**Adopted by the Holland Selectboard on April 16th, 2018**

*Holland Historical Society, Gore Road*

# Town of Holland

## Single-Jurisdiction Local Hazard Mitigation Plan

Prepared by:

The Town of Holland and

Northeastern Vermont Development Association

**Certificate of Local Adoption**
**Town of Holland Selectboard**
**A Resolution Adopting the Local Hazard Mitigation Plan**

WHEREAS, the town of Holland has worked with the Northeastern Vermont Development Association, and with residents and stakeholders to identify hazards which can result in economic hardship, and the loss of property and life; and

WHEREAS, the *Town of Holland, Vermont Single-Jurisdiction Local Hazard Mitigation Plan* recommends several hazard mitigation actions that will provide mitigation for specific natural hazards that impact the Town of Holland with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, the Town of Holland has received conditional approval from the Federal Emergency Management Agency (FEMA) on December 13, 2017 for its 2017 *Town of Holland, Vermont Single-Jurisdiction Local Hazard Mitigation Plan* under the requirements of 44 CFR 201.6; and

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

RESOLVED by the Town of Holland Selectboard:

1. The 2017 *Town of Holland, Vermont Single-Jurisdiction Local Hazard Mitigation Plan* is hereby adopted as an official plan of the Town of Holland;

2. The Town of Holland officials are hereby directed to pursue implementation of the recommended actions;

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

4. The Selectboard shall review progress on the implementation elements of the Plan on a yearly basis, and document the findings of this review in that body's official minutes.

IN WITNESS WHEREOF, the undersigned have affixed their signature on this 16 day of April, 2018

Selectboard Chair _____

Selectboard Member _____

Selectboard Member _____

Attested to by Town Clerk _____

# Contents

# 1. INTRODUCTION AND PURPOSE

## 1.1 Purpose and Scope of the Plan

The purpose of the 2016 Town of Holland Single-Jurisdiction Local Hazard Mitigation Plan is to identify all hazards facing the community and identify policies and actions that can be implemented to reduce risk and future losses in the Town of Holland from the identified natural hazards. This includes modifying structures, such as culverts, so they can better withstand natural hazards, and avoiding development in identified hazardous areas. The mitigation actions identified in this plan are intended to reduce or eliminate long-term risks to hazards. It is recognized that it is less expensive to prevent damage from disasters than to get caught in a cycle of repetitive repair after a disaster has struck.

In order for the Town of Holland to continue to be eligible for grant funding of mitigation projects, the Town must review, revise and resubmit their Plan to FEMA for approval every five (5) years.

## 1.2 Hazard Mitigation

The Vermont State All-Hazards Mitigation Plan of 2013 defines hazard mitigation as:
*"Any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. The Federal Emergency Management Agency (FEMA) and state agencies recognize that it is less expensive to prevent disaster or mitigate its effects than to repeatedly repair damage after a disaster has struck. This plan recognizes that communities have opportunities to identify mitigation strategies and measures during all of the other phases of Emergency Management—Preparedness, Response and Recovery. Hazards cannot be eliminated, but it is possible to determine what the hazards are, where they are, where they are most severe and to identify actions that can reduce the severity of the hazard."*

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

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

Hazard mitigation planning is the process that analyzes a community's risk from natural hazards, coordinates available resources, and implements actions to reduce risks. Per *44 CFR Part 201: Hazard Mitigation Planning,* this planning process establishes criteria for State and local hazard mitigation planning authorized by Section 322 of the Stafford Act as amended by Section 104 of the *Disaster Mitigation Act of 2000*. Effective November 1, 2003, municipalities must have an approved local

mitigation plan prior to the approval of a local mitigation project funded through federal Pre-Disaster Mitigation funds. Furthermore, the State of Vermont is required to adopt a State Pre-Disaster Mitigation Plan for Pre-Disaster Mitigation funds or grants to be released for either a state or local mitigation project after November 1, 2004.

## 1.4 Eligibility for State and Federal Funds

Having a locally adopted, FEMA-approved Local Hazard Mitigation Plan makes the Town of Holland eligible for Flood Mitigation Assistance Grant Program (FMA) funds, Hazard Mitigation Grant Program (HMGP) project grants, and Pre-Disaster Mitigation (PDM) program funding.

As of October 14th, 2014, a community that lacks a Local Hazard Mitigation Plan gets less matching funds from the State under the Emergency Relief Assistance Fund (ERAF) when public assistance is awarded after a Presidentially-declared emergency.

## 1.5 Local Hazard Mitigation Plan Goals

This Local Hazard Mitigation Plan establishes the following general goals for the town and its residents:

1) Reduce at a minimum, and prevent to the maximum extent possible, the loss of life and injury resulting from all hazards.

2) Mitigate financial losses and environmental degradation incurred by municipal, educational, residential, commercial, industrial and agricultural establishments due to various hazards.

3) Maintain and increase awareness amongst the town's residents and businesses of the damages caused by previous and potential future hazard events as identified specifically in this Local Hazard Mitigation Plan.

4) Recognize the relationship between the relative frequency and severity of disaster events and the design, development, use and maintenance of infrastructure such as roads and storm water management.

5) Maintain existing municipal plans and programs, adherence to state standards and ordinances that directly or indirectly support hazard mitigation.

## 1.6 Integration into Town Planning

The proposed mitigation actions in this Plan will provide a basis for town budgeting decisions, will help the Town be better prepared for future disasters, and will ease the receipt of post-disaster state and federal funding because the list of mitigation actions is already identified. This Hazard Mitigation Plan was in development when the Planning Commission was also working to update the Town Plan. As a result the goals and action steps contained in the Holland Town Plan, adopted on January 23, 2017, are closely aligned with the mitigation actions included in this Local Hazard Mitigation Plan.

## 1.7 Community Overview

Chartered: October 26, 1779
Coordinates: (Geographic Center): N 44° 58' W 72°00'
Altitude: 1,405 feet ASL

Holland is a sparsely developed rural town comprising approximately 40 square miles in Orleans County in the Northeast Kingdom of Vermont. The Town is located on the Canadian border and abuts the town of Coaticook, Quebec on the north; and the U.S. towns of Derby on the west, Morgan on the south, and Norton and the Unified Towns and Gores of Essex County (UTG) on the east. Holland has one paved road, Valley Road. The terrain of Holland is rolling and the land is primarily used for residences, agriculture and home-based occupations.

### 1.7.1 Public Lands, Facilities, and Services

The Town provides a local elementary school for grades pre-K through 6th grade. The facility, located on 6+ acres of land on School Road, consists of limited administrative space, classrooms, and a gym/meeting hall. The school is used for community functions, including Town Meeting and large public hearings, and is also available for private usage when not conflicting with educational needs. The School is equipped with a backup generator and serves as a secondary Local Emergency Operations Center, and emergency shelter.

*Holland Elementary School*


*Holland Town Offices*

There were 41 students enrolled in the Holland Elementary School in the 2016-2017 school year, including 7 in Pre-K. Junior and senior high school students are educated, respectively, at North Country Junior High School in Derby and North Country Senior High School in Newport.

The Town offices are also located on School Road, and consist of a small one-story structure on approximately one acre of land accommodating the Town Clerk's office, vault, and a meeting room. The Town offices are the designated primary Emergency Operations Center for the Town.

The Town garage is located on Valley Road and also serves as the Town recycling center.

*Holland Town Garage*

The Sladyk Wildlife Management Area (WMA) comprises 9,493-acres that extends into neighboring Norton and the UTG, and is owned and managed by the Vermont Fish & Wildlife Department. Approximately 4,655 acres of the

WMA is in Holland. A public fishing access area with a boat launch serving small boats is located on Holland Pond and is maintained by the Vermont Department of Fish and Wildlife.

Holland Pond is used a back-up water source for the neighboring Village of Derby Line. The Quebec-based International Water Company, which provides public water to the Derby Line, owns a dam on Holland Pond and a waterline connecting the pond to a reservoir in Derby Line. In an emergency, water would be pumped from Holland Pond into a reservoir in Derby Line.

The Town of Holland does not have a public water system, although there are two hydrants in town that are connected to the waterline owned by the International Water Company: one on Goodall Road (Town hydrant # 4) and one on Lyon Road, near LaFoe Road (Town hydrant #3). There are four additional "dry" hydrants in Town at the following locations: School Road, north of the Town offices; Gore Road south of TH 8; Valley Road near Hunting Camp Road; and Holland Pond Road at crossing of Holland Brook.

The Town of Holland does not have any local emergency services. Police protection is provided by the State Police, and the Border Patrol officers who frequently patrol the border in Holland also have "police officer" status in Vermont. The International Boundary Commission also has a presence in Holland, and their capabilities include repairing damage to monuments along the border. Fire and ambulance service is provided by volunteer companies in neighboring Derby Line Village.

The closest hospital is North Country Hospital in Newport, about a 20 minute drive from the Holland Elementary School.

### 1.7.2 Population and Housing

Based on the American Community Survey 2015 estimates, the current population of Holland is 668. Table 1.1 shows selected population characteristics.

**Table 1.1 Town of Holland, Orleans County**
**Selected Population Characteristics**

| Subject | Number | Percent |
|---|---|---|
| Total Population | 668 | 100% |
| Population 65 and older | 92 | 13.8% |
| Population under 18 years old | 183 | 27.4% |
| Population 18 years and older | 485 | 72.6% |
| Population between 20 and 24 | 10 | 1.5% |
| Population between 25 and 44 | 156 | 23.4% |
| Population between 45 and 64 | 220 | 32.9% |
| Median Age | 43.5 | N.A. |
| Source: 2011-2015 American Community Survey 5-Year Estimates, U.S. Census Bureau | | |

The vast majority of housing stock in Holland consists of single-family detached homes. There is a concentration of seasonal and year round homes around Holland Pond, which is located in the eastern part of the Town within the Bill Sladyk WMA. The remaining homes are interspersed along the main roads in Town.

The Census Bureau estimates there are 423 housing units in Holland, with 282 occupied year round. The majority of occupied housing units are owner-occupied. Average household size for owner-occupied

units 2.4 and for renter-occupied units, 1.95. The Holland 2016 Grand List identifies 139 residences as seasonal, about a quarter of which are located on the shores of Holland Pond.

| Table 1.2 Town Of Holland, Orleans County<br>Selected Housing Characteristics | | | |
|---|---|---|---|
| **Subject** | **Number** | **Percent of Total Housing Units** | |
| Total Housing Units | 423 | 100% | |
| 1-unit, detached | 360 | 85% | |
| 2 units | 15 | 4% | |
| Mobile home | 44 | 10% | |
| Boat,RV,van,etc | 4 | 1% | **Percent of Occupied Housing Units** |
| Occupied Housing Units (households) | 282 | 67% | 100% |
| Owner-occupied | 261 | --- | 92.6% |
| Renter-occupied | 21 | --- | 7.4% |
| Vacant Housing Units | 141 | 33% | --- |
| Source: 2011-2015 American Community Survey 5-Year Estimates, U.S. Census Bureau | | | |

The 2015 American Community Survey estimates, the main source of household heating fuel in owner-occupied units in Holland was wood (53%) followed by fuel oil ( 40%). About 5% of households heated with bottled, tank or LP gas and remaining households used other heating sources. The median value of owner-occupied units was $129,900.

### 1.7.3 Income and Employment

Holland operates primarily as a bedroom community for the greater Newport/Derby area, which provide the majority of jobs for residents. Based on the most current American Community Survey estimates, the average travel to work time for those commuting to work was 20.2 minutes. Of the 320 residents who comprised the civilian employed population over 16 years old, the industrial sector employing the highest percentage of Holland workers was “Educational services, health care and social assistance” at about 21% of workers. Other industrial sectors employing sizeable percentages of workers in Holland were “Agriculture, forestry, fishing and hunting, and mining” (17.2 %); “Retail trade” (11.6%); “public administration” (10.3%); and “Construction” (10.0%). About 14% of workers were self-employed, and almost 9% of those in the work force worked from home.

The town encourages businesses of a type and scale appropriate to the culture of agriculture and forestry to ensure the rural quality of the community. In addition to farming operations, there are a handful of commercial enterprises in town including a self-storage facility, auto mechanic, trucking, among other small home based businesses.

The median household income in Holland was $37,500 and the median family income was $45,750, which is lower than the Orleans County household median income of $42,831 and median family income of $54,658.

### 1.7.4 Governance and Regulations

The Town of Holland is governed by a three-member Select Board. The Select Board is responsible for the maintenance of Town-owned facilities and road infrastructure, and hires a road foreman who undertakes this work. The Town has adopted a local road access ordinance, which sets minimum requirements for driveways, including culvert size. The Town does not have zoning or subdivision regulations, and therefore does not have a zoning administrator. There is an active Planning Commission that has recently completed an update to the Town Plan, which was adopted by the Town in January of 2017. The Town Plan is a guidance document, rather than a regulatory document.

Land development that exceed thresholds established in State statute triggers Act 250 development review and/or other State permits such as wetlands, stream encroachment, or stormwater permits. The State Department of Environmental Conservation issues permits for potable water supplies and wastewater systems for all residential development in town.

The Town of Holland has adopted the State Road and Bridge Standards, and has an up-to-date Local Emergency Operations Plan. The Town is a member of Local Emergency Planning Committee (LEPC) #10 and is served by Vermont Agency of Transportation (VTRANS) Maintenance District #9.

## 1.8 PLANNING PROCESS

### 1.8.1 Previous Draft Plan

Although Holland has never adopted a Hazard Mitigation Plan, it did prepare a draft plan in 2005 as an "annex" to the Northeastern Vermont Development Association's (NVDA) All-Hazards Plan. It's worth noting that the 2005 Holland plan identified three potential hazards with medium to high risks: Flash Flood, Winter Storm/Ice, and High Winds.

### 1.8.2 Development of New Plan

In February of 2015, in response to expressed interest from the Holland Planning Commission, NVDA planning staff presented information via teleconference regarding the role of the Local Hazard Mitigation Plan (LHMP), particularly in addressing flood mitigation projects in Holland. Officials from the neighboring Town of Morgan attended the presentation in Holland since they were also considering developing a LHMP.

In late July of 2015, NVDA was awarded a grant from the State of Vermont Department of Emergency Management and Homeland Security (DEMHS) for the development of Local Hazard Mitigation Plans for a number of municipalities in the Northeast Kingdom, among which was Holland.

On September 10, 2015, Irene Nagle (NVDA planner), and Vermont Rivers Program staff Staci Pomeroy (River Scientist) and Rebecca Pfieffer (Regional Floodplain Manager) attended a meeting of the Holland Planning Commission. Staci and Rebecca presented information on mapped River Corridors in Holland, and answered questions about fluvial erosion, the value of buffer areas, and what is required for a Town to be a member of the National Flood Insurance Program. Irene explained the role of the LHMP in identifying areas in Town vulnerable to natural hazards, formulating actions that serve to mitigate these hazards, and providing eligibility for funding to undertake these mitigation projects.

At the end of September, 2015 the Town signed a Memorandum of Understanding with NVDA, which outlined the respective responsibilities of NVDA and Holland in developing the LHMP for the Town.

A Local Hazard Mitigation Planning team was assembled, consisting of members of the Planning Commission, members of the Selectboard, the Town Clerk, and the Town Road Foreman. Core team members at the start of the process were :

- Andrew Bouchard, Holland Planning Commission
- Brett Farrow, Select Board Chair
- Dianne Judd, Town Clerk
- Irene Nagle, NVDA Planner
- Timothy Sykes, Select Board member
- Bard Wiesen, Town Road Commissioner*
- Mitch Wonson, Planning Commission Chair*
- Dennis Ziegler, Town Emergency Management Director*

**By the summer of 2017, when this draft Mitigation Plan was completed, Road Commissioner Bard Weisen had been replaced with Larry Judd; Mitch Wonson's position changed from Planning Commission Chair to Town Moderator; and Emergency Management Director Dennis Ziegler had been replaced by David Jacobs.*

Through phone conferencing, a work plan was developed and the first public meeting on the Local Hazard Mitigation Plan was scheduled for December 10, 2015. It was determined that the most effective way to reach out to the residents and those in neighboring communities was by strategically placed flyers, direct emails, and by using the local phone tree and email list used by the local elementary school to reach all families.

At this time, a community survey was also made available, in print and online, that asked residents questions regarding their experience with previous hazard events and about emergency preparedness. Only 15 residents responded to the survey, about half of whom indicated that they had been impacted by a natural disaster in Holland in the past. Six of those responding identified flooding or streambank erosion as the cause of the disaster they had experienced, five indicated high winds was the cause, three indicated a severe thunderstorm as the cause, and one identified hurricane/tropical storm as the cause. Hazards respondents were most concerned about were severe winter storms (14); flooding and streambank erosion (11), and high winds (11).

Officials from neighboring communities of the UTG, Norton, Derby and Morgan in Vermont, and in Coaticook, Quebec were invited to attend the meeting on December 10 as was a representative from U.S. Customs and Border Protection in Newport.


The meeting on the evening of December 10, 2015 was attended by Larry Labo, Select Board member from the Town of Morgan; and by Victor J. Mancini, Supervisory Border Patrol Agent in Newport, VT; in addition to residents and officials from the Town of Holland.

At the meeting, the purpose of a FEMA-approved Hazard Mitigation Plans was discussed, and information on disaster occurrences in region was presented via powerpoint.

The critical facilities in town were identified on a large format map that was spread out on the meeting table, and a Hazards Checklist was completed as a group. Areas in town that had been the site of damage in the past from natural hazards were identified on the map. Meeting attendees shared stories of past occurrences of damage due to high winds, flooding and winter storms. The results of that meeting formed the basis for the risk assessment and the vulnerability assessment in sections 4 and 5 of this plan.

A second public meeting was held on March 24, 2016 and residents of Town and neighboring communities were invited to review proposed mitigation strategies and assess the cost and benefits of each proposed action. This meeting was advertised in the same manner as the first meeting, relying heavily on direct emails and phone calls as well as flyers, to solicit participation. The results of this public meeting set the framework for section 6 of this Plan – Mitigation Strategy.

A draft Plan was prepared using data sources that included:

- The results of surveys and public comments provided at public meetings
- Input of the Holland Town Road Foreman regarding problem culverts and vulnerable stretches of road
- 2013 Vermont State Hazard Mitigation Plan (provided key guidance language and definitions throughout the plan).
- Vermont Agency of Natural Resources (ANR) and the Vermont Department of Transportation (VTrans) (Provided key policy recommendations on environmental conservation, climate change and fluvial erosion data, and road and stormwater infrastructure).
- Vermont Department of Environmental Conservation (DEC) (provided river corridor data for mapping purposes.)
- FEMA Open Source (data.gov) Data for Disaster History and PA funding (provided comprehensive declared disaster by year and type as well as project descriptions and cost per event).
- 2013 ACCD Mobile Home Resilience Plan (served as resource for future mitigation actions)

Using the above data sources, the planning team worked with NVDA to create the Plan.

In the Spring of 2016 the Planning Commission, which had taken the lead on the Hazard Mitigation Plan development, put the Hazard Mitigation Plan on hold while they completed the update to the Town Plan. The Town Plan was adopted in January of 2017, and received regional approval in March 2017. With the Town Plan process complete, the Planning Commission again turned its attention to the Hazard Mitigation Plan.

The Planning Commission reviewed the draft Hazard Mitigation Plan at its regular meeting on April 24th, 2017 and updated sections to reflect latest available census data and to reference the recently adopted 2017 Town Plan.

On May 11, 2017 Irene Nagle, NVDA planner, met with the new Town Road Commissioner, Larry Judd, to visit various locations in Holland that had been identified as potential problem spots during flood and other hazard events. On June 15th, the Derby Volunteer Department Chief was interviewed by phone in regard to the adequacy of the existing fire hydrants in town. He noted that yearly spring maintenance is needed to clear mud and debris from around all hydrants, and noted that both the live hydrant on Goodall Road and the one on Lyon Road were in need of repair. He recommended that an additional dry hydrant be installed on Valley Road just south of the Town garage.

On June 26th, 2017 the Planning Commission met to finalize the draft Hazard Mitigation Plan, prior to presenting to the public at a specially advertised meeting scheduled on July 10.

# 2. HAZARD IDENTIFICATION

The planning team looked at natural hazards identified in the State hazard mitigation plan, and for each considered prior history, current trends and available data in order to select (profile) hazards that are most likely to impact Holland and for which local mitigation actions could be developed.

The 2013 State of Vermont Hazard Mitigation Plan identified the following natural and technological hazards, and ranked them according to vulnerability.

| Hazard | Justification for Inclusion |
|---|---|
| Flooding and Fluvial Erosion | Frequency, previous incidents |
| Terrorism | Potential adverse impact |
| Earthquakes | Potential adverse impact |
| Infectious Disease Outbreak | Previous incidents |
| Hurricanes/Tropical Storms | Previous incidents |
| Tornadoes | Frequency, previous incidents |
| Nuclear Power Plant Failure | Potential adverse impact |
| Landslides/Rockslides | Previous incidents |
| Severe Thunderstorms | Frequency, previous incidents |
| Wildfires | Frequency, potential adverse impact |
| Dam Failure | Potential adverse impact |
| Severe Winter Storms | Frequency, previous incidents |
| Hail | Frequency, potential adverse impact |
| Ice Jams | Previous impacts, potential adverse impact |
| Drought | Previous incidents, potential adverse impact |
| Rock Cuts | Frequency, previous incidents |
| Invasive Species | Potential adverse impact |
| Extreme Temperatures | Frequency |

While it is understood that FEMA will only reimburse the town for disasters caused by natural hazards, considerations for other the categories can increase resilience to a natural disaster. Technological hazards are distinct from natural hazards primarily in that they originate from human activity. In contrast, while the risks presented by natural hazards may be increased or decreased as a result of human activity, they are not inherently human-caused.

Technological and social hazards often occur as a secondary consequence of a natural disaster, and become vulnerabilities. For example, loss of telecommunications or electrical service can be the result of a natural hazard such as high winds or heavy snowfall.

Since Holland is located on the international border with Canada, the planning team considered the technological hazard of terrorism. On this issue, the State hazard mitigation plan notes:

"…some in the U.S. intelligence community believe that radical extremist organizations may have small cells in parts of Canada not far from the U.S. border. In this regard, Vermont is considered a potential transit point for terrorist organizations operating out of Canada who may travel through the state to reach points to the south. However, it is not likely that a major or even a small-scale terrorist attack will occur in Vermont due to its lack of high profile national targets."

While recognizing them as potential vulnerabilities, the Town decided not to profile man-made/ technological hazards for the purposes of this plan.

The Town has reviewed information for all natural hazards, and has divided them into "profiled" and "non-profiled" hazards. In order to determine which hazards should be profiled, the planning team reviewed a "Hazards Checklist" (see Table 3.2 in Section 3. Risk assessment). Based on this exercise, the hazards chosen to be profiled because they presented the highest risk to people in property in Holland were

- Flooding/Stream Bank Erosion,
- High Winds,
- Severe Thunderstorm (with associated lightning), and
- Severe Winter Storms.

It is noted that the State Hazard Mitigation Plan does not list the hazards of high winds or lightning separately, but includes them as related to the hazard of "Severe Thunderstorm." For the purposes of profiling the hazard of Severe Thunderstorm in the Holland Plan, the incidents of "Thunderstorm Winds" and "Lightning" in Orleans County and in Holland as documented in the National Atmospheric and Oceanic Administration (NOAA) database were examined.

## 2.1 Natural Hazards

### 2.1.1 Climate Change:

From 1962 to 2006, each five-year period resulted in 0-6 Major Disaster Declarations in Vermont. From 2007-2011, there were 11. It is commonly accepted that weather extremes are becoming more commonplace in Vermont. Since 2011, record setting snow, rain and cold have been experienced in the state. In recent years, it has become evident that human activities, mostly associated with the combustion of fuel, have added to the natural concentration of greenhouse gases in the atmosphere and are contributing to rapid climate change on a global scale. While projections of the effects of climate change vary, it is generally predicted that Vermont will have warmer temperatures year-round, with wetter winters and drier summers. An increase in the size and frequency of storms is also predicted. Thus, climate change in the next century will likely increase the chance of weather-related hazards occurring. An increase in precipitation may also result in increased flooding and fluvial erosion. Drier summers may increase the chance of drought and wildfire. A warmer climate may also result in the influx of diseases and pests that cold winters previously prevented. The severity of climate change is also difficult to predict, though the effects may be mitigated somewhat if greenhouse gas emissions are reduced soon. In 2013, the Vermont Agency of Natural Resources (ANR) released the Climate Change Adaptation Framework which addresses climate change exposures, vulnerability-specific elements within each of the natural resource sectors, and ongoing and proposed actions that can be or have been taken to prepare for the expected changes. In line and in conjunction with the ANR report, the primary goal of a VTrans climate change adaptation policy is to minimize long-term societal and economic costs stemming from climate change impacts on transportation infrastructure.

### 2.1.2 Disaster History

There have been 17 disasters and 3 emergencies declared in Orleans County from 1973 through 2015 (it is noted that "Hurricane Irene" was listed as an Emergency, and then "Tropical Storm Irene" was listed as a Disaster a few days later). Incident types in Orleans County have been Severe Storm (9 incidents, 7

of which included flooding), Flood (6 incidents), Severe Ice Storm, Hurricane, and Snow. Table 2.1 list these hazard events, with those affecting Holland shown in bold.

**Table 2.1:**
**Summary of Disasters (DR) and Emergency Declarations (EM) in Orleans County, 1973-2015**
**(BOLD denotes those affecting the Town of Holland)**

| Disaster Number | Declaration Date | Disaster Type | Incident Type | Title |
|---|---|---|---|---|
| 4207 | 2/3/2015 | DR | Severe Storm(s) | SEVERE WINTER STORM |
| **4178** | **6/11/2014** | **DR** | **Flood** | **SEVERE STORMS AND FLOODING** |
| 4163 | 1/29/2014 | DR | Severe Ice Storm | SEVERE WINTER STORMS |
| 4140 | 8/2/2013 | DR | Flood | SEVERE STORMS AND FLOODING |
| 4066 | 6/22/2012 | DR | Severe Storm(s) | SEVERE STORM, TORNADO, AND FLOODING |
| **4022** | **9/1/2011** | **DR** | **Hurricane** | **TROPICAL STORM IRENE** |
| **3338** | **8/29/2011** | **EM** | **Hurricane** | **HURRICANE IRENE** |
| **1995** | **6/15/2011** | **DR** | **Severe Storm(s)** | **SEVERE STORMS AND FLOODING** |
| 1715 | 8/3/2007 | DR | Severe Storm(s) | SEVERE STORMS AND FLOODING |
| **1559** | **9/23/2004** | **DR** | **Severe Storm(s)** | **SEVERE STORMS AND FLOODING** |
| 1428 | 7/12/2002 | DR | Severe Storm(s) | SEVERE STORMS AND FLOODING |
| **3167** | **4/10/2001** | **EM** | **Snow** | **SNOW** |
| 1307 | 11/10/1999 | DR | Severe Storm(s) | TROPICAL STORM FLOYD |
| 1228 | 6/30/1998 | DR | Severe Storm(s) | SEVERE STORMS AND FLOODING |
| 1184 | 7/25/1997 | DR | Flood | EXCESSIVE RAINFALL, HIGH WINDS, AND FLOODING |
| 1101 | 2/13/1996 | DR | Flood | ICE JAMS AND FLOODING |
| 1063 | 8/16/1995 | DR | Severe Storm(s) | EXCESSIVE RAINFALL, FLOODING |
| 518 | 8/5/1976 | DR | Flood | SEVERE STORMS, HIGH WINDS & FLOODING |
| 397 | 7/6/1973 | DR | Flood | SEVERE STORMS, FLOODING, & LANDSLIDES |

Source: Data.gov, FEMA Declarations Data Set

The following discussion on natural hazards is based upon information from several sources, but specific extent data for Holland was limited. However, extent data available for Orleans County and nearby towns can be used to capture the extent of natural hazard events for Holland. General descriptions are based upon the 2013 Vermont State Hazard Mitigation Plan.

According to National Oceanic and Atmospheric Administration (NOAA) Storm Events Database Data, 473 weather events were reported in Orleans County from 1995 to April of 2017. Events specific to Holland, in addition to declared emergencies and disasters, include:

- 7/28/1997; 8/1/2006; 7/6/2011 Thunderstorm Winds
- 5/19/2015 Hail

The highest risk hazards -- severe winter storm, flooding (including that associated with fluvial erosion and ice jams), severe thunderstorm (with lightning), and high winds -- have been profiled to provide the basis of future mitigation strategies. However, lower risk natural hazards (drought, tornado, tornado, extreme temperatures, hail, landslide, earthquake, naturally-occurring radiation and fire hazards) are

omitted from full profiling because they do not pose enough risk in Holland to substantiate mitigation efforts at this time. However, information and data related to these hazards are included in the "Non-profiled" hazard section is the event that a future update requires that these lower risk hazards be reconsidered in the town and as means of developing a more comprehensive awareness.

### 2.1.3 Profiled Hazards

***High Winds***

The National Oceanic and Atmospheric Administration (NOAA) lists three type of wind events that effect Orleans County: "Strong Wind," "High Wind," and "Thunderstorm Wind."

Strong Wind is defined as non-convective winds gusting less than 50 knots (58 mph), or sustained winds less than 35 knots (40 mph).

High Wind is defined by NOAA as sustained non-convective winds of 35 knots or greater lasting for 1 hour or longer, or winds (sustained or gusts) of 50 knots for any duration, on a widespread or localized basis.

The last recorded high wind event as tracked by the National Weather Service was recorded on 17-18 January 2012. An 81 mph wind gust was measured atop Vermont's highest peak Mount Mansfield. These strong gusts caused numerous power outages across northern New York and parts of central and northern Vermont. At the peak of the event, over 10,000 people were without power across northern New York, including the Saint Lawrence Valley and over 2,500 people had no power in parts of Vermont. During this event, Orleans County had wind speeds of 30-40 mph (category 7-8 on the Beaufort scale).

According to the NOAA *Storm Events Database*, from 1997 to 2017 there were 13 "High Wind" events, and 17 "Strong Wind" events throughout Orleans County.

One of these high wind events resulted in a documented power outage affecting Holland:

> **Date:** 11/02/1999
> **Event:** High Wind
> **Property Damage:** 15 K
> **Description:** A storm system over the Tennessee Valley Tuesday morning, November 2, 1999 moved northeast into the St. Lawrence Valley Wednesday morning, November 3, 1999. Strong winds developed ahead of this system. Trees were uprooted in Newport Center with power outages. Across the county, numerous trees and power lines were blown down. Power outages were reported in Lowell, Westfield, Craftsbury, Coventry, Irasburg, Derby Center, Troy, Jay, Morgan and Holland.

***Severe Thunderstorms***

As noted in the State Hazard Mitigation Plan, thunderstorms and associated hazards can occur anywhere in Vermont at any time of the year; however, spring and summer are the most common times for severe thunderstorms. The State Plan also notes that severe summer thunderstorm winds occur more frequently than any other natural hazard incident within Vermont.

Severe thunderstorms are described in the State Plan as follows:

> "Severe thunderstorms are capable of producing high winds (including downdrafts), large hail, lightning, flooding, rains, and tornadoes. Thunderstorm winds are generally short in duration, involving straight-line winds and/or gusts in excess of 50 mph. Thunderstorm winds tend to affect areas of Vermont with significant tree stands as well as areas with exposed property and infrastructure and aboveground utilities. Thunderstorm winds can cause power outages, transportation and economic disruptions, and significant property damage, and pose a high risk of injuries and loss of life…"

Thunderstorm Wind is defined by NOAA as winds, arising from convection (occurring within 30 minutes of lightning being observed or detected), with speeds of at least 50 knots, or winds of any speed (non-severe thunderstorm winds below 50 knots) producing a fatality, injury or damage. Downbursts and microbursts are included in "Thunderstorm Wind" events.

According to the NOAA *Storm Events Database*, from 1997 to 2017 there were 87 "Thunderstorm Wind" events throughout Orleans County. Three "Thunderstorm Wind" events were documented to have affected Holland. Thunderstorm Wind events were also recorded in the adjacent Town of Morgan (4 events), and in the adjacent town of Derby (14 events).

The level of magnitude recorded in the Holland wind events of 2006 and 2011 was 50 knots.

The event descriptions are as follows:

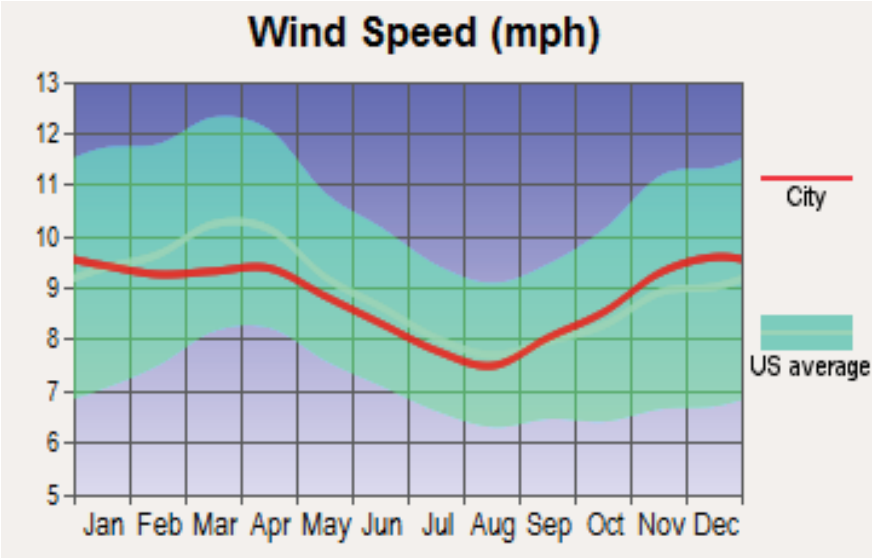
1. **Date:** 7/28/1997
   **Event:** Thunderstorm Wind
   **Property Damage:** 5 K
   **Description:** "Trees and power lines blown down."

2. **Date:** 8/1/2006
   **Event:** Thunderstorm Wind
   **Magnitude:** 50 kts.
   **Property Damage:** 5 K
   **Description:** "A MCS (Mesoscale Convective System) developed in an extremely warm, humid and unstable airmass across southern Quebec, during the late evening of the 1st, and moved southeast into New Hampshire and Maine by midnight. However, the western edge clipped extreme northern Vermont with severe thunderstorms. A severe thunderstorm moved into Orleans county and knocked down trees in Holland and Derby Center."

3. **Date:** 7/6/2011
   **Event:** Thunderstorm Wind
   **Magnitude:** 50 kts.
   **Property Damage:** 10 K
   **Description:** "A cold front and upper atmospheric disturbance moved across a warm, moist unstable air mass across northern New York and Vermont during the afternoon of July 6th. Thunderstorms developed across Franklin county New York and became more organized as they moved across the Champlain Valley of New York into Vermont. In Vermont, a well established squall line moved across the state during the afternoon with numerous reports of wind damage

as well as lightning strikes. As a result of these storms, more than 15,000 customers in Vermont lost power. Trees and power lines down."

**Figure 2.1**
**Average Wind Speed in Holland**
**Source: Citi-Data.com, 2017**




Transportation route access and electric power supply are at risk during a major wind event. However, *average* wind speeds in Holland as indicated on Figure 2.1, are below 10 miles per hour, what is described on the Beaufort Scale as a "gentle breeze."

Members of the Hazard Mitigation team recall a power outage of eight days in October of the early 2000s, at the time when Holland was supplied by Citizen's Electric. Only a portion of Town was affected – the area which receives power via the lines on Mead Hill coming from the south. Residents also recall that parts of Town were without power for two weeks following the Valentine's Day storm of 2007 (see *Severe Winter Storm* section). According to the records of Vermont Electric Cooperative, which acquired Citizen's Electric in April of 2004, the longest duration of power supply disruption in Holland for any hazard event since 2013 has been 24 hours from December 22 to December 23, 2013 due to trees falling on power lines.

One of the first scales to estimate wind speeds and the effects was created by Francis Beaufort in 1805 to help sailors estimate the winds via visual observations. The scale starts with 0 and goes to a force of 12. The Beaufort scale is still used today to estimate wind strengths.

Table 2.2 describes the Beaufort Scale.

**Table 2.2: Beaufort Scale**

| Force | Speed (mph) | Speed (knots) | Description | Specifications for use at sea<br>Specifications for use on land |
|---|---|---|---|---|
| 0 | 0-1 | 0-1 | Calm | Sea like a mirror.<br>Calm; smoke rises vertically. |
| 1 | 1-3 | 1-3 | Light Air | Ripples with the appearance of scales are formed, but without foam crests.<br>Direction of wind shown by smoke drift, but not by wind vanes. |
| 2 | 4-7 | 4-6 | Light Breeze | Small wavelets, still short, but more pronounced. Crests have a glassy appearance and do not break.<br>Wind felt on face; leaves rustle; ordinary vanes moved by wind. |

| | | | | |
|---|---|---|---|---|
| 3 | 8-12 | 7-10 | Gentle Breeze | Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered white horses.<br>Leaves and small twigs in constant motion; wind extends light flag. |
| 4 | 13-18 | 11-16 | Moderate Breeze | Small waves, becoming larger; fairly frequent white horses.<br>Raises dust and loose paper; small branches are moved. |
| 5 | 19-24 | 17-21 | Fresh Breeze | Moderate waves, taking a more pronounced long form; many white horses are formed.<br>Small trees in leaf begin to sway; crested wavelets form on inland waters. |
| 6 | 25-31 | 22-27 | Strong Breeze | Large waves begin to form; the white foam crests are more extensive everywhere.<br>Large branches in motion; whistling heard in telegraph wires; umbrellas used with difficulty. |
| 7 | 32-38 | 28-33 | Near Gale | Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.<br>Whole trees in motion; inconvenience felt when walking against the wind. |
| 8 | 39-46 | 34-40 | Gale | Moderately high waves of greater length; edges of crests begin to break into spindrift. The foam is blown in well-marked streaks along the direction of the wind.<br>Breaks twigs off trees; generally impedes progress. |
| 9 | 47-54 | 41-47 | Severe Gale | High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility<br>Slight structural damage occurs (chimney-pots and slates removed) |
| 10 | 55-63 | 48-55 | Storm | Very high waves with long overhanging crests. The resulting foam, in great patches, is blown in dense white streaks along the direction of the wind. On the whole the surface of the sea takes on a white appearance. The tumbling of the sea becomes heavy and shock-like. Visibility affected.<br>Seldom experienced inland; trees uprooted; considerable structural damage occurs. |
| 11 | 64-72 | 56-63 | Violent Storm | Exceptionally high waves (small and medium-size ships might be for a time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere the edges of the wave crests are blown into froth. Visibility affected.<br>Very rarely experienced; accompanied by wide-spread damage. |
| 12 | 72-83 | 64-71 | Hurricane | The air is filled with foam and spray. Sea completely white with driving spray; visibility very seriously affected. |

***Lightning***

The State Hazard Mitigation Plan states,

> "Lightning is the most unpredictable weather-related event. According to the NWS, lightning is the first thunderstorm hazard to arrive and the last to leave. Lightning can strike up to 50 miles away from a thunderstorm, can carry up to 100 million volts of electricity, and can reach temperatures upward of 50,000 degrees Fahrenheit."

The NOAA Storm Events Database lists 9 lightning events between June 1995 and June 2017, the most recent event occurring on September 9, 2015 in North Troy, about 30 miles west of Holland.

Two of lightning events during this period occurred in the neighboring Town of Derby, in the Village of Derby Line. A lightning strike on May 18, 1996 resulted in $5,000 in property damage; and on August 29, 2004 lightning hit a house resulting in $10,000 in property damage.

Members of the Holland hazard mitigation team also recalled an event in recent memory where lightning struck a home in Holland resulting in property damage. However, this damage doesn't appear to have been recorded in the NOAA database.

***Severe Winter Storm***

Winter storms impact the entire planning area. According to the *2013 Vermont State All-Hazards Mitigation Plan*:

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

County-wide, the winter of 2010-2011 was the third-snowiest on record with a total of 124.3 inches. The record of 145.4 inches was set in 1970-1971.

**Figure 2.2 Average snowfall in Holland, VT**
**Source: City-data.com**

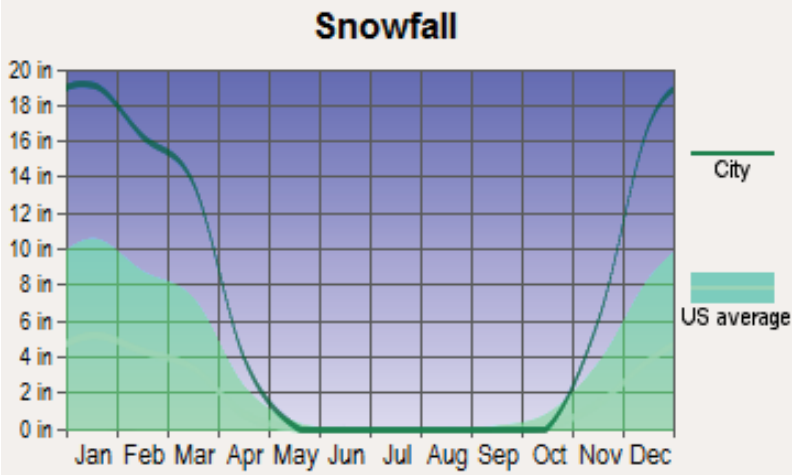



Figure 2.2 depicts average snowfall in Holland, which is well above the U.S. average. According to the NOAA Database, from 1997 to 2017 in Orleans County there were 99 "Winter Storm" events, nine "Heavy Snow" events, and two "Ice Storm" events.

On February 5, 2001, a winter storm event with accumulations of 10 to 14 inches across Orleans County had reported damage in several towns, including Holland:

"A storm system developed off the coast of Virginia early Monday, February 5, 2001 and moved northeast . It moved across extreme southeast coastal New England late Monday night and into the Gulf of Maine early Tuesday, February 6th. Steady snow spread across the area by the afternoon of Monday, February 5th and continued overnight and was heavy at times. The snow tapered off to flurries Tuesday

morning, February 6th. Some minor automobile accidents were reported. Barn roofs collapsed in the Towns of Craftsbury and Holland (Orleans County), apparently due to the weight of the snow after the storm ended. Across the counties, generally 10 to 14 inches of snow fell, with Sutton (Caledonia county) reporting 14.4 inches, Chelsea (Orange county) with 12 inches, and Greensboro (Orleans county) with 10."

On March 5 – 7, 2001, there was a snow emergency event for which the Town of Holland received Public assistance funds (EM 3167). The NOAA database reports that between 12 and 30 inches of snow fell, and $75,000 in property damage resulted. The following description is provided:

> "Snow overspread Vermont Monday morning (March 5th) and became steady and heavier by afternoon and continued through the night before tapering off late Tuesday, March 6th. The snow was heavy at times. Some impacts included: Many schools were closed and many towns postponed their Town meeting day. A number of accidents were reported including some on I-89. Generally, between 12 and 30 inches of snow fell, with the least in the extreme north and in the shadow effect area of eastern Orleans county. A few snowfall reports included: In Franklin county, Enosburg Falls reported 16 inches while in Orleans county, Newport reported 19 inches."

On February 14, 2007 a "heavy snow" event in Orleans resulted in 200 K in property damage county-wide, and deposited **24 inches of snow in Holland**. The NOAA database includes the following description:

> "Snow moved into southern Vermont around midnight on the 14th, then overspread the rest of Vermont during the early morning hours. Snow fell heavy at times from late morning through early afternoon in southern Vermont and early afternoon through early evening elsewhere, before dissipating during the night. Snowfall rates of 2 to 4 inches per hour and brisk winds of 15 to 25 mph caused near whiteout conditions at times, along with considerable blowing and drifting of the snow, making roads nearly impassable. Further, temperatures in the single numbers above zero combined with these brisk winds created wind chill values of 10 degrees below zero or colder. Snowfall totals ranged from 15 to 25 inches in the Connecticut River valley to 20 to 35 inches elsewhere across Vermont. The National Weather Service office in South Burlington set an all-time record 24 hour snowfall of 25.3 inches, breaking the old mark of 23.1 inches set on January 14, 1934. In addition, the storm total of 25.7 inches was the 2nd heaviest storm total snowfall on record, behind the 29.8 inches received on December 25th through 28th, 1969… The deep snowfall (18-30 inches) and deeper snow drifts (4-6+ feet) caused numerous problems, including the blocking of numerous heat vents that resulted in the build-up of carbon monoxide and sent dozens of people seeking treatment at area hospitals. There were additional indirect injuries resulting from this storm, including vehicle accidents and cardiac arrests due to overexertion during snow removal. Snow removal operations took several days and up to a week in some urban communities. In addition, the weight of the heavy snowfall on some weaker roofs, resulted in the partial or total collapse of 20 or more barn roofs and the deaths of more than 100 cattle."

On February 13$^{th}$ and 14$^{th}$, 2014, another heavy snow event resulted in accumulations of 18 inches in Holland:

> "Snow began to overspread southern Vermont during the mid-morning hours of February 13th, not reaching the Canadian border until the evening commute. There were two bands of heavy snowfall, snowfall rates of 1-2+ inches an hour, that moved across the region. The first band moved across

southern and eastern Vermont during the afternoon hours of February 13th and again during the early morning hours of February 14th.

Total snowfall ranged from 6 to 10 inches across the Champlain Valley of Vermont to 15 to 24 inches in central and eastern Vermont with the heaviest across the southern Green Mountains. Thursday evening and especially Friday morning's commute was hazardous with nearly all schools closed due to the storm on Friday, February 14th… Snowfall across Orleans County was 12 to 18 inches with 18 inches in Holland, 16 inches in Newport and Greensboro, 14 inches in Derby, 13 inches in Craftsbury and 12 inches in Barton."

The two "ice storm" events listed on the NOAA database occurred on January 6, 1998, and December 21-22, 2013.

The January 1998 ice storm event resulted in $80K in property damage County-wide, with ice accumulations of ¾ inches or less. NOAA describes the effects of this event:

"The impact on the region ranged from ice accumulations damaging tens of thousands of trees. Downed power lines resulted from the weight of the ice with several thousands without power. Farmers who lost electricity were unable to milk cows with loss of income and damage to cows. Automobile travel was negatively impacted with a number of roads closed due to ice and fallen trees. There were numerous traffic accidents.

INDIRECT injuries were reported due to carbon monoxide poisoning while improperly using generators. Falling tree limbs and other debris was a significant hazard during and following the storm."

The December 2013 event resulted in 750K in property damage, with ice accumulations of ½ to ¾ inches. The effects were described as follows:

"The greatest impact was in northwest Vermont, especially along the Canadian border, with widespread tree and utility line damage as well as numerous vehicle accidents. More than 75,000 customers were without power from hours to days across the region. The areas impacted were similar to the Ice Storm of January 1998, but not the severity as precipitation and ice accumulation were half of the 1998 storm.

Ice jams also developed during this time period as runoff from melting snow and rainfall swelled area rivers. River rises were enough to break up and move ice cover, resulting in scattered ice jams."

***Flooding and Fluvial Erosion Hazards***

Holland is within Tactical Basin 17, and the majority of the town drains north to Lake Massawippi in Quebec. The southern portion of the town is within the Clyde River subwatershed.

The Federal Emergency Management Agency has not mapped Holland for flood prone areas, and consequently there is no Flood Insurance Rate Map for the town. The Town of Holland has not participated in the National Flood Insurance Program, because there is no official mapping of flood hazards to serve as the basis for flood hazard regulations that meet the minimum requirements of FEMA.

Flooding is the most common recurring hazard event in the state of Vermont. There are three main types of flooding that occur in Vermont: flooding from rain or snow melt, flash flooding, and urban

flooding. Flooding has also been known to occur as a result of ice jams in rivers adjoining developed towns and cities. These events may result in widespread damage in major river floodplains or localized flash flooding caused by unusually large rainstorms over a small area. The effects of all types of events can be worsened by ice or debris dams and the failure of infrastructure (especially culverts), private and/or beaver dams. Rain storms are the cause of most flooding in Holland.

The NOAA lists 24 "Flood" events, 21 "Flash Flood" events and six "Heavy Rain" events in Orleans County from 1997 to 2017.

On August 12, 2004 a "Heavy Rain" event was recorded in the NOAA database, with average rainfall of 1 to 2 and 1/2 inches across Orleans County. August 30-31, 2004 a "Flood" event was recorded, resulting in $30,000 in property damage. The period August 12 – September 12, 2004 was covered by Disaster #1559.

On April 26 – 27th, 2011, a flash flood event resulted in a reported 50K in property damage according to the NOAA database. FEMA disaster number 1995 covered the period when this flood event occurred, and ten separate locations in Holland had recorded damage to road infrastructure including on Mead Hill Road, Tice Mill Road, Twin Bridges Road, Cross Road, Page Hill Road, Stearns Brook Road, Valley Road, Trucott Road, and Holland Pond Road.

The description of the April 2011 flash flood event as listed in the NOAA database is as follows:

> "The Snowmelt from an above normal snowpack and daytime high temperatures in the 50s and 60s on the 25th and 26th, combined with rainfall of a half to one inch early on the 26th to set the stage for a significant flood event across the region. Late in the day on the 26th into the early morning hours of the 27th thunderstorms repeatedly moved over central and northern Vermont, dumping over two inches of rain into already saturated soils and swollen rivers and streams. Flash flooding during the overnight hours late on the 26th quickly transitioned into river flooding by the morning of April 27…
> In Morgan, a portion of VT Route 111 was closed due to power lines and poles downed by flash flood waters, and a portion of the road was washed out. Residents on nearby Toad Pond Road were evacuated because of flooding. Other numerous roads were damaged by flood waters elsewhere in Morgan, and in the towns of Brownington, Charleston, Derby, and Holland. "

As noted above, ice jams can cause or exacerbate flooding when combined with rainfall and snowmelt. Members of the Holland Planning Commission recall that an ice jam on a tributary to Stearns Brook caused flooding on a section of Stearns Brook Road north of Twin Bridges Road during the Spring flood event of 2011 (described above). Neither the number of occurrences, or extent data for ice jams is available for Holland. A diagram depicting recorded ice jams in Vermont provided by the National Weather Service in Burlington[1] shows no recorded ice jams in Holland or adjacent Towns.

Another significant flood event occurred in Holland on April 15-16, 2014 (Federal Disaster # 4178) caused by heavy rain combined with snow melt. According to the NOAA database, this event resulted in $125,000 in property damage. A description of this event from the NOAA Storm Events Database is as follows:

[1] Presented at the *Springtime Flood Briefing* on February 21, 2017 at the VT State Emergency Operation Center

"Snowmelt from a late season snowpack combined with heavy rain produced widespread flooding across northern and central Vermont. Four to six inches of water was released from the snowpack over April 10 to 15 when daytime highs reached the 60s and 70s, and overnight lows remained well above freezing. Rivers were brought to near bankfull or minor flood levels from snowmelt alone. Rain developed along and ahead of a cold front on April 15, and forced rivers out of their banks. Freezing temperatures returned by the morning of April 16, which slowed or halted the runoff, and flooding gradually subsided. Flooding from heavy rain and snowmelt caused damage to roadways across much of Orleans County. Road and culvert damage occurred in Charleston, Holland, Irasburg, Troy, and Westmore. The Missisquoi River flooded portions of Route 100 in Lowell and Troy. The Missisquoi at North Troy exceeded its flood stage of 9 feet on 14 April at 4:24 pm EST, crested at 11.95 feet at 10:15 pm EST on 15 April 2014, and fell below flood stage at 9:51 am EST on 16 April 2014. The Barton River at Coventry exceeded flood stage of 8 feet at 6:45 am EST on April 11, crested at 9.39 feet at 2:15 am EST on April 16, and fell below flood stage at 6:30 am EST on 18 April 2014."

There are three sources of historical precipitation data for Vermont. The following data are reported at the county level: 1) recurrence time intervals for 24-hour rainfall storm depth, 2) annualized daily frequency of rainfall, and 3) rainfall-intensity frequencies.

The first source of data is the recurrence time intervals for 24-hour rainfall storm depth. The recurrence depth data describes the expected intensity of major rainfall events with respect to both rainfall depth and frequency of occurrence.

| **Table 2.3:**<br>**24-Hour Rainfall Depths (inches) for Common Recurrence Intervals (ANR, 2002)**<br>**Orleans County** |
|---|
| 1-yr, 24-hr Rainfall Depth: 2.1'' |
| 2-yr, 24-hr Rainfall Depth: 2.2'' |
| 10-yr, 24-hr Rainfall Depth: 3.1'' |
| 100-yr, 24-hr Rainfall Depth: 5.0'' |

The second source of data are the annualized daily frequencies of rainfall, which were obtained from the National Climatic Data Center (NCDC), Climate Normals program for 1981 – 2010. The data provides the average number of days per year with measurable precipitation (greater than 0.01 inches) on a county by county basis. This data allows for the conversion of the annual probabilities derived from the recurrence time intervals to daily probabilities. The annualized estimated daily frequency of measureable rainfall for Orleans County is 174 days (highest in the state) with 119 days of rain and 55 days of snow.

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

| Table: 2.4<br>Orleans County Rainfall-Intensity Range (in. /hr.) |
|---|
| x ≤ 0.01: 22.5% |
| 0.01 < x ≤ 0.05: 25.6% |
| 0.05 < x ≤ 0.10: 38% |
| 0.10 < x ≤ 0.15: 3.2% |
| 0.15 < x ≤ 0.20: 5.9% |
| 0.2 < x ≤ 0.25: .8% |
| 0.25 < x: 4.7% |

Winter and spring thaws, occasionally exacerbated by ice jams, are another significant source of flooding, especially when coupled with high rain levels. Much of this flooding is flash flooding, occurring within hours of a rainstorm or other event. Flash flooding, as opposed to flooding with a gradual onset, causes the largest amount of damage to property and infrastructure. Floods cause two major types of damage: water damage from inundation and erosion damage to property and infrastructure. The 2013 Vermont Hazard Mitigation Plan discusses flooding extensively. While that plan is concerned with all of Vermont, the information on flooding is all relevant to Holland. The Plan states:

*"Recent studies have shown that most flooding in Vermont occurs in upland streams and road drainage systems that fail to handle the amount of water they receive. Due to steep gradients, flooding may inundate these areas severely, but only briefly. Flooding in these areas generally has enough force to cause erosion capable of destroying roads and collapsing buildings. These areas are often not mapped as being flood prone and property owners in these areas typically do not have flood insurance (DHCA, 1998). Furthermore, precipitation trend analysis suggests that intense local storms are occurring more frequently. Additionally, irresponsible land use and development will exacerbate the preexisting vulnerability... Over the past two decades, flood damage costs have risen dramatically in Vermont due to increasing occurrences of flooding and increases in vulnerability associated with unwise land use development in flood plains or within stream corridors. The geography and topography are right for a significant localized storm with extreme damage at almost any location in Vermont. Heavy rains with previous ground saturation, which causes runoff, are a significant part of the flooding formula in Vermont. Steep topography and narrow, inhabited, stream and river valleys further increase the dangerous nature of this hazard. Furthermore, precipitation trend analysis suggests that intense, localized storms that can cause flash flooding are occurring with greater frequency. While flooding will continue, planning and other mitigation measures can help minimize damages.*
*… Lakeshore property in Vermont is vulnerable to flooding from high water levels, either by surface water erosion or flooding. Occasionally, water-saturated ground and high water tables cause flooding to basements and other low lying areas. Lakeshore property is highly desirable and valuable, making the development of lakeshore areas very likely, even with the high potential for flooding. Restrictions on lakeshore property development have significant negative economic and tax revenue impacts that must be carefully weighed against the gains in personal safety and protection of property."*

The estimated Capacity-Disruption Levels Given a Measured Rainfall Event can be interpreted as the conditional probability that a particular roadway capacity disruption occurs, given that a rainfall event occurs. For Orleans County, the probability that the intensity of a rain event will result in approximately a 2%, 7.5%, or 13.5% roadway capacity reduction are 7.35%, 23.96%, or 1.3%, respectively (Source: A Risk-Based Flood-Planning Strategy for Vermont's Roadway Network, 2015).

**Fluvial Erosion**

Erosion occurs on a consistent, but small-scale, basis within the riparian corridor of Holland's streams. This is a part of normal natural processes and as such is necessary for the proper functioning of the ecosystem of these waterways. However, fluvial erosion on a large scale can damage stream banks and undercut infrastructure such as roads, bridges and culverts as well as agricultural land and structures, causing severe damage. Fluvial erosion on a large scale can cause stream bank collapses, which are generally classified as landslides.

Most flood damage in Vermont is associated with fluvial erosion rather than inundation. The *2013 Vermont State All-Hazards Mitigation Plan* contains the following discussion of fluvial erosion: *"While inundation-related flood loss is a significant component of flood disasters, the predominant mode of damage is associated with the dynamic, and often times catastrophic, physical adjustment of stream channel dimensions and location during storm events due to bed and bank erosion, debris and ice jams, structural failures, flow diversion, or flow modification by man made structures… Transportation infrastructure and agricultural property are the most frequently endangered types of human investment affected by fluvial erosion hazards. Residential, commercial and other municipal properties are also frequently endangered. Changes in watershed hydrology that significantly influence fluvial stability are commonly associated with urbanization or with silvicultural practices. However, watershed scale hydrologic changes have been observed in Vermont as a localized phenomenon either in small, highly urbanized watersheds or in small, rural sub watersheds where clear cutting of a large percentage of the watershed land area has recently occurred. … When human investments and land use expectations include all the land in the valley up to the river banks, there results extreme public interest in maintaining this unsustainable morphological condition despite its great cost and resultant hazard to public safety."*

The State of Vermont Agency of Natural Resources (ANR) has mapped "River Corridors" throughout the State. The River Corridors, as defined by ANR, "encompass the area of land surrounding a river that provides for the meandering, floodplain, and the riparian functions necessary to restore and maintain the naturally stable or least erosive form of a river thereby minimizing erosion hazards over time." Since lands within and immediately abutting a river corridor are at higher risk to fluvial erosion, the State recommends that development within mapped River Corridors be avoided, and that a 50 foot setback be maintained from smaller streams.

As an incentive to encourage Towns to restrict new development within River Corridors, the State provides an increased State match under ERAF for Towns that adopt local flood regulations incorporating regulation of State River Corridors.

River Corridors have been mapped by the State for portions of Stearns Brook, Orcutt Brook and Holland Brook in Holland (see map in appendix). An estimated 403 acres of land in Holland is within the State-identified River Corridors, indicating the extent of land that may be subject to fluvial erosion hazards. Most of this acreage is within undeveloped areas of Town, although there are a few locations where roads or existing houses are located within the River Corridor (see map in the Appendix).

Although the title of Disaster #1995 which occurred in 2011 is simply "Severe Storms and Flooding," some of the infrastructure damage was due to fluvial erosion (e.g., Tice Mill Road and the Stearns Brook Road BR. 31 over Stearns Brook). The number of instances where flood damage in Holland was caused by fluvial erosion is not available, nor is there documentation of the extent of fluvial erosion.

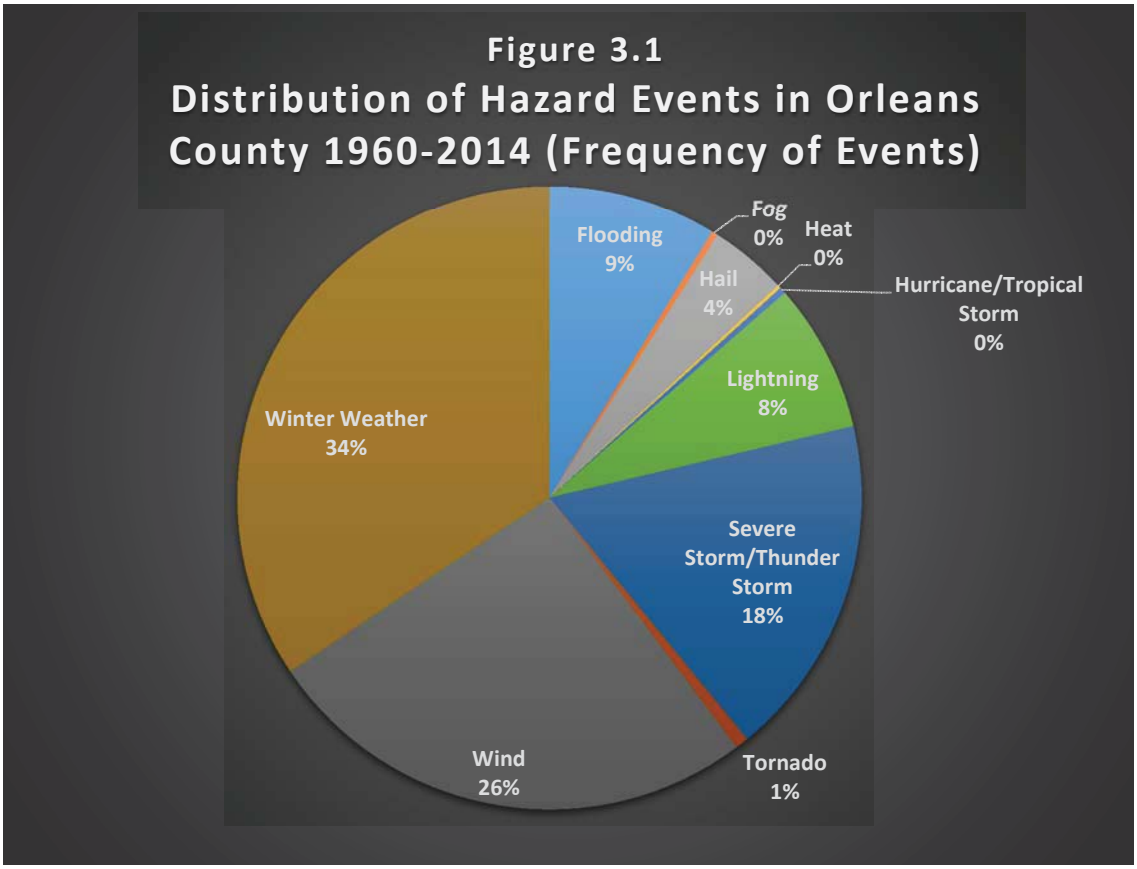
# 3. RISK ASSESSMENT

## 3.1 Natural Hazard Events

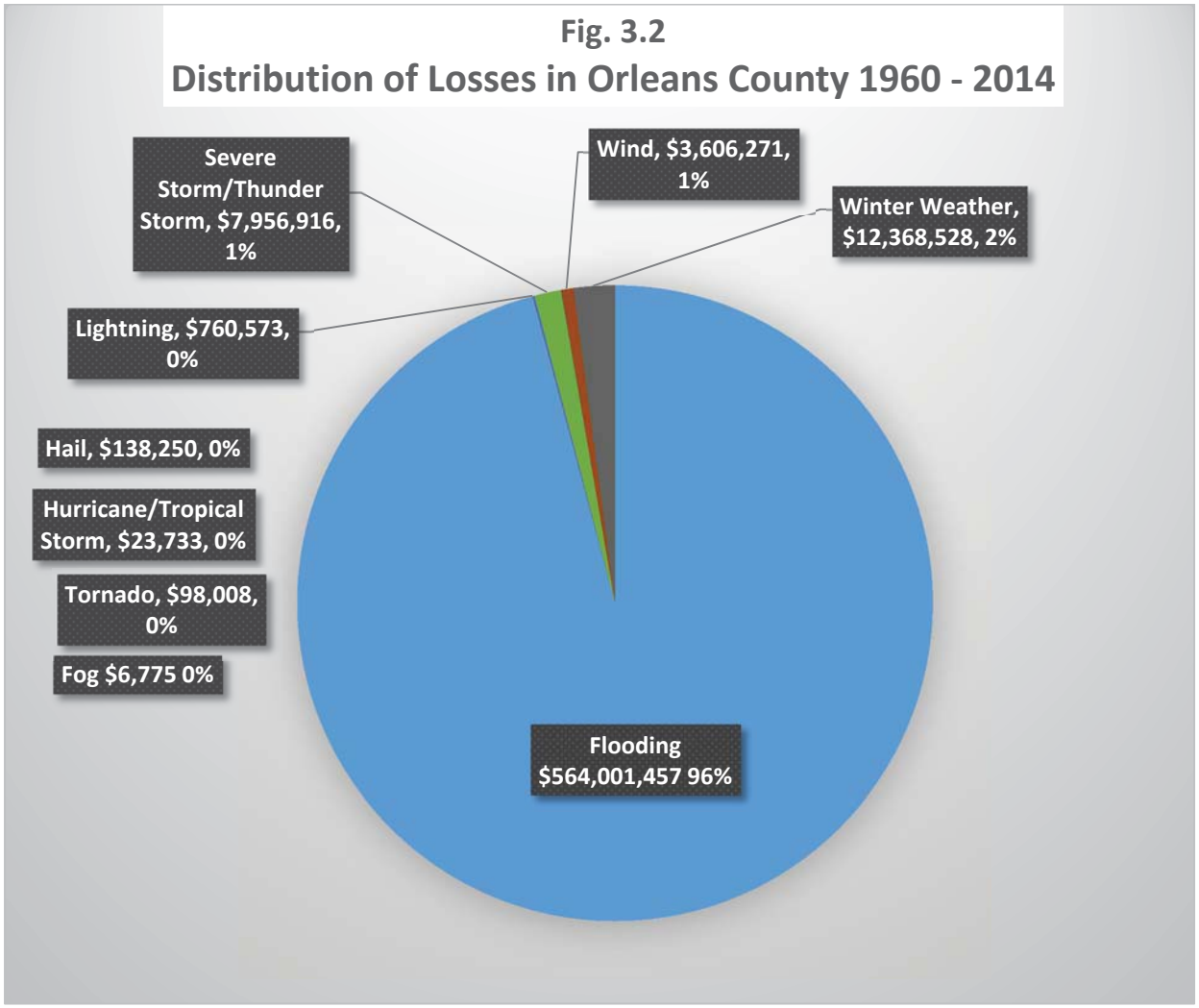
The process of risk assessment for Holland began with a review of the 2013 State of Vermont Hazard Mitigation Plan. The State Plan notes:

"Risk assessment measures the potential loss of life, personal injury, economic injury, and property damage resulting from natural hazards by assessing the vulnerability of people, buildings, and infrastructure to natural and technological disasters."

The following hazards includes in the State Plan were not profiled in Holland's plan: Nuclear Power Plant Failure, Dam Failure, Rock Cuts, Invasive Species, and Extreme Temperatures. The Hazard Mitigation Planning team assessed the hazards that were likely to impact Holland, and discussed probability, impact, risk level and history.




Regional data on past hazard occurrences is available from the Spatial Hazard Events and Losses Database for the United States (SHELDUS). The database provides information on both the frequency of events and the cost of damage resulting from various hazards. As shown on the Figure 3.1 "Winter Weather" and "Wind" were the most frequently occurring hazard event in Orleans County from 1960 through 2014. Flooding accounted for only 9% of hazard events. However, as shown in figure 3.2, flooding presented the costliest of damage of all hazard events.




The Town of Holland received Public Assistance grants under five declared disasters, from 2001 through 2014. The incident types and costs are shown in Table 3.1 below.

**Table 3.1**

**Data.gov Public Assistance Subgrantee Summary**
**PA Grant Program (CDFA Number 97.036), Funded Projects**

| Disaster Number | Declaration Date | Incident Type | State | County | Applicant Name | Education Applicant | Number of Projects | Federal Share Obligated |
|---|---|---|---|---|---|---|---|---|
| 3167 | 04/10/2001 | Snow | Vermont | Orleans | HOLLAND (TOWN OF) | No | 1 | $3,027.62 |
| 1559 | 09/23/2004 | Severe Storm(s) | Vermont | Orleans | HOLLAND (TOWN OF) | No | 9 | $88,487.49 |
| 1995 | 06/15/2011 | Severe Storm(s) | Vermont | Orleans | HOLLAND (TOWN OF) | No | 12 | $544,174.17 |
| 4022 | 09/01/2011 | Hurricane | Vermont | Orleans | HOLLAND (TOWN OF) | No | 4 | $13,459.52 |
| 4178 | 06/11/2014 | Flood | Vermont | Orleans | HOLLAND (TOWN OF) | No | 1 | $40,574.14 |

## 3.2 Local Risk Assessment

A "Hazards Checklist and History" was completed as a group by attendees at the December 10 meeting, and the results of this preliminary assessment are shown in Table 3.2.

**Table 3.2**
**Holland Hazards Checklist and History (Completed as a group at December 10, 2015 public meeting)**

| **Natural Hazards** | **Probability**<br>Likelihood of it happening in any given year<br>HIGH: 100%<br>MED: 10-99%<br>LOW: 1-9% (less than every 10 years) | **Impact**<br>Damage, injuries, disruption<br>MINOR<br>MODERATE<br>MAJOR: severe damage town-wide, multiple injuries/fatalities, critical facilitites shutdown | **Risk Level**<br>Based on probability, impact, and warning time<br>LOW<br>MODERATE<br>HIGH | **History: When, where, extent and impact**<br>Extent: wind speed, snow depth, earthquake magnitude<br>Impact : the effect that the hazard event had on people, property and infrastructure. Dollar amount value of damage, if known. |
|---|---|---|---|---|
| Flooding/Stream Bank Erosion | **High** | **Major** | **High** | **2014, 37 locations affected in one event; Spring storm, 2011 (rain came with snow on the ground)** |
| Earthquake | **Low** | **Major** | **Low** | **5.2 magnitude, eastern upstate NY, April 2002** |
| Hurricane/Tropical Storm | **Medium** | **Moderate** | **Moderate** | **Inches of rain** |
| High Winds | **High** | **Major** | **Moderate** | **Spring 2015, roof blew off horse barn; June 2008, roof lost to high winds (near Stearns Brook & Twin Bridge rds); 1993, wind damage to power lines** |
| Landslide/Rockslide | **Low** | **Low** | **Low** | **No events recalled** |
| Severe Thunderstorm | **Medium** | **Moderate** | **Moderate** | **Lightning strike, damage to personal property** |
| Sever Winter Storm (ice storms, snowstorms) | **High** | **Major** | **High** | **March 2012, snowstorm caused roof collapse on homes/barns, downed trees & power lines; 2007, Valentine's Day storm, loss of power for two weeks.** |
| Extreme Cold (colder than 30 below 0) | **Medium** | **Low** | **Low** | **2012, 48 below 0** |

| | | | | |
|---|---|---|---|---|
| Hail | **Low** | **Low** | **Low** | **1 inch hail on 5/19/2015 according to NOAA database.** |
| Drought | **Low** | **Low** | **Low** | **No events recalled** |
| Wildfire | **Low** | **Low** | **Low** | **No events recalled** |

Based on this exercise, the planning team decided to profile in detail the hazards that posed the greatest risk to Holland, and to develop mitigation measures for those hazards. The hazards that were felt to present the highest risk to people and property in Holland were Flooding/Stream Bank Erosion, High Winds and Severe Winter Storms. While other hazards, such as earthquakes, were recognized to have a major impact if it were to occur in close range and at a high magnitude, the probability of one occurring, based on past history, was low. The Hazard Mitigation Planning Committee also decided not to profile man-made, or "technological" hazards.

# 4. ASSESSING VULNERABILITY

## 4.1 Populations at Risk

Vulnerability refers to the potential impact of a specific loss related to an identified risk.

As noted in the introduction, the Town of Holland does not have a FIRM map, so assessment of vulnerability to the primary hazard – flooding – is largely based on knowledge of previous occurrences. Because of the lack of FIRMs, Holland has not been able to participate in the National Flood Insurance Program.

Areas of repetitive flooding and ongoing streambank erosion was discussed by the planning team, with the Town Road foreman providing detailed information on the problem areas. These areas were depicted on a map of the town, on which critical facilities were also mapped. (See attached map in appendix.)

The State River Corridors, also depicted on the above referenced map, provide an indication of areas that are vulnerable to fluvial erosion. There are approximately 10 residences in or directly adjacent to the mapped River Corridors, indicating that these properties may be at risk of damage. There are also portions of the town's road infrastructure that are within the mapped River Corridors. Detailed locations where damage has occurred in the past is noted on Table V.1, along with an explanation of the expected reasons for the damage (e.g., undersized culverts not able to handle high flows).

Vulnerable, or "at-risk" populations would include the elementary school, a senior residence at the corner of Page Hill Road and Holland Pond Road, and the visiting population of second-homeowners, most of which are concentrated around Holland Pond.

## 4.2 Critical Assets and Infrastructure

Critical facilities are structures critical to the operation of the community and the local economy, which may include historic structures. Critical facilities/assets within the Town of Holland that are important to protect during hazard events are listed in Table 4.2., along with the estimated replacement cost, if relevant.

**Table 4.1**
**Critical Facilities in Holland Town**

| Asset / Critical Infrastructure | Location | Ownership | Estimated Value ($) |
|---|---|---|---|
| Holland Elementary School (also emergency shelter) | School Road | Holland School District | 1,856,900 |
| Holland Town Offices | School Road | Town of Holland | 206,900 |
| Holland Town Garage | Valley Road | Town of Holland | 284,100 |
| Fire hydrants (Dry and Live) | 6 in various locations | Town of Holland/ International Water Co. | 2,000-5,000 per hydrant |
| Holland Historical Society (Old Congregational Church) – National Register property | Holland Pond Road | Holland Historical Society | 26,200 |
| Methodist Church | Holland Pond Road | Holland Community Church, Inc. | 137,100 |
| Valley Road (only paved road). Link to Interstate 91 and south to State Rt 111 | Across town | Town | NA |
| Connects south to State Rt. 111 | Gore Road | Town | NA |

| | | | |
|---|---|---|---|
| Connects south to State Rt. 111 | Mead Hill Road | Town | |
| Water pipeline from Holland Pond (backup water supply for Derby Line) | Across town from Holland Pond | International Water Co. | NA |
| Holland Pond Dam | Holland Pond | International Water Co. (private) | NA |

The Holland Pond Dam is regulated by the Vermont Department of Environmental Conservation and is rated as a "low hazard potential". Its original purpose was for log driving and it is now used for the purpose of a backup water supply for the Town of Derby. Holland Pond is also an important recreational resource in the Town, and a state-maintained fishing access is located on the western shore. The dam is 137 feet long, 5 feet high and is constructed of earth, stone and concrete.

The median value of an owner-occupied unit in Holland in 2015 was $129,900 as per the 2015 American Community Survey.

One of the vulnerabilities the town has is the lack of a local gravel supply for road repair and maintenance. The 2012 Town Plan notes:

"A significant problem with maintaining the Town roads is both the lack of and cost of gravel. The Town has no sand/gravel pit and thus must haul in material for both winter sand and gravel…The Town needs to seriously explore the opportunity for purchase or long term lease of a pit or other long term source of gravel. "

The Town currently obtains gravel from Island Pond, in the town of Brighton, and from Derby.

**Development Trends: Population and Housing**

The Census Bureau's *American Community Survey* indicates that the population is slowly growing -- 668 was the estimated population in Holland as of 2015. As shown on the table below, the percentage of the population comprising residents age 65 and older has increased from 2000 to 2015. The aging of the population is a trend seen throughout the northeast.

**Table 4.2**
**Population Trends**

| **Population** | **2000** | | **2010** | | **2015** | |
|---|---|---|---|---|---|---|
| | **Number** | **Percent** | **Number** | **Percent** | **Number** | **Percent** |
| **Total Population** | **588** | **100** | **629** | **100** | **668** | **100** |
| Under 5 years | 39 | 6.6 | 31 | 4.9 | ---- | 4.9 |
| 5 to 19 years | 162 | 27.5 | 133 | 21.2 | ---- | 23.5 |
| 20-64 | 334 | 56.8 | 383 | 60.9 | ---- | 57.7 |
| 65-84 | 51 | 8.7 | 74 | 11.8 | ---- | 12.7 |
| 85 and over | 2 | 0.3 | 8 | 1.3 | ---- | 0.9 |
| Source: 2000 and 2010 Decennial Census; 2011-2015 ACS 5-year estimates. | | | | | | |

Based on town records, from 2010 to 2016 there were 5 new lots were created, and 26 new buildings were constructed including 11 new year-round residences. The estimated number of housing units in town in 2015 was 423.

# 5. MITIGATION STRATEGY

## 5.1 Evaluation of Mitigation Actions

At the public meeting on March 24, 2016 several mitigation strategies were evaluated using an evaluation matrix. Between March 2016 and April 2017, additional mitigation measures were added, and all actions were re-evaluated at a hazard mitigation meeting on June 26, 2017. This evaluation helped to prioritize actions. The hazard type which was addressed by each action appears in the first column, followed by the proposed mitigation action. The following criteria were considered in the matrix:

- What is the likelihood of securing funding for the action?
- Does the action protect threatened infrastructure and is it environmentally sound?
- Can the action be implemented quickly?
- Is the action socially and politically acceptable?
- Is the action technically feasible?
- Is the action administratively realistic given the capabilities of responsible parties?
- Does the action offer reasonable benefit compared to its cost of implementation?

Each criteria was rated on a scale of 1 to 5, 1 being “poor” and 5 being “excellent.” The results are shown on Table 5.1. Some of the mitigation actions that were identified as having the highest benefit, were also the most costly or were deemed to have low social/political acceptance, resulting in a lower overall rating.

**Table 5.1**
**Evaluation of Mitigation Actions**
1= Poor 2= Below Average or unknown 3= Average 4= Above Average 5= Excellent

| Hazard Type | Mitigation Action | Funding potential | Protection value/ Environmental Advantage | Time to implement | Social and Political acceptance | Technical Feasibility | Admin. Feasibility | Benefit to cost | Total Score |
|---|---|---|---|---|---|---|---|---|---|
| **All Hazards** | Integrate Hazard Mitigation Plan into relevant sections of Town Plan (e.g., facilities and utilities, transportation, flood resilience) | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| | Integrate Hazard Mitigation Plan into annual budget | 2 | 5 | 5 | 1 | 3 | 5 | 4 | **25** |
| | Develop and implement a public education program on hazards and mitigation measures | 5 | 4 | 5 | 5 | 5 | 5 | 5 | **34** |
| | Develop regular maintenance plan to remove silt and vegetation from around dry hydrants in town, and make repairs when necessary | 5 | 5 | 5 | 5 | 5 | 5 | 5 | **35** |
| **Flooding/Stream bank erosion (due to hurricanes, tropical storms, severe thunderstorms)** | Undertake stream geomorphic assessments for State-mapped River Corridors as a basis for future Flood Hazard regulations, and to join the NFIP | 4 | 5 | 3 | 2 | 2 | 2 | 5 | **23** |
| | Require propane tank tie-downs (free-standing ordinance or in conjunction with flood hazard regulations) | 4 | 5 | 3 | 2 | 2 | 2 | 5 | **23** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Maintain bridge and culvert inventory on VOBCIT | 5 | 5 | 5 | 5 | 3 | 5 | 5 | **33** |
| | Undertake a cost/benefit analysis for replacement of Br. 31 on Holland TH 8 (Stearns Brook Road) as per VTrans hydraulics report. Compare to alternative of discontinuing road section, after traffic count. | 2 | 3 | 3 | 1 | 1 | 1 | 2 | **13** |
| | Undertake a road erosion inventory with the assistance of a Category A Better Backroads grant, to identify problem areas | 5 | 5 | 5 | 5 | 5 | 5 | 5 | **35** |
| | Identify and develop a convenient source of gravel for roads, including potential in-Town sources. Roads tend to be silty, and more prone to erosion | 2 | 5 | 4 | 3 | 4 | 4 | 5 | **27** |
| | Restore riparian areas with stream buffer plantings | 5 | 5 | 5 | 5 | 5 | 5 | 5 | **35** |
| | Facilitate addition of drainage structures (gutters, downspouts, drywells) on commercial agricultural property to contain stormwater runoff and avoid spillage onto public road. (Currently, excessive stormwater runoff creates flooding/icing hazard on Valley Road adjacent to | 2 | 5 | 5 | 5 | 2 | 2 | 5 | **26** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | commercial agricultural property.) | | | | | | | | |
| **High Winds (due to Hurricanes, Severe Thunderstorms and Winter Storms)** | Protect public buildings, and town roads from wind damage through regular tree pruning, maintenance and upkeep, taking aesthetic considerations into account. | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| | Retrofit/replace public buildings (Town Garage in particular) and critical facilities to reduce future wind damage | 2 | 3 | 3 | 3 | 3 | 3 | 3 | **20** |
| | Increase public awareness of severe wind by providing information on property maintenance and building retrofits. Encourage use of natural protection using landscape and vegetation as wind buffers. | 5 | 5 | 5 | 5 | 5 | 5 | 5 | **35** |
| | Recommend burial of utilities serving new development. | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| | Develop and maintain a local database to track Holland's vulnerability to severe wind (possibility integrate into a school project.) | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| **Lightning** | Protect facilities such as the School, Town Garage, Municipal Offices and the Holland Historical Society building with lightning protection devices | 4 | 5 | 4 | 5 | 5 | **5** | **5** | **33** |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Install and maintain surge protection on critical Town-owned electronic equipment | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| | Provide information on lightning-protection devices to property owners via mailing with property tax bill. | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| **Severe Winter Storms** | Increase public awareness of severe winter storms by distributing information about available weatherization and heating assistance programs, how to protect pipes from freezing, and how to guard against carbon monoxide poisoning. | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |
| | Develop plans for safe and effective snow plowing, assure roads are plowable before winter, and identify alternative support mechanisms for snow removal when local capacity is overwhelmed | 5 | 5 | 5 | 5 | 5 | **5** | **5** | **35** |

## 5.2 Capabilities

The Town of Holland has a low year-round population, and limited paid staff. The Town employs a Town Clerk and a Town Road Foreman. The Town of Holland does not have zoning regulations, so does not have a Zoning Administrator or a Development Review Board. The Holland Selectboard is responsible for developing the Town budget and enforcing the local road access ordinance. The Selectboard appoints an Emergency Management Director, who works with the Town Selectboard, NVDA and the Local Emergency Planning Committee (LEPC) #10 to develop a Local Emergency Operations Plan.

The Holland Planning Commission consists of an elected board of volunteers and is responsible for developing the Town Plan, the most recent version of which was adopted in January of 2017. Although not a regulatory document, the Town Plan suggests general standards for land use and protection of natural resources, and identifies necessary upgrades to public facilities and road infrastructure. The Town Plan is used as a guidance document for development projects which rise to the threshold that triggers Act 250 review, the State's Land Use and Development law. Act 250 review is undertaken by District Environmental Commission #7, which is based in St. Johnsbury. The District Environmental Commission is responsible for assuring that developments or subdivisions comply with Act 250's ten criteria.

Due to fiscal constraints because of a limited tax base and modest incomes, the Town of Holland does not have the ability to expand their capabilities "in-house." However, Holland depends on technical support from outside agencies in order to expand on and improve its capabilities and programs. The Regional Planning Commission (NVDA), the Orleans County Natural Resources Conservation District (NCRD), and the staff at the Vermont Department of Transportation (VTrans) and provide support to the Town of Holland in furthering the mitigation actions in this Plan.

Table 5.2 lists each mitigation action, along with the party or parties that would have the capability of implementing the action, and time-frame. Source of funding, if relevant, is also noted. The estimated cost is noted as a 1 if low (under $5,000); 2 if medium ($5,000 to $10,000); or 3 if high (over $10,000).

**Table 5.2**
**Capabilities, Costs and Timeframes**

| Hazard Type | Mitigation Action | Responsible Party | Estimated Cost | Funding Source | Time-frame |
|---|---|---|---|---|---|
| All Hazards | Integrate Hazard Mitigation Plan into relevant sections of Town Plan (e.g., facilities and utilities, transportation, flood resilience) | Planning Commission | 1 | NA | Fall - Spring Year 1 |
| | Integrate Hazard Mitigation Plan into annual budget | Selectboard | 1 | NA | Annually |
| | Develop and implement a public education program on hazards and mitigation measures | Planning Commission/Selectboard | 1 | NA | Fall- Spring, Year 1 and ongoing |
| | Develop regular maintenance plan to remove silt and vegetation from around dry hydrants in town, and make repairs when necessary | Emergency Management Director/Road Foreman | 1 | Vermont Association of Conservation Districts grant program for dry hydrants | Annually |

| | | | | | |
|---|---|---|---|---|---|
| Flooding/Streambank erosion (due to hurricanes, tropical storms, severe thunderstorms) | Undertake stream geomorphic assessments for State-mapped River Corridors as a basis for future Flood Hazard regulations, and to join the NFIP | Planning Commission/Selectboard working with Natural Resources Conservation District and VT DEC | 2 | Ecosystem Restoration Program grant | Summer-Fall, Year 2 |
| | Require propane tank tie-downs (free-standing ordinance or in conjunction with flood hazard regulations) | Selectboard | 1 | NA | Spring-Fall, Year 3 |
| | Maintain bridge and culvert inventory on VOBCIT | Road Foreman/Selectboard | 1 | NA | Ongoing |
| | Undertake a cost/benefit analysis for replacement of Br. 31 on Holland TH 8 (Stearns Brook Road) as per VTrans hydraulics report. Compare to alternative of discontinuing road section, after traffic count. | Selectboard | 1 | NA | Fall - Winter, Year 1 |
| | Undertake a road erosion inventory with the assistance of a Category A Better Backroads grant, to identify problem areas | Selectboard working with Sarah Damsel of Orleans County NRCD | 1 | Better Backroads grant | Spring – Summer, Year 1 |
| | Identify and develop a convenient source of gravel for roads, including potential in-Town sources. Roads tend to be silty, and more prone to erosion | Selectboard/Road Foreman | 1 | Municipal Planning Grant/Town highway budget | Fall-Winter, Year 1 |
| | Restore riparian areas with stream buffer plantings | Property owners working with non-profit/ State agencies | 2 | ERP grant | Ongoing |
| | Facilitate addition of drainage structures (gutters, downspouts, drywells) on commercial agricultural property to contain stormwater runoff and avoid spillage onto public road. (Currently, excessive stormwater runoff creates flooding/icing hazard on Valley Road adjacent to commercial agricultural property.) | Selectboard working with property owner | 3 | Property owner/Dept. of Agriculture | Fall – Spring, Year 1 |
| **High Winds (due to Hurricanes, Severe** | Protect public buildings, and town roads from wind damage through regular tree pruning, | Selectboard/School Board | 1 | Town/Vermont Urban and | Ongoing |

| | | | | | |
|---|---|---|---|---|---|
| **Thunderstorms and Winter Storms)** | maintenance and upkeep, taking aesthetic considerations into account. | | | Community Forestry Grant | |
| | Retrofit/replace public buildings (Town Garage in particular) and critical facilities to reduce future wind damage | Selectboard | 3 | Town/USDA Community Facilities Grant | Spring- Fall, Year 3 |
| | Increase public awareness of severe wind by providing information on property maintenance and building retrofits. Encourage use of natural protection using landscape and vegetation as wind buffers. | Selectboard/Planning Commission | 1 | NA | Annually |
| | Recommend burial of utilities serving new development. | Planning Commission | 1 | NA | Ongoing (in Town Plan) |
| | Develop and maintain a local database to track Holland's vulnerability to severe wind (possibility integrate into a school project.) | Planning Commission/Town School/Private landowners | 1 | NA | Fall – Spring, Year 1 and Ongoing |
| **Lightning** | Protect facilities such as the School, Town Garage, Municipal Offices and the Holland Historical Society building with lightning protection devices | Selectboard/School Board/Holland Historical Society | 1 | USDA Community Facilities Grant | Fall-Spring Year 1 |
| | Install and maintain surge protection on critical Town-owned electronic equipment | Selectboard | 1 | Town | Fall-Spring, Year 1 and ongoing |
| | Provide information on lightning-protection devices to property owners via mailing with property tax bill. | Planning Commission/Town Clerk | 1 | NA | Summer, Year 1, and ongoing |
| **Severe Winter Storms** | Increase public awareness of severe winter storms by distributing information about available weatherization and heating assistance programs, how to protect pipes from freezing, and how to guard against carbon monoxide poisoning. | Selectboard | 1 | NA | Annually |

| | | | | | |
|---|---|---|---|---|---|
| | Develop plans for safe and effective snow plowing, assure roads are plowable before winter, and identify alternative support mechanisms for snow removal when local capacity is overwhelmed | Selectboard/Road Foreman | 1 | NA | Fall – Spring, Year 1 and Ongoing |

## 5.3 Implementation and Monitoring of Mitigation Strategies

### 5.3.1 Public Involvement Following Plan Approval

After the Plan has received approval from FEMA and has been adopted by the Town, the Town Selectboard will provide a summary in the Annual Town Report regarding any progress to date on mitigation actions in the Plan, any changed conditions, and an evaluation of the plan to assess whether it is still effectively promoting Holland's hazard mitigation goals. At Town Meeting every March, the public will have the opportunity to ask questions and provide comments on the mitigation strategy.

### 5.3.2 Project Lead and Monitoring Process

Once the Plan is approved by FEMA, the calendar will begin for annual review of the mitigation plan.

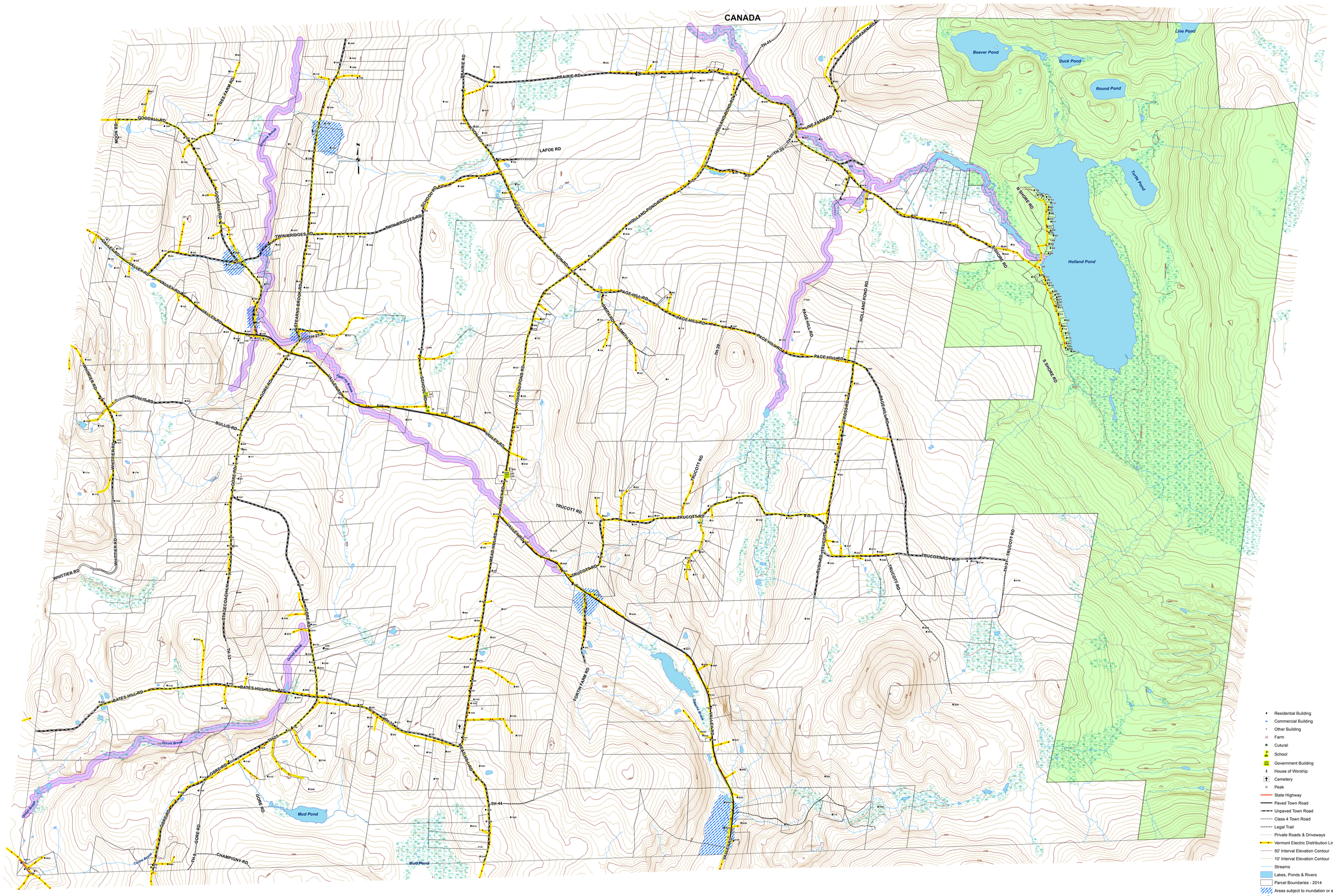
The Holland Selectboard Chair is the project lead and will work in conjunction with the Holland Emergency Management Director, the Road Foreman, the Town Clerk, and the Planning Commission to complete the yearly progress report included in the Annual Town Report. The Town Clerk will assure that all road improvement projects are tracked in collaboration with the Road Foreman.

### 5.3.3 Plan Update Process

The Plan update will be led by the Planning Commission. The Planning Commission may elect to acquire the assistance of the Northeastern Vermont Development Association or a consultant to update the plan following a declared disaster and/or the next five-year planning cycle. The process of updating the Hazard Mitigation Plan will begin one year prior to its expiration. The update process will begin with a review of the annual progress reports, and will include an update of data on population and development. Any changes in vulnerability will also be documented. The Planning Commission will seek public involvement through methods similar to those used in the development of this Plan: use of the local elementary school email list, online resident survey, direct emails to adjacent Town officials, announcements in the local newspaper, and public meetings.

# Town of Holland
# Hazard Mitigation Map

*03/18/2016*




1 inch = 1,000 feet

0 1 2 Miles

NVDA
Northeastern Vermont Development Association

***Warning- This Data is for planning purposes only and does not replace a survey and/or engineering study. Because this map is developed from various scale sources, there may be some discrepancies between data layers.***