See Section 5.4 for details on locations identified during Plan development.* |
| **Action C-1 Develop Roads Stormwater Management Plan**<br>(Town Road Foreman, CCRPC/Consultant) | -MRGP obtained from State?<br>-note projects developed and scoped with costs<br>-Roads Stormwater Management Plan filed with State |
| **Action C-2 Begin Roads Stormwater Management Plan implementation** (Town Road Foreman) | -note which RSMP projects underway/completed<br>-note annual MRGP reports filed with State |

## 5.6 Implementation of Preparedness, Response and Recovery Strategies

Based on feedback from FEMA, CCRPC Staff have concluded that several strategies previously identified in 2011 by the Town of Underhill as mitigation strategies are more accurately classified as preparedness, response and recovery strategies. These strategies are not intended to mitigate against the hazards identified in Section 3, and should not be evaluated as such. Rather, they are included here to serve as a record of the strategies being undertaken by the Town in order to prepare for, respond to and recover from damage caused by those hazards. The first table records the strategies from the 2011 Plan and progress that has been made towards them. The second table outlines the strategies that have been developed for implementation from 2017 through 2021.

*Table 5-9 Town of Underhill: Progress on Preparedness, Response and Recovery Strategies since 2011*

| **Action**<br>**Primary Responsible Entity** | **Task** | **Brief Description** | **Progress** |
|---|---|---|---|
| **#1 Review and modify evacuation and sheltering plans based on the results of drills and exercises or procedures implemented in an actual incident** | | | |
| Emergency Management Director, Fire Chief | Evacuation and Sheltering Exercises | Conduct evacuation drills or exercises and evaluate performance. | New strategy |
| Emergency Management Director, Fire Chief | Evacuation and Sheltering Plans | Review evacuation, sheltering, and relocation plans based on results of drills, exercises, and actual incidents. | New strategy |

| #2 Evaluate capabilities of existing and potential public shelters | | | |
|---|---|---|---|
| Emergency Management Director; Fire Chief | Confirm Existing Shelter Capability | Confirm capabilities of existing shelters, maintain and improve upon if needed. | New strategy |
| Emergency Management Director; Fire Chief | Investigate Alternate Shelters | Investigate capabilities of other buildings sufficient to serve as smaller shelters. | New strategy |
| Emergency Management Director; Fire Chief | Shelter Generators | Work with schools and other shelters to obtain funding for the purchase of generators and/or electrical transfer panels. Maintain practice of shifting electrical power as needed to provide power to critical sites. | New strategy |

| #3 Raise public awareness of hazards, hazard mitigation and disaster preparedness. | | | |
|---|---|---|---|
| Fire Chief, Emergency Management Director | School Programs | Continue school programs to raise student awareness of hazards, safety, preparedness and prevention. | Continuing programs |
| Fire Chief, Emergency Management Director | Family Programs | Continue family programs, such as car safety seat and bike safety programs, to raise family awareness of hazards, safety, preparedness and prevention. | Continuing programs |
| Fire Chief, Emergency Management Director | Fire Prevention Programs | Continue National Fire Prevention Week and other programs to raise public awareness of fire hazards, safety, preparedness and prevention. | Continuing programs |
| Emergency Management Director | Other hazard awareness programs | Develop public awareness programs, based on all-hazards needs. Programs to address pandemic hazards, preparedness and mitigation may be appropriate. | New project |