Town of Orange, Vermont
2017 Local Hazard Mitigation Plan

Prepared by the Town of Orange and
the Central Vermont Regional Planning Commission

Date of Town Adoption: , 2017

_____
Date of Final Approval by FEMA
Plan Expires 5 years from FEMA Approval:

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Funded in part by a Hazard Mitigation Grant Program grant from the Division of Emergency Management and Homeland Security.

Orange Local Hazard Mitigation Plan Update
2017
Prepared by the Town of Orange and CVRPC

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1. Introduction

In accordance with the Stafford Act, municipalities may perform mitigation planning and be eligible to receive increased federal funding for hazard mitigation measures. (42 U.S.C. 5165).

The impact of expected, but unpredictable natural and human-caused events can be reduced through planning and action. The goal of this Local Hazard Mitigation Plan (hereafter referred to simply as the Plan) is to update the local mitigation strategy that makes Orange more disaster resistant and reduces its risk from natural hazards.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from hazards and their effects. FEMA defines a natural hazard as a source of harm or difficulty created by a meteorological, environmental, or geological event. Based on the results of previous Project Impact efforts, FEMA and State agencies have come to recognize that it is less expensive to prevent disasters 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 the hazards are most severe and identify local actions that can be taken to reduce the severity of the hazard. These actions and measures, also known as "hazard mitigation strategies," can 1) alter the hazard by eliminating or reducing the frequency of occurrence, 2) avert the hazard by redirecting the impact by means of a structure or land treatment, 3) adapt to the hazard by modifying structures or standards, or 4) avoid the hazard by preventing, limiting, or relocating development, improving public education, or ensuring development is disaster resistant.

2. Purpose

The 2017 Orange Local Hazard Mitigation Plan is an update of the town's 2012 plan. The purpose of this Plan is to assist Orange in recognizing hazards facing the community, ranking them according to local vulnerabilities, and identify strategies to reduce risks from acknowledged hazards of highest concern based on current information. The town reviewed, evaluated, and revised the 2012 plan to reflect changes in development, progress in local mitigation efforts and changes in priorities. New information has been incorporated into this Plan making it up to date, stronger and more useful for the Orange town officials and residents who will implement the actions and measures going forward. Implementation of this Plan will make Orange more resistant to harm and damages in the future, and will reduce public costs.

Orange strives to be in accordance with the strategies, goals and objectives of the Vermont State Hazard Mitigation Plan, latest version date November 2013, including an emphasis on proactive pre-disaster flood mitigation for public infrastructure, good floodplain and river management practices, and fluvial erosion risk assessment initiatives.

The 2017 Orange Local Hazard Mitigation Plan includes:

- Current information since the last plan update done in 2012.
- A status update of the 2012 mitigation strategies/actions.
- A new mitigation strategies/action section to reflect the current priorities and intended actions of the community over the next five years.
- An updated and more robust Hazard Ranking Methodology is used in this Plan which adds an additional level of probability under the Frequency of Occurrence criteria, looks at Warning Time, and Potential impact.
- Updates have been made to the Hazard Analysis Map.
- Addition of a new Transportation Vulnerability Analysis Map (Vulnerability Assessment).
- - A copy of the Thurman Dix Reservoir Dam Inundation Area Map has been added to this Plan attachment section. The Inundation Area Maps for the East Barre Dam and the Thurman Dix Reservoir Dam along with each dams EAP (Emergency Action Plan) are now on file at the Orange Town Clerk Office.
- The town has updated the hazards to reflect changes in the communities' priorities.
- Minor changes to the plan update and plan maintenance process to incorporate greater public participation and reflect scheduling changes of the Selectboard and Planning Commission since the last plan adoption.

3. Community Profile

Geography

The rural Town of Orange is located within the northeast corner of Orange County. It is bordered to the north by the Washington County Town of Plainfield and the Caledonia County Town of Groton. To the east and south are the Orange County towns of Topsham, Corinth, and Washington; and to the west is Barre Town of Washington County. Orange is located at the southern boundary of the 25,645 acre Groton State Forest, of which 1,934 acres are in Orange, and is adjacent to Central Vermont's largest job centers. Two village centers exist in Orange. East Orange is located at the southeastern corner and Orange Center is at the west and central edge of town. Orange Center is bisected by Route 302 and hosts a number of residential and commercial buildings. East Orange Village is less developed and comprised of mostly residential building.

Comprising of rural mountainous terrain, the Town of Orange covers 38.77 square miles. The Orange Town Forest located near the center of the Town on the North side of Route 302 is comprised of 306.4 contiguous acres. The Town has a Forest Management Plan dated 1999 and manages the forest primarily for the harvest of timber. The town is split on its north-south axis by a major watershed boundary and is predominantly located within the Winooski Watershed. The eastern portion of the town drains into the Steven, Wells, Waits and Ompompanoosuc Watershed. Tributaries along the eastern slopes flow into the Waits River and Wells River leading to the Connecticut River. Tributaries along the western slopes flow into the Jail Branch River and then into the Winooski River. The northeastern quadrant is heavily forested with little development or human habitation. Mountains in this area reach elevations of over 3,000 ft.

The southeastern quadrant is predominantly rolling hills, river valleys, and forest land. The most intensely inhabited areas and most suitable for development lie on the western reaches of Orange. The Nate Smith Brook and the Nelson Brook both flow westward into the Thurman W. Dix Reservoir. According to the Town Plan, "this reservoir drains south into Orange Brook and then on to the Lower Orange Reservoir, also a drinking water source for Barre City residents." And "Baker Brook originates on the western slope of the Town, joining Orange Brook below lower Orange Reservoir before its confluence with the Jail Branch."

In addition to the many watercourses, Orange has significant bodies of water, both natural and man-made. Riddel Pond is a source of exceptional wildlife habitat and provides quality aesthetic value. Numerous small ponds, many created by beaver, dot the landscape. These bodies of water act as storage areas during heavy rains and snowmelt creating flood control and preventing erosion. Associated wetland areas also act to control flooding, prevent erosion, and filter sediments.

The Thurman W. Dix Reservoir and the Lower Orange Reservoir serve as drinking water sources for Barre City. Barre City owns the dams and the approximately 1,200 acre tract of adjacent lands (aka Barre City Forest) surrounding the reservoirs. The Thurman W. Dix Reservoir Dam was built in 1950, drains 9.1 square miles and is classified by the State of Vermont as a High Hazard dam (potential for loss of life - more than a few, and potential economic loss - excessive). The Emergency Action Plan (EAP) was last updated in 2008. The East Barre Dam is a flood control structure owned and managed by the State of Vermont which has a significant portion of its flood reservoir located in the southeastern quadrant of Orange and incorporates a significant portion of the Jail Branch floodplain. The flood reservoir is under both state ownership and private ownership. The dam itself is located in East Barre, a village of Barre Town. The East Barre Dam drains an area 38.7 square miles. It too is categorized by the State of Vermont as a high hazard dam. The EAP for East Barre Dam was last updated in 2012 by DuBois & King, Inc. According to the State of Vermont 2013 Hazard Mitigation Plan, "none of the high hazard dams under the jurisdiction of the ANR Dam Safety Program are considered to be in imminent danger of failure…"

Transportation

The major transportation route through Orange is Vermont Route 302. Route 302 bisects the Town on an east-west axis with a number of commercial and residential structures located along it, including the Town Hall and the Orange Center School. The Orange Town Plan states that Route 302, also called the William Scott Memorial Highway, "is a high volume transportation corridor of regional significance." It provides access to Montpelier and Barre in the west and to the Connecticut River Valley and Interstate 91 in the east. Other signification roads include Route 110 that cuts across the south western corner of the town from north to south providing access from Barre Town to Washington. Lastly, Reservoir Road runs from Plainfield in the north past the Thurman W. Dix and Lower Orange Reservoir before intersecting with Route 302.

In April 2014, the Selectboard adopted The Orange Town Highway Consolidated Ordinance that incorporated the preexisting ordinances of Street Naming, Snow Clearing Clearing Restrictions,

Obstruction of Highway, and Overhead Wires. Upon the adoption of the consolidated highway ordinance, the four Speed Limit ordinances expired. The purpose of the consolidated ordinance, "is to establish and to clarify the standards of construction and the authority of the Selectboard and their agents with regard the Town Highways." The consolidated ordinance further directs the Selectboard to institute and periodically review and update the town road management plan in making decisions about preventative maintenance and road improvements…" The Town follows the Vermont Agency of Transportation minimum standards A-76 for roads and B-71 for drives.

Population

According to US Census data the population of Orange in 2010 was 1,072 with 425 households. The population increased by 11% from 2000 to 2010. According to the Town Plan and CVRPC EPR 2001 forecasts the population is expected to continue to increase and it is projected to be 1,276 in 2020 (a 20% growth rate). However, the US Census Bureau, 2011-2015 American Community Survey 5-Year Estimates put the estimated 2015 Orange population at 1,002 with 462 housing units. Since 2012, Orange has experienced minor growth. According to the Annual Town Report of the past three years, there have been more deaths than births in town.

Orange is a bedroom community that strives to maintain its rural character. It feels the development pressure of the neighboring Washington County towns. The majority of working residents commute to neighboring towns for work. The Town does not have zoning regulations and relies on the state's ACT 250 rules and state on-site sewage disposal regulations to guide development. The goal of the town plan is to maintain the rural character of Orange. Commercial and industrial development is to take place in areas where existing business or industry occur and where town water and sewer are available or will become available. Economic growth is encouraged in the areas of Orange Center and East Orange. Housing development is scattered throughout the rural countryside. The objective of the Town Plan is to develop rural areas in a way that does not negatively impact the natural, cultural, and aesthetic resources and be consistent with the existing density patterns and a "reasoned pace of growth." Lacking building permits to track development, the town had about ten new single family houses built over the last five years. Four of these homes were located in the village centers and the other six were located throughout the rural countryside. No subdivisions have occurred since the last mitigation plan and none are proposed. Orange foresees development to continue to be scattered rural residential. Overall, new development in Orange since the 2012 Plan has caused no change in the community's vulnerability.

National Flood Insurance Program

Since 1985, Orange has participated in the National Flood Insurance Program and is currently in compliance. The Town of Orange FIRMS are dated September 1985, community panel #500239B, sheets 1 -11. In 2013, official Digital Flood Insurance Rate Maps became available. As noted in the Town Plan, "the most significant floodplains occur along portions of the Jail Branch, Orange Brook, Nate Smith Brook, East Orange Branch, Nelson Brook, and Baker Brook." Snow melt and heavy rain are the major contributing factors to flooding in Orange. In 2014, the Orange Planning Commission prepared an update to the flood hazard regulations. On July 14, 2014 the Selectboard adopted the Town of Orange Inundation Hazard Area Regulations. The

regulations prevent new development in Special Flood Hazard Areas and the Floodway, institute setbacks, regulate uses, establish minimum standards for building and flood proofing, and regulate improvements to existing structures. The Administrative Floodplain Officer for the town is Kathie Felch. There are 21 structures and 13,090 acres in the floodplain. There are no repetitive loss properties in Orange and no BCX claims. B, C, and X are zones from the older FEMA floodplain maps and are areas outside of the Special Flood Hazard zone A. There are 23 policies. There has been 3 Letter of Map Changes to date.

Lacking current land use regulations for zoning and subdivision and a history of no repetitive loss properties in the community, it is highly likely that Orange cannot meet the eligibility criteria to enroll in the NFIP Community Rating System (CRS). The administrative resources necessary for enrollment and ongoing program maintenance are likely to be a significant challenge for Orange and a deterrent for participation. Orange has no intention of enrolling in the CRS at this time.

Utilities, Water, and Sewer

The Town Plan states "Orange is within the service area of two electrical utilities. The Washington Electric Cooperative serves the majority of Town, while The Green Mountain Power Corporation serves a small area in the southwestern corner of Town along Route 110 and a portion of Route 302." Velco runs two transmission lines through town as well. Regarding other utilities, the town of Orange depends on groundwater as its potable's water source and all building have drilled wells, dug wells or natural springs. Disposal of wastewater is treated via individual sub-surface sewage disposal systems. The town of Orange relies on the State of Vermont Regional Office to issue water/waste water permits for soil based wastewater systems with flows less than 6500 gallons per day, for potable water supplies (water supplies that are not public), and for municipal water and sewer connections.

Emergency Services

The Town of Orange does not maintain a fire department. It relies on the Barre Town Fire Department, the Washington Fire Department and the Tri-Village Fire Department to provide "as-needed" service to residents. The Forest Fire Warden for the town is Fred Byrd with John Barnes as an assistant. F. Byrd regulates open burning in the town by issuing burning permits ("Permits to Kindle Fire"), educating town residents about safe open burning practices, and maintains relationships with the area fire departments and the Vermont Department of Forest, Parks, and Recreation. As the Forest Fire Warden, F. Byrd is responsible for wildland fire suppression in the town and may ask the state for technical assistance and specialized equipment.

The Vermont State Police provide local routine patrols and law enforcement. The nearest HazMat response truck is located approximately 47 miles away at the IBM Facility in Essex Junction. The nearest HazMat decontamination, rescue and mass care trailer is located at Barre City and Berlin Fire Departments. In accordance with 20 V.S.A. §6, Local organization for emergency management, the Orange Selectboard appoints an Emergency Management Director who "shall have direct responsibility for the organization, administration, and coordination of the local organization for emergency management, subject to the direction and

control of the executive officer or legislative branch." Dustin Comstock serves as the Emergency Management Director.

Municipal Governance - Local Ordinances, Plans and Regulations

The 2013 Orange Town Plan, includes a description, discussion, and goals in regards to development on steep slopes, site design, floodplains, emergency services, and public infrastructure. The 2013 Orange Town Plan specifically calls out and states by title heading, "The Orange Local Hazard Mitigation Plan Update of December 2011 as adopted and all subsequent adopted hazard mitigation plans are and shall be incorporated by reference and shall become part of the Orange Town Plan." Under the Floodplains section of the Town Plan, policies call for the development of lands to be in compliance with local, state and federal flood hazard regulations in order to protect life property, and the environment. Further, it recommends the continual update and re-adoption of the Orange Local Hazard Mitigation Plan. The Planning Commission with the support of CVRPC Senior Planner Eric Vorwald, has begun the process of updating the Municipal Plan due to expire in 2018. The goals and objectives of this Orange Hazard Mitigation Plan will be incorporated into the municipal plan update.

The Town does not have Zoning By-Laws or a Subdivision Ordinance. On July 14, 2014, the Town of Orange adopted Inundation Hazard Area Regulations. The Town of Orange has an approved Local Emergency Operations Plan (LEOP), (formerly known as the Rapid Response Plan), that is updated and adopted annually, after Town Meeting Day and before May 1st. The current LEOP was adopted on March 13, 2017 and is due for renewal by May 1, 2018. The town coordinates with the Central Vermont Regional Planning Commission who provides technical support and guidance with the LEOP plan update. The town requires the certifying officer to be trained in ICS 402 or ICS 100 at a minimum. It is the policy of the town to have a minimum of one Selectboard member trained in ICS (Incident Command System). Eric Holmgren, Selectboard Chair and Dustin Comstock, former Selectboard Chair and EMD received their ICS certification in April of 2016. The Board of Selectmen appoint an Emergency Management Director (EMD). Dustin Comstock was appointed to the position in 2014 and continues to serve in this capacity. In conjunction with the LEOP, on April 14, 2014, the town adopted the use of the National Incident Management System (NIMS) as the standard for management and systematic approach involving all threats and hazards, regardless of cause, size, location, or complexity, in order to reduce loss of life, property, and harm to the environment.

Orange is eligible under the Vermont Emergency Relief and Assistance Fund (ERAF) to receive state funding to match Federal Public Assistance funds after a federally declared disaster. Communities that take specific steps to reduce flood damage can increase the percentage of state funding they receive from 7.5% up to a maximum of 17.5%. At the time of this Plan development, Orange has an ERAF rating of 17.5%. Orange has taken the specific steps to reduce flood damage by 1) participating in the National Flood Insurance Program, 2) adopting standards that meet or exceed the current Vermont Roads and Bridge Standards 2013, 3) adopting a Local Emergency Operations Plan which is renewed and adopted annually, 4) adopting a Local Hazard Mitigation Plan approved by FEMA, and 5) adopting Interim River Corridor protection standards (River Corridor Plan criteria). Maintaining these measures ensures Orange the maximum state contribution rating.

Orange is one of numerous communities that has adopted regulations for a subset of their watercourses (buffer setbacks, Phase 2 data-generated FEH overlays, or avoidance-based Flood Hazard Areas) prior to the ERAF Amendments that took effect on October 2014. When Orange adopted their *Inundation Hazard Area Regulations* on July 14, 2014 they satisfied the river corridor plan requirement as well. Orange was given approval for Interim River Corridor standards. In order to retain eligibility under the River Corridor Plan criteria of the ERAF and qualify for the maximum 17.5% rate, Orange will need to update their interim river corridor standards to meet the Agency of Natural Resources (ANR) criteria within two years of ANR publishing a statewide river corridor map updated to include existing Phase 2 Stream Geomorphic Assessment (SGA) data. The data release, expected to occur at the end of 2016, has been delayed and the agency has not announced a new release date. The other option to qualify for the maximum ERAF rate is for Orange to enroll in the NFIP Community Rating System (CRS) and adopt a bylaw that prohibits new structures in the Flood Hazard Area. However, Orange has elected not to pursue enrollment in the CRS. The CVRPC is posed to assist the community in drafting a river corridor plan with the release of the Phase II data.

Information on ERAF Eligibility Criteria – 17.5% State Share can be found at:
http://floodready.vermont.gov/sites/floodready

4. Planning Process and Maintenance

4.1 Planning Process

PLANNING TEAM:

Lee Cattaneo, PC member (Chair 2017, term ends June 2018)
Ray Rossi, PC member (term ends June 2019)
Tom Peairs, PC member (Chair 2016, retired before end of term in 2017)
George Malek, PC member (filled remaining term of T. Peairs; June 2016 – April 2017)
John Barnes, Road Foreman
Kathie Felch, Town Clerk/Treasurer
Dustin Comstock, Emergency Management Director (EMD)
Eric Holmgren, Selectboard Chair
Laura Ranker, CVRPC Planner
Ashley Andrews, CVRPC GIS Planners

PUBLIC PROCESS:

Initial Participation

On December 10, 2015, the Central Vermont Regional Planning Commission (CVRPC) sent a letter to Orange Selectboard Chair, Ronald Tallman, announcing the opportunity for the RPC to provide assistance in updating their local hazard mitigation plan with funding provided by the Hazard Mitigation Grant Program. The letter noted the current plan expiration date of 10/25/2017. Copies of the letter were also sent by email to Dustin Comstock, Emergency Management Director, and George Malek, local representative on the CVRPC Board and Executive Director of the Central Vermont Chamber of Commerce.

First Planning Team Meeting

Town Clerk, Kathy Felch and CVRPC Planner, Laura Ranker coordinated a meeting with the Planning Commission which took place on 2/5/2016. This February meeting initiated the plan update process. Those present were Planning Commission members Ray Rossi, Tom Peairs, and Lee Cattaneo, Town Clerk Kathy Felch, Road Foreman John Barnes, Emergency Management Director Dustin Comstock, and CVRPC Planner Laura Ranker. The purpose of this meeting was to initiate the planning process, identify a planning team, and review the steps for updating the local hazard mitigation plan. Planning team members also expressed concerns about dam safety during this meeting.

CVRPC staff Laura Ranker contacted Lauren Oates, Hazard Mitigation Officer of the Vermont Department of Public Safety (DPS), Division of Emergency Management and Homeland Security (DEMHS) on 3/2/2016 to inquire on dam safety resources and mitigation actions used by other municipalities to address dam safety concerns expressed by the planning team. A conference call was scheduled and took place on 3/10/2016 with L. Oates, L. Ranker and Josh Cox, Critical Infrastructure Planner at DEMHS. J. Cox discussed dam safety measures in Vermont and the Emergency Action Plans (EAP) required by dam owners. Some mitigation strategies and preventative measures were discussed as well. On 4/19/16, J. Cox sent the EAPs for the Thurman W. Dix Dam and the East Barre Dam to L. Ranker; inundation maps were not available. These were then forwarded to K. Felch, Town Clerk and T. Peairs, Planning Commission Chair. Subsequently, Steven Hanna, Dam Safety Engineer with DEC, provided the inundation maps for both dams.

Further Planning Team review

On March 25, 2016, after review of the 2012 Orange Hazard Mitigation Plan and the 2013 Municipal Plan, CVRPC staff L. Ranker prepared and sent a detailed summary document of the required and recommended updates for incorporation in the new Plan along with the FEMA Local Mitigation Plan Review Guide to Chair T. Peairs. T. Peairs forwarded these materials to the other members of the Planning Commission (L. Cattaneo and R. Rossi) for their review and work on the plan updates. Members of the Planning Commission spent the next several months independently reviewing the 2012 Plan and recommended updates along with the FEMA guide (PC members were out of state/town with other commitments during this time that prevented them from meeting as a group).

Transportation Vulnerability Assessment

In May of 2016, CVRPC GIS staff Ashley Andrews and staff Laura Ranker met with the Town Clerk, Kathy Felch, Road Foreman John Barnes and Emergency Management Director Dustin Comstock to review the GIS generated Vulnerable Assessment Transportation Map prior to CVRPC field verifying the data. Critical infrastructure and hazardous sites were reviewed and priority areas identified. Data included identification of adequate and undersized culverts and bridges; road modifications for areas with low spots or high spots; identification of areas with steep slopes; and road alterations required to improve drainage such as ditches, swales, cross bars. On May 19 and May 20, 2016 CVRPC staff A. Andrews and L. Ranker drove all the roads in Orange to field verify the vulnerable assessment data. Photos and notations were made and

A. Andrews updated the maps for delivery to the Town of Orange planning team with the accompanying photos and list of priority sites. Subsequent conversations with Road Forman John Barnes also took place. This vulnerability assessment information was considered in updating this Plan.

Planning Team Meetings reconvene

On February 9, 2017 the Planning Commission reconvened a meeting with CVRPC staff L. Ranker. The Planning Commission had experienced turn over and newly appointed Planning Commission member George Malek, serving the remaining term of T. Peairs, joined the other two members. George recently retired as Executive Director of the Central Vermont Chamber of Commerce, a position he held for over 25 years. Also present was Selectboard Chair Eric Holmgren. The group did a brief recap from the last meeting. The focus of this meeting was to identify the hazards, assess the risk and prioritize them. In addition, the group reviewed the 2012 mitigation action table. The table was updated to reflect the current status of the actions listed. The group also identified actions taken since 2012 not on the list that will be included in this Plan update. New strategies and projects were brainstormed. George Malek volunteered to compile a draft list of new mitigation actions and consult with various parties in town such as the Road Foreman, School, and Selectboard. On April 11, 2017 George died unexpectedly. E. Holmgren was appointed by the Selectboard to fill his term.

The CVRPC staff worked on preparing a first draft for the Planning Commission review. The Planning Commission resumed meeting on June 14, 2017 with CVRPC staff to go over the first draft of the 2017 Orange LHMP. A timeline and schedule for distribution of the draft was set.

Planning Team findings

The planning team meetings indicated that the Town remains most vulnerable to flood/flashflood/fluvial erosion. Orange feels flooding is still a significant hazard and continues to focus mitigation activities on flood events as these events are the most common and severe. Dam failure is still a high concern, particularly because the town does not own the dams and has no control over them. However, this hazard has been moved to a moderate threat with the knowledge of current EAPs in place for both dams and the State determination of imminent failure to be unlikely as noted in the 2013 State of Vermont Hazard Mitigation Plan. Severe Weather has replaced the "Hurricane/Tropical Storm/Severe Storm" hazard category. Severe Weather has been defined to include Thunderstorms, Lightening, High Winds, and Hail with two or more of the hazards occurring; usually over a prolonged period. Severe weather is more frequent and intense and is more prevalent than hurricanes and tropical storms. Severe weather is a high threat hazard for Orange and results in a majority of the flooding that occurs. Hurricanes and tropical storms are still an occurrence however not as frequent and the town has separated them from severe weather and ranked them as a moderate threat hazard. Extreme cold, winter storms and ice storms, structure fires and forest fires remain moderate threat hazards. Continued investments and maintenance in the town's machinery, equipment, and infrastructure and updated ordinances and regulations have positioned the town to better address these threat hazards. Continued investments by the Green Mountain Power Company and Washington Electric Coop, Inc. for ongoing line clearing maintenance, upgrades to the grid, and a varied mix of power sources reduce the impact from power outages. The town is still

predominantly rural and heavily forested and the potential for structural fires and forest fires remain a moderate threat hazard. The town is more vulnerable to impacts from fire because it relies on outside fire service from neighboring communities on an as needed basis, so response time can be hindered.

Public Outreach

The draft Orange Hazard Mitigation Plan was distributed electronically to the area municipalities on July 10, 2017. These towns included Barre Town (Carl Rogers, Town Manager), Barre City (Steve McKenzie, City Manager), Washington (Harry Rousch, EMD), Plainfield (Linda Wells, Town Clerk), Groton (Linda Nunn, Town Clerk), Topsham (Cynthia Flannigan, Town clerk) and Corinth (Nancy Ertle, Town Clerk). An electronic copy was sent to Rob Evans, VT Floodplain Manager at DEC, Josh Cox, DEMHS Critical Infrastructure Planner, Eric Blatt, DEC dam safety program, and LEPC 5 Chair Katina Johnson. The draft Plan was posted on the Orange Town website and CVRPC website with hard copies made available at the Municipal Office Building. A notice was posted in Front Porch Forum, CVRPC newsletter, Washington World, and at the Orange Center School. The public was directed to send comments to Town Clerk Kathy Felch at Email: kfelch@orangevt.org or drop them off in the suggestion box located in the Town Offices during regular business hours. Comments were asked to be received by July 24, 2017. The Planning Commission considered all comments received and incorporated them as deemed appropriate and in keeping with the purpose and goals of the LHMP. Concurrently, a draft plan was submitted to DEMHS on June 30, 2017 which started the review process with DEMHS and FEMA. Throughout the draft plan process, the Planning Commission considered any and all comments and notified DEMHS of any plan changes resulting from incorporation of public participation.

Ongoing public participation in the plan maintenance process will continue by providing opportunities for feedback at Selectboard meetings, Planning Commission meetings, and informational meetings particularly directed after hazard events. A suggestion drop box at the town clerk's office will be maintained.

Governmental participation and involvement

The Planning Team worked closely with Stephanie Smith, VT Hazard Mitigation Planner with DEMHS and FEMA Planners during the Plan update review process prior to final adoption by the Orange Selectboard.

The Orange Selectboard stayed informed and participated in the Plan update process by designating a representative to serve on the planning team. Chair Eric Holmgren served this role.

Prior to formal adoption, a Public Meeting was warned by the Orange Selectboard on _____(TBD), to get public comment on the final plan. Upon FEMA written notice of FEMA "Approval Pending Adoption," the Orange Selectboard approved and adopted the 2017 Town of Orange Hazard Mitigation Plan by resolution at a regular warned meeting of the Orange Selectboard. A copy of the resolution is in this Plan as an attachment.

During the update and adoption process of the 2013 Municipal Plan that expires in 2018, the Planning Commission will incorporate and address the hazard mitigation goals and objectives of this Plan into the updated 2018 Municipal Plan. Vermont statute enables this incorporation to satisfy state municipal planning requirements for towns to develop a flood resilience element in municipal plans.

4.2 Plan Update Process

Background

The Orange Town Local Hazard Mitigation Plan was originally adopted by the Town as an Annex to the Central Vermont Regional Pre Disaster Mitigation Plan in November 2007 and received FEMA final approval in September of 2008. During 2011 and 2012 the Town updated the plan creating a single jurisdiction local mitigation plan which received FEMA approval on October 25, 2012. This Plan is an update of the 2012 Town of Orange Hazard Mitigation Plan and will guide the town into the next five years and maintain the town's eligibility as an applicant for mitigation grants.

Review of existing plans, studies, reports, and technical information

Preparation for the Planning meetings included a review of the following documents and resources as noted below as well as conversations with CVRPC GIS Planner, CVRPC Transportation Planner, Town Clerk Kathie Felch, Road Foreman John Barnes, DEMHS Critical Infrastructure and Hazard Mitigation staff, and DEC Dam Safety Program staff.

- Orange Local Hazard Mitigation Plan Update December 2011; FEMA approved 10/25/2012.
- Orange Town Plan adopted May 13, 2013.
- Town of Orange Inundation Hazard Area Regulations, July 14, 2014.
- Orange Town Highway Consolidated Ordinance, April 4, 2014.
- 2012 Final FEMA Review Tool-Town of Orange.
- State of Vermont Hazard Mitigation Plan, November 2013.
- East Barre Dam and Reservoir Dam-Break Flood Analysis Interim Inundation Mapping, February 2004, prepared by DuBois & King, Inc.
- Emergency Action Plan, East Barre Dam, Barre, VT Sate ID #14.02, August 31. 2012, prepared by DuBois & King, Inc.
- Emergency Action Plan Thurman W. Dix Dam, State of Vermont Dam # 147.01. January 28, 2009, prepared by DuBois & King, Inc.
- Federal Emergency Management Agency, Repetitive Losses/BCX Claims, Vermont; and Non-mitigated repetitive loss properties data.
- FEMA Disaster Declarations in Vermont.
- National Weather Service.
- National Oceanic and Atmospheric Administration (NOAA), National Centers For Environmental Information and historical weather data.
- 2017 Town of Orange Local Emergency Operations Plan.
- Town of Orange 2016 Hazard Analysis Map
- 2016 Town of Orange Transportation Vulnerability Assessment and Map.
- Flood Ready VT.
- FEMA Local Mitigation Planning Handbook, March 2013
- FEMA Local Mitigation Plan Review Guide, October 1, 2011.
- NFIP FEMA FIRMS Town of Orange, September 1985.
- Town of Orange Annual Town Reports, years covering 2014 – 2017.

- Vermont Housing DATA.
- American Community Survey Demographic and Housing Estimates, 2011-2015 American Community Survey 5-Year Estimates.
- Orange Town Forest Management Plan 1999.
- 2010 Vermont Forest Resource Plan, Dept. Forest, Parks, and Recreation, Division of Forestry

In the process of updating the local hazard mitigation plan, the following is a list of revisions to the 2012 Plan. There is no identification of new hazards. Hazards are clarified and reprioritized based on current town conditions and vulnerability.

General Updates:

- Update to Community Profile
- Reevaluation, identification and analysis of all significant hazards
- Update to Planning Process and Maintenance.
- New Hazard Risk Assessment that expands on the community's vulnerability ranking and is similar to what is used by the Vermont Division of Emergency Management and Homeland Security. See appendix for methodology.
- Incorporation of new data and information throughout the Plan since last update in 2011/2012 including town regulations, ordinances, and hazard data (events, declarations, non-declared disasters).
- Acknowledgment of implemented mitigation strategies since 2012 and update status of 2012 proposed actions/strategies.
- Identification of on-going, new and proposed mitigation projects and strategies for the next 5 years.
- Update Existing Hazard Programs, Projects, and Activities.
- Use of a mitigation action evaluation table. See Plan attachments for table template.
- Recommended use of Mitigation Tracking Tool. See Plan attachments for tracking template.

Hazard Analysis Updates

- Updated location/vulnerability/extent/impact/likelihood table for each hazard to summarize hazard description.
- Review of Vermont Hazard Mitigation Plan November 2013.
- Review of Federally declared disasters, weather data, ANR resources, VT Flood Ready site, Dam Emergency Action Plans (EAPs), and NOAA site.

Maps

- Updated Hazard Analysis Map 2016 with tier II sites, current E911 locations, structures in Special Flood Hazard Areas, river corridors, and label public forests by owner.
- Include Transportation Vulnerability Assessment Map 2016 (new map)
- Include Dam inundation areas map for Thurman W. Dix Dam taken from EAP prepared by DuBois & King, Inc. 1/28/2009.

The following chart provides an overview of Orange's proposed 2011/2012 local hazard mitigation actions along with their current status. The Planning Team reviewed these actions and reported on the status of each:

STATUS OF MITIGATION ACTIONS TO DATE

Proposed 2011/2012 Mitigation Action	2017 Status
Purchase Generator for the Orange Center School (Install 100 kw generator and transfer switch)	This action has been carried forward since 2007. In 2014 Town applied for a HMGP Generator Grant. In 2015 Selectboard entered into discussions with the Orange Center School (a designated town shelter location). In 2016 the town was awarded federal monies to install a generator at the school for Emergency Evacuation addressing the long standing needs of the town shelter. Work to install the generator occurred in June/July 2017.
Upgrade and Expand George Street Bridge	Project is completed. Funds from the Municipal Transportation Funding, Town Bridge Grants program, 2014.
Upgrade and expand Manning Road culvert	Project was slated for 2015 but got pushed back and was completed in 2016.
Upgrade and expand Prechtl Road culvert	Prechtl Road culvert has been replaced as part of the town ongoing culvert replacement program. Completed in 2014.
Work with Barre City ~~Town~~ to clean dam channel/reservoir around Nelson Brook inlet	This work was completed in 2015 and is now a regular ongoing maintenance item for the two communities.
Work with elected officials, the State, and FEMA to correct existing compliance issues and prevent any future NFIP compliance issues through continuous communications, training and education	Orange is in compliance with NFIP. The Orange Town Planning Commission prepared *Town of Orange Inundation Hazard Area Regulations* as an update to the town Flood Plain Bylaws to be in compliance with State and Federal regulations and to put the town in the position of receiving maximum federal matching dollars when applicable. PC approved the regulations on 5/21/2014, conveyed them to the SB on 6/9/2014, and the SB held a Public Hearing on 6/14/2014 and adopted them following the hearing on 6/14/2014. The town continues to take advantage of training opportunities as they arise. Selectboard appointed Kathie Felch as the Floodplain Administrator.

STATUS OF MITIGATION ACTIONS TO DATE	
Proposed 2011/2012 Mitigation Action	2017 Status
Obtain Red Cross shelter certification for Orange Center School	Completed - Orange Center School is an American Red Cross Shelter, shelter no. 51755.
Upgrade all town radios and town truck radios to narrowband	The town has completed this work and new radios have been installed.
2007 action (still relevant): Cut back and maintain trees along power lines and road along Reservoir Road	Ongoing maintenance program by Town and utility power companies.
2007 action (still relevant): Implement strategies to reduce the risk of beaver dam failures	Trappers are hired annually; ongoing. Now part of town's regular road maintenance program.

The 2017 Orange Local Hazard Mitigation Plan reflects changes from the 2012 plan related to the town's vulnerabilities to hazards and how Orange addresses them based on changes in priorities and the effects of the implementation of past mitigation actions and strategies. The implementation of several mitigation actions over the past five years, some not listed because the town considers them to be regular maintenance and program implementation measures, have reduced the town's vulnerability to specific hazards. Orange has benefitted from the collaborative approach to achieving mitigation on the local level, by partnering with Agency of Natural Resources (ANR), Vermont Agency of Transportation VTrans, Agency of Commerce and Community Development (ACCD), Division of Emergency Management and Homeland Security (DEMHS) to be renamed Vermont Emergency Management effective July 1, 2017, Central Vermont Regional Planning Commission (CVRPC), Federal Emergency Management Administration (FEMA) Region 1 and other agencies, all working together to provide assistance and resources to pursuing mitigation projects and planning initiatives in Orange.

Town Capabilities for Implementing Mitigation Strategy

Services provided by the Orange municipality are overseen by a three member volunteer Selectboard. The three member volunteer Planning Commission is charged with developing the Municipal (Town) Plan, as well as any community land use regulations and plans such as the local Orange Hazard Mitigation Plan and the Inundation Hazard Area Regulations. Orange relies on the Orange County Forester and private consultants for advice and guidance on the Orange Town Forest and the management of it.

The Town employs a handful of staff members to carry out services to its residents on a daily basis. The following are the paid positions which are involved in hazard mitigation:

- Town Clerk/Treasurer (Full Time) – Kathie Felch
- Floodplain Administrator – Kathie Felch
- Road Foreman & 1-Person Crew (Full Time) _ John Barnes, Road Foreman and Mark Little, Sr. road crew

Volunteer municipal officials also play a crucial role in carrying out hazard mitigation. Dustin Comstock is the volunteer Emergency Management Director. Fred Byrd is the local Forest Fire Warden. The Selectboard oversees all municipal & mitigation activities and the Planning Commission ensures long term community planning, including hazards.

The municipal budgeting process occurs on an annual basis, planning for a fiscal year from January to December. The budget is usually developed between early November and early January, and put to voter approval on the first Tuesday in March at Annual Town Meeting Day. The Selectboard is charged with developing and proposing the budget to the voters, including the budget for the Highway Equipment Savings Account. After the budget has been adopted by vote of town residents, the Selectboard has the authority to modify it in cases of extraordinary circumstances; i.e. natural disaster, unexpected equipment/infrastructure failure (i.e., water well, power failure, major bridge/culvert failure). The budget is monitored several times a month by the Selectboard and Town Clerk.

Municipal revenues are generated primarily through levy of taxes on property value. Other major sources are federal & state payments to support the town school, aid (including grants) from the Vermont Agency of Transportation for highways, and payments in lieu of taxes for land owned by the State of Vermont. The municipality also has the authority to incur debt through bonding.

Other Existing Hazard Mitigation Programs, Projects & Activities:
The Town of Orange is currently engaged in the following hazard mitigation programs, projects, and activities that are listed by mitigation strategy. They share and incorporate the overall goals of the local hazard mitigation plan. Orange has the capacity to maintain these programs and initiatives using the staff and volunteers described in the Community Capacities.

<u>Community Preparedness Activities</u>

- Annual update and adoption of Local Emergency Operations Plan – work on plan by town clerk, EMD, and SB. No need to expand on program.
  - last updated and adopted on 3/13/2017 and accepted by DEMHS on 3/27/2017
- School Safety Evacuation Plan – worked on by School District and Principal annually reviewed and practiced. School District has access to VT School Safety Crisis Planning Team. School may utilize educational resources provided by DEMHS for school age children to address emergency preparedness and update school programs of 2008 and 2009 that are no longer in use at the Orange Central School.
- Mutual Aid agreement with surrounding communities. Selectboard reviews agreements annually. No need to expand on program. Town would benefit from having the mutual aid departments report annually on the number and nature of response calls performed on behalf of Orange.
  - Barre Town Fire Department, Washington Fire Department, and Tri Village Fire Department

- Equipment Replacement Plan – Ongoing. Selectboard approval with input from Road Foreman. Town has an established Highway Equipment Savings Account that is part of the Town's budget voted at Town Meeting Day. No need to expand program.
- American Red Cross (ARC) Shelter at Orange Center School – ARC will manage shelter if request to activate is provided by duly authorized town official to ARC VT/NH office. Town is in the position to man the shelter for first 72 hours if necessary. The shelter and shelter contact information is incorporated into the Town of Orange LEOP. No need to expand program.
- The Orange Town Emergency Management Director is a voting representative on the Local Emergency Planning Committee #5 which meets bi monthly. The EMD has access to trainings promoted by the CVRPC and DEMHS to assist and support him in his position as EMD.
- Appointment of a Town Forest Warden to serve a five year term. The town forest warden is Fred Byrd. No need to expand program.

Insurance Programs

- Participation in National Flood Insurance Program (NFIP) since 1985. Town has a designated Flood Administrator and up to date regulations. No need to expand program.
- Most current FEMA FIRM maps dated September 1985; Community Panel #500239B, sheets 1-11 and digitized in 2013. FIRMS are in need of updating but town does not have the capacity to do this. Federal government action is required.
- Adopted new regulations in 2014, *Town of Orange Inundation Hazard Area Regulations.* New regulations are NFIP compliant. No need to expand program.

Land Use Planning/Management

- Orange Town Plan, adopted May 13, 2013 and expires in 2018. Planning Commission began update process in May 2017 with support of the CVRPC. Action is ongoing.
- Maintain copies of Emergency Action Plans and Inundation Area maps for the East Barre Dam and the Thurman W. Dix Dam at Town Offices with the Hazard Mitigation Plan. Town Clerk will maintain plans. Participation in annual EAP review is recommended. This action is at the discretion of the Selectboard.
- Update and adopt Orange Hazard Mitigation Plan in 2017 prior to the expiration of the 2012 Plan. This action is in process and there is no need to expand the program. Town Planning Commission and Selectboard are key responsible parties.
- Orange Town Forest Management Plan 1999. Town has maintained the forest with timber harvesting by qualified forestry consultants. Orange Town Forest Management Plan is in need of updating. Town Clerk and Selectboard are key responsible parties.

Hazard Control and Protection of Critical Infrastructure and Facilities

- Maintenance of 6 Dry Hydrants throughout rural areas in town is ongoing. Selectboard is responsible party with input from the EMD. Town may want to expand program in the future if funding is available. Town desires to capture GIS coordinates on each hydrant location for permanent data base and reproduction on town maps.
- Purchase and installation of Generator at Orange Center School 2016/2017. Selectboard, School Board with ARC coordinated effort. No need to expand program. Project will be completed in summer of 2017.
- 5 – 10 Year Road Plan - Selectboard is working with CVRPC Transportation Planner under the 2016 Municipal Road General Permit and Better Back Roads grant (category A grant) to develop an Orange Town Road Plan. Road Foreman will provide input and assistance throughout the process. Summer of 2017 - connected roads inventory and road surface management inventory will be performed under the direction of CVRPC with assistance from the town to help develop the road plan. Program is ongoing.
- Orange Town Highway Consolidated Ordinance adopted 4/4/2014 with State of Vermont minimum road standards. Selectboard approves all road work with input from Road Foreman who implements projects with town road crew.
    - Selectboard annually reviews inventories of all roads, bridges, ditches, culverts, which specifies the width and length of roads, condition of all culverts and ditches for the purpose of continuing to improve the roads and develop a road plan. Selectboard is expanding this program with the support of CVRPC and the Vermont Agency of Transportation.
    - Selectboard will continue to apply for Bridge Grants each year. The Manning Road culvert/bridge project was completed in 2016.
    - Selectboard will continue to participate in the culvert replacement program and culvert inventory program. Culvert inventory was last done in 2009 and is schedule to occur in 2017/2018.
    - In 2014, 2015, and 2016, sections of the Reservoir Road continued to be constructed and paved using state grant monies. This road has been subject to damage by flooding.
    - In 2016 Selectboard fixed road surfaces over culverts on Reservoir Road and Tucker Road.
    - In 2016, stone lined ditches were placed on various trouble spots around the town to help mitigate storm water runoff.
    - In 2014, the Selectboard entered into an Agreement with Barre Town for road maintenance to improve truck routes and efficiency for both towns with respect to the Partridge Road in Orange and the Ladd Road in Barre Town.

- In 2014, the Selectboard identified the following road needs as actions to continue to pursue: (as taken from the Selectmen's Report in the Town of Orange Annual Report of the Town Officials 2014)
    - A State of Vermont paving grant to resurface the section of Tucker Road at the intersection of VT Route 110. *This project received a state grant for funding and work is scheduled to begin in the summer of 2017 and be completed in the fall of 2017.*
    - Resurface and re-ditch Provencher Road and work with VT AOT to solve the problem of chronic flooding at the bottom of the road across state-owned land. *This work is waiting for receipt of state funding and has not begun.*
    - Work with the City of Barre to purchase a small piece of land near the intersection of Lord Road and Reservoir Road to straighten out the curve there, deemed a High Risk Rural Road area. *This project has been presented to the TAC (Transportation Advisory Committee of the CVRPC) for placement on the AOT High Risk Rural Road Program but has not been competitive enough and does not meet eligibility criteria. Cost estimates of 50 – 60 thousand dollars makes this project prohibitive for the Town of Orange to undertake.*

- Plan for and Purchase Equipment:
    - Selectboard has been budgeting for the purchase of a loader over the last couple of years to replace the 21 year old loader and in 2016 bought a new John Deere 544 Loader. Funds in the town's Equipment Savings Account were used to help pay for the purchase.
    - In 2015, the Selectboard purchased culvert thawing equipment which allows them to do the work without having to hire Barre Town. This has been a valuable and time saving piece of equipment to address the impacts from severe and extreme cold winter weather.
- 2016 Town purchased a hydro seeder for the road crew. Use of this equipment will assist in preventing soil erosion along road sides and in road side ditches.
- Trappers are hired annually to implement strategies to reduce the risk of beaver dam failures. This is an ongoing action that does not need to be expanded. This is now part of the town's regular routine maintenance.
- The Town road crew and power companies cut back and maintain trees along the power lines and the road along the Reservoir Road. This is an ongoing program and there is no need to expand it. This is now part of the town's regular routine maintenance and the power utilities line clearing program.

Public Awareness, Training & Education

- Selectboard members maintain ICS 402 or ICS 100 training and certification as needed. Last taken in 2016. As new Selectboard members are appointed they will need to become certified in ICS 402 and or ICS 100.
- Town maintains information on the town website with regard to open burning and provides the contact information for the Town Forest Fire Warden. The websites states the need to obtain a burning permit and details how to go about it.

4.3 Plan Maintenance Process

The Orange Local Hazard Mitigation Plan will be updated and evaluated annually at a regular Select Board meeting during the months of March through May, at the convenience of the Selectboard. The Local Emergency Operations Plan is reviewed and updated annually during this same time period. Updates and evaluation by the Selectboard will also occur within three months after every federal disaster declaration and as updates to town land use regulations, ordinances and plans come into effect. The plan will be reviewed by the Selectboard, Planning Commission, Town Clerk, and public at the abovementioned Selectboard meetings as warned by the Selectboard. CVRPC will help with updates or if no funding is available, the Town Clerk, Planning Commission, and Select Board will update the plan.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, notice in the municipal building, Orange Central School, Washington World newspaper and CVRPC newsletter inviting the public to the scheduled Selectboard (or specially scheduled) meeting. Additional stakeholders invited to the meeting will be the Orange Center School, local power companies, dam owners and operators, and the Vermont State Central Region, Regional Floodplain Manager, as they are able to provide assistance with NFIP outreach activities, models for stricter floodplain zoning regulations, delineation of fluvial erosion hazard areas, and other applicable initiatives. These efforts will be coordinated by the Town Clerk and Selectboard.

Monitoring of plan progress, implementation, and the 5 year update process will be undertaken by the Town Clerk and Selectboard. Monitoring updates may include changes in community mitigation strategies; new town bylaws, land use and planning strategies; progress of implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities. If new actions are identified in the five year interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings. After a five-year period, the plan will be submitted for re-adoption following the process outlined in the schematic found in the Attachments section of this Plan. The town may use the mitigation action tracking sheet (see attachment section of Plan) or similar method to assist with progress reporting on the mitigation actions and strategies taken over the next five years.

In order to maintain a current up to date unexpired Plan, within one year of this Plan expiration date, the plan update process with FEMA should begin. For the next Plan update, CVRPC will assist and support the Town of Orange at their request provided there is funding and staffing

available for CVRPC to do so. If CVRPC is unable to assist the Town of Orange, then the Town will update the plan using the Planning Commission as the lead or the Selectboard will update the plan or the Selectboard may appoint a committee of interested citizens and key stakeholders with the Emergency Management Director and Planning Commission Chair serving on this committee to draft changes. The Town of Orange is responsible for the update and maintenance of this Plan.

Orange will incorporate the goals and objectives of the hazard mitigation plan into their long term land use and development planning documents and the Municipal Plan. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, road plan, and inundation hazard and river corridor regulations. The Town may consider reviewing any future CVRPC planning documents and studies for ideas on future mitigation projects and hazard areas.

In 2013, the Vermont Legislature passed a law requiring all towns to incorporate a flood resiliency element into their Municipal Plan as of July 2014. As part of meeting this requirement, Orange will identify flood hazard and fluvial erosion hazards, strategies, and recommendations to mitigate risks to public safety, critical infrastructure, historic structures, and public investments. This Plan will help Orange comply with the new community flood resilience requirements for Municipal Plans adopted after July 2014 and will assist the Planning Commission in their work as they update the existing and due to expire Orange Municipal Plan.

5. Risk Assessment

5.1 Hazard Identification and Analysis

The planning team performed an evaluation of the known hazards to the area and the risks the hazards pose looking at three main questions, 1) what damage can happen given the Town's vulnerabilities, 2) how likely are they to occur, and 3) how damaging can they be. Using a table to show this process, the town was able to then prioritize actions designed to mitigate the effects of each of the disaster types. The Town looked at past occurrences at the town, county and state level for guidance. Although the Town cannot predict the future, recent changes in the climate have made old weather patterns less predictable and Vermont has seen an increase in the number and severity of storms, especially high intensity rainfall events. In response to the changes in the weather patterns, Orange has added severe weather as a top priority.

The following table reflects the hazards Orange feels can be expected, or at least are possible, to occur in Orange. In this 2017 Plan, the Town expanded on the risk analysis by considering factors such as frequency of occurrence, warning time, and potential community impact modeling the methodology used in the 2013 Vermont Statewide Hazard Mitigation Plan. The hazards were ranked based on these factors to determine which hazards posed the greatest risk to Orange and found to be the most significant. The top or worst threats are highlighted and bolded in the table. Further discussion, associated mitigation actions and follow-up is provided in this Plan.

The process used to rank the hazards and score them is found in the Attachments of this Plan. The process is very similar to the one the State of Vermont used in their 2013 statewide hazard mitigation plan. Unlike the state process, the geographic extent focused on Orange, a small rural town and not the entire State of Vermont and therefore did not use the state-wide or region wide extent. Those hazards not found to pose the greatest threat to Orange such as drought, avalanches, earthquakes, tornadoes, water supply contamination, ice jams, extreme heat, landslides/mudslide/rockslides, invasive species, hazard material spills, and nuclear power plant failure are not addressed in this Plan due to low probability of impact and scarce community resources (time and money). A review of the Vermont State Hazard Mitigation Plan of November 2013 provides a greater explanation of these hazards and possible mitigation strategies to address them. Like the State of Vermont Hazard Mitigation Plan, Orange did not include the following hazards in the risk and vulnerability assessment due to the low occurrence, low vulnerability, and or geographic proximity: civil disturbance, coastal erosion, expansive soils, karst topography, sinkholes, tsunami, and volcano.

HAZARD ASSESSMENT

Hazard	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score
Avalanche (Due to topography of Orange, avalanches are not likely to form in Town)	Unlikely (1)	None-Minimal (4)	Negligible (1)	6
Landslide/ Mudslides/ Rockslides	Occasionally (2)	None-Minimal (4)	Negligible (1)	7
Dam Failure East Barre Dam	Unlikely (1)	6-12 hours (2)	Major (4)	7
Dam Failure Thurman W. Dix Dam	Occasionally (2)	6-12 hours (2)	Major (4)	8
Drought (while a drought may occur occasionally, the planning team decided to remove this hazard from further analysis due to the relatively large volume of precipitation the Town receives each year)	Unlikely (1)	12 + hours (1)	Minor (2)	4
Earthquake (while an earthquake may occur occasionally, the planning team decided to remove this hazard from further analysis due to the very low magnitude earthquakes that have occurred in the Town in the past)	Occasionally (2)	None-Minimal (4)	Negligible (1)	7
Severe Weather (Thunderstorms, Lightening, High Winds, Hail) (we have defined "severe weather" to include two or more of the above listed hazards)	Highly Likely (4)	6-12 hours (2)	Moderate (3)	9
Flash Flood/ Flood/ Fluvial Erosion	Highly Likely (4)	6-12 hours (2)	Moderate - Major (3.5)	9.5
Ice Jam	Unlikely (1)	3-6 hours (3)	Minor (2)	6
Hurricanes/ Tropical Storms	Likely (3)	12+ hours (1)	Moderate (3)	7
Tornado (Due to the topography of Orange, tornados are not likely to form in Town)	Unlikely (1)	None-Minimal (4)	Minor - Moderate (2.5)	7.5
Structure Fire	Likely (3)	None-Minimal (4)	Negligible (1)	8
Water Supply Contamination	Unlikely (1)	6-12 hours (2)	Negligible (1)	4
Wildfire/Forest Fire	Likely (3)	None-Minimal (4)	Negligible - Minor (1.5)	8.5

Hazard	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score
Hazardous Material Spill	Unlikely (1)	6-12 hours (2)	Negligible (1)	4
Invasive Species / Infestation	Occasionally (2)	12+ hours (1)	Negligible - Minor (1.5)	4.5
Extreme Heat (While extreme heat does occur occasionally, the planning team discussed past occurrences of extreme heat and determined that a reprieve from the heat often comes before serious issues result, therefore decided to remove it from further analysis)	Occasionally (2)	12+ hours (1)	Negligible (1)	4
Tsunami (Vermont is landlocked)	N/A	N/A	N/A	N/A
Volcano (Vermont has no active volcanoes)	N/A	N/A	N/A	N/A
Extreme Cold/Winter Storm/Ice Storm	Highly Likely (4)	12+ hours (1)	Moderate (3)	8
Nuclear Power Plant Failure (Vermont Yankee Nuclear Power Plant was permanently shut down in 12/29/2014 and the fuel was removed from the reactor on 1/12/2015. Current negotiations on the decommissioning are taking place with a possible date of 2018; earlier than the previous 2020 date set.	N/A	N/A	N/A	N/A

Just because the town has not identified a hazard as a top priority or significant threat, does not mean the hazard will not occur in the future, they are just not the focus of this Plan.

Orange has identified the following hazards to be most significant in the Town:

- Flash Flood/Flood/Fluvial Erosion
- Severe Weather (Thunderstorms, Lightening, High Winds, Hail)

Moderate threat hazards include:

- Extreme Cold/Winter Storm/Ice Storm
- Structure Fire
- Wildfire/Forest Fire
- Dam Failure
- Hurricane/Tropical Storm

A discussion of each significant hazard is included in the proceeding subsections. An updated Hazard Analysis Map is included in the attachments to this Plan. Each subsection includes a list of past occurrences based upon County-wide and State-wide FEMA Disaster Declarations (DR-#), where applicable. Information was also gathered from local records, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Environmental Information (formally known as the National Climate Data Center, NCDC), reports from the National Weather Service in Burlington, Vermont, the Vermont Forest, Park and Recreation Department, and VT State Hazard Mitigation Plan. This section includes a narrative description of the hazard and a hazard matrix containing the following overview information:

Overview Information in Matrix

Hazard	Location	Vulnerablity	Extent	Observed Impact	Likelihood/Probability
Type of hazard	General areas in community that may be vulnerable to the hazard	Community Structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard event	Strength or magnitude and general details of the most notable event(s): Minimal, Moderate; or Severe*	Dollar value or percentage of damages	Likelihood of hazard occuring based on past events: Occasionally: 1-10% probability of occurrence pre year, or at least one chance in next 100 years. Likely: >10% but <100% probabiity per year, at least 1 chance in next 10 years. Highly Likely: 100% probable in a year.

5.2 Worst Threat Hazards

FLOOD/FLASH FLOOD/FLUVIAL EROSION

Flood/flash flood/fluvial erosion is Orange's most commonly recurring hazard. Flooding is the overflowing of rivers, streams, drains and lakes due to excessive rain, rapid snow melt or ice. Flash flooding is a rapidly occurring flood event usually from excessive rain. Fluvial erosion is the process of natural stream channel adjustments. Fluvial erosion causes erosion of sediment in some areas, while causing aggradation of sediment in others. Fluvial erosion processes occur more quickly and severely during flood events.

Flooding of land adjoining the normal course of a stream or river has been a natural occurrence since the beginning of time. If these floodplain areas were left in their natural state, floods would not cause significant damage. Development has increased the potential for flooding because rainfall that used to soak into the ground or take several days to reach a body of water now quickly runs off streets, parking lots and rooftops and through human-made channels and pipes.

Past instances of flooding in Orange have included rain and or snow melt events that cause flooding of the major floodplains along the main rivers in town and localized flash flooding from

intense rainstorms. Debris and ice build-up can contribute to the failure of infrastructure (culverts and bridges) during these events. The State of Vermont Hazard Mitigation plan states, "In recent years, flood intensity and severity appear to be increasing." The following chart indicates the history of occurrence with regard to this hazard in Orange. Data is both county-wide and state-wide. Due to the small population of the Town of Orange, specific data is difficult to obtain. Federal declared disaster numbers are noted where applicable. Data on the fluvial erosion damage in number of acres lost was not found for the events. Information to complete the history of occurrences was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, the FEMA Declared Disasters in Vermont data base, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Flood/Flash Flood/Fluvial Erosion History of Occurrences:

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
4/15/2014 – 4/18/2014 DR-4178 VT	Severe Storms and Flooding	State-wide County-wide Orange County	Heavy rains and melting snow pack created widespread flooding and release of 4-6 inches of water from snowpack causing many waterways to reach near bankfull conditions across Central Vermont. Damage to roads and bridges occurred.
6/25/2013 – 7/11/2013 DR-4140 VT	Severe Storms/Flash Flooding/and Flooding	State-wide County-wide Orange County	Severe storm caused flooding throughout Central Vermont with impact to roads and bridges. A few Green Mountain Power Customers reported no power. Federal share obligated to Town of Orange was $2,509.94.
8/26/2011 – 9/2/2011 DR-4022 VT	Tropical Storm *causing mass, severe flooding and flash flooding, and fluvial erosion.	State-wide County-wide Orange County	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet); Statewide rainfall of 3-5 inches with 5-7+ inches in Central Vermont. Orange received 3-4 inches of rain resulting in town-wide flooding. Major damage to George Street, Manning Road and Prechtl Road including replacement of all three culverts estimated @ over $200,000. Some damage to Eastman Road and Emery Road. Washington Electric Coop, Inc. and Green Mountain Power customers without power for prolonged period of time (days). Federal share obligated to Town of Orange was $7,125.58
5/25/2011 - 5/27/2011 DR 1995 VT DR 4001 VT	Flash Flood	Orange, County-Wide	Montpelier flood gauge at 17.59 feet, 3-5" of rain. Federal share obligated to Town of Orange was $40,307 with 12 projects.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
10/1/2010	significant flood event	Orange County	$52,000 property damage in Orange County per SHMP. No specific data for Town of Orange.
7/21/2010	significant flood event	Orange County	Very heavy localized rains; Super cell storms in area. $140,000 property damage in Orange County per SHMP. No specific data for Town of Orange.
1/25/2010 – 1/26/2010	significant flood event	Orange County	Rainfall through day and night created sharp rises in rivers and streams that crested and lifted ice. Flooding caused by ice jams on Waits River, also Winooski in Montpelier. There was $10,400 property damage in Orange County per SHMP. No specific data for Town of Orange.
8/21/2009	Flash Flood	Orange County	Thunderstorms produced torrential downpours in the area. Unofficial reports of 4 inches of rain within 2 hours were common. $371,428.57 in property damage for Orange County per SHMP. Chelsea, Washington, and Corinth hardest hit. Numerous roads, bridges and culverts washed out. No specific data for Town of Orange
7/21/2008 – 8/12/2008 (8/07/2008) DR 1790 VT	Flash Flood	County wide Orange County	Heavy rainfall, a slow moving storm and saturated soils set up conditions for flash flooding across the county. Route 302 flooded. No specific data for Town of Orange. $52,525.25 and $26,262.63 in property damage in Orange County per SHMP.
7/11/2007 DR 1715 VT	Flash Flood	County-wide Orange County, Town of Orange	3-6” of rain in 2 hours. Federal share obligated to the Town of Orange was $86,111.52 with 10 projects. Property damage in Orange County was over $821,052 (adjusted for inflation) per SHMP.
3/15/2007	significant flood event	Orange County	$54,736.84 in property damage in Orange County per SHMP. Warm temperatures and rainfall caused significant snow melt resulting in rising water levels and lifting of ice creating localized ice jams and flooding. Specific data for Town of Orange is not available.
1/18/2006 – 1/19/2006	significant flood event	Orange County	$2,260.87 in property damage in Orange County per SHMP. No specific data for Town of Orange. Warm temperatures created snowmelt with 1.5 – 2.5 inches of rainfall over area causing flooding.

Date and Disaster Declaration Number if applicable	Event (By FEMA classification)	Location	Extent and impacts
7/21/2003 – 8/18/2003 DR 1488 VT	Severe Storm and Flooding	Bennington County, Orange County, Windham County and Windsor County.	Flooding in 4 counties as a result of heavy rains in July. No specific data for Town of Orange
4/14/2002	significant flood event	County wide Orange County	1-3" of rain across the county plus snow melt. $50,120.48 in property damage in Orange County per SHMP.
12/17/2000	Flood	County Wide Orange County	3" of rain, $1 M in damages
9/16/1999 – 9/21/1999 DR 1307 VT	Tropical Storm Floyd *causing flooding and flash flooding, and fluvial erosion	County Wide, Town of Orange	Montpelier flood gauge at 9.30 feet, 5-7" rain county wide $27,766.54 federal share obligated to Town of Orange with 6 projects.
6/27/1998 Part of DR 1228 VT	Flash Flood	County Wide	$2M in damages, 4-8 inches rain fell across northern portion of county. Several homes and businesses without power and flooded; National Guard called in for relief efforts. Waits River and Ayres Brook experienced massive flooding.
01/08/1998 DR 1201 VT	Flooding/Flash flooding	County wide	Flood damage occurred throughout region. 3 – 5 inches rainfall during week. Waits River flooded
7/15/1997	Flash Flood	County wide	$500k in damages
1/19/1996 – 1/20/1996	Flood; ice jam	County wide	Montpelier flood gauge at 14.64 feet. Orange County reported 250K in damages. Roads washed out, power outages.
03/1992 DR 938 VT	Flooding	State wide County wide	Flooding occurred throughout the state including Orange County due to heavy rain and ice jams during the winter season. Data for Town of Orange is not available.
8/10/1976	Flood	County wide	Montpelier flood gauge at 12.31 feet
6/28/1973 – 6/30/1973 DR 397 VT	Flooding/ Flash Flood	State wide, County wide	Montpelier flood gauge at 17.55 feet. As much as 6 inches of rain within 24 hours in some areas. Damage estimated at 64 million (1973 dollars). Orange Town specific data not available.
9/22/1938	Flood, Hurricane	County wide	Montpelier flood gauge at 14.11 feet
11/02/1927- 11/04/1927 (Flood of 1927)	Flood	County wide	Montpelier flood gauge at 27.10 feet. One of VT's worst disasters. Heavy rain, 4-9 inches statewide, fell on frozen ground. Damage and loss of live occurred with 84 deaths, over 1,000 bridges taken out, over 600 farms and businesses destroyed, and miles of roads and railways claimed.

A stream gauge is located in East Orange; the East Orange Branch drains into the Waits River. Most flooding in Orange occurs from the Winooski River. The closest Winooski gauge is located in Montpelier – approximately 13 miles downstream. During Tropical Storm Irene, the levels of State flood control dam were 15 feet above normal levels (1147 feet from 1132 feet), while the Montpelier flood gauge was 4 feet above flood stage. The worst flooding event in Orange's history was the 1927 event; however, exact data from that event is not available. In 1927 event, the Montpelier flood gauge was at 27.10 feet; however, since the 1927 flood a number of flood control dams have been installed in the region to prevent the same flooding extent. Lesser but more regular flooding occurs in Orange, with generally 1 foot of water in areas designated on the hazard analysis map.

As stated in the Orange Town Plan "a major watershed boundary splits the Town on its north-south axis" The eastern slopes drain into the Waits and Well Watershed and the western slopes drain into the Winooski Watershed. Major water ways and bodies of water include the Nate Smith, the Nelson Brook and the Orange Brook, the Thurman W. Dix Reservoir, the Lower Orange Reservoir, the Jail Branch River, Riddle Pond plus numerous tributaries and small ponds and wetlands.

Based on the results of overlaying Orange's current Flood Insurance Rate Maps (FIRM) with the location of E911 points, 21 structures are located within the National Flood Insurance Program's designated 100-year floodplain. The estimated loss for a severe flooding event for all properties located within the Orange's 100-year floodplain is approximately $2,136,700 (2012 data). As previous events have made clear, however, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to flood related hazards.

The flood of July 11 and 12, 2007 remains one of most significant flooding events in recent town history. Approximately 4-6 inches of rain fell in a 24 hour period between noon on July 11 and July 12, causing the Jail Branch and tributaries to overflow their banks causing significant stream bank erosion, road embankment and shoulder wash, and culverts and bridges to be overtopped and outflanked. Areas of road most significantly affected included US Route 302 (east of the Village), Reservoir Road, Bisson Road, George Street, Eastman Road, Strong Road, Tucker Road, Prechtl Road, Melissa Lane, and Fish Pond Road. According to the Town Clerk the 2007 flood event resulted in the loss on one bridge, severe damage to four 3' – 5' sized culverts and head walls plus the loss of road surface on several roads.

In addition to the July 2011 storm, a second storm proceeded it in May. Orange roads and culverts were flooded during these two events. In the May severe thunderstorm, the following roads were damaged; George St, Clement Rd, Emery Rd, Eastman Rd, Spencer Hill Rd, Provencher Rd, Manning Rd, Prechtl Rd, Bennett's Mill Rd, Lord Rd, and Smith Rd.

After the May storm event Eastman, Bennett's Mill, and Emery Roads were repaired with expanded culverts and stone ditching. The repairs to Bennett's Mill Road cost the Town $14,000. The Town received $60,000 from FEMA from the May floods.
On August 28, 2011, Orange received 3-4" of rain from Tropical Storm Irene resulting in town wide flooding. Both Eastman and Emery roads held better during Tropical Storm Irene.

The town applied for and received hazard mitigation grant funding to repair the damages caused by the May and August 2011 storms. Over the past five years the town has mitigated the risk of future damage by installing larger culverts and bridges on George Street, Manning Road, and Prechtl Road. They have also done major upgrades throughout town on the road ditches. These improvements to the town infrastructure helped to minimize the damage from the federally declared disasters of 2013 (DR 4140 VT) and 2014 (DR-4178 VT) which brought flooding and flash flooding to the state from heavy rains and melting snow pack. Orange received $2,509.94 in federal grant monies to assist with the repairs to their damaged roads.

The town is currently working under an Agency of Transportation grant in conjunction with the CVRPC Transportation Planner to inventory all the roads and associated infrastructure to develop a Town Road Plan. Orange maintains a culvert inventory with up to date information on size and condition but lacks a data base for tracking the culverts. CVRPC maintains a GIS database that has the coordinates for each culvert and bridge and other road infrastructure. The transportation Vulnerability Assessment Map shows the mapped infrastructure locations based on GIS field coordinates. These tools will help the town prioritize and implement their strategies.

Historical channel management activities, floodplain encroachments, adjacent land use practices and/or changes in watershed hydrology associated with conversion of land cover and drainage activities, within and beyond the NFIP floodplain, have frequently been documented to have devastating consequences. The Orange Local Hazard Analysis Map 2016 identifies areas that have experienced flooding in the past. The 2014 flood regulations prohibit new construction and fill in the SFHA in an effort to reduce the risk of flood damage and maintain the floodplain area to receive waters.

It is important to note that Vermont has experienced a majority of their flooding in areas along upland streams and in road drainage systems that do not adequately convey the amount of water they are receiving. Flooding in these areas should be expected and planned for. The National Weather Service has seen a trend in recent years of more intense, locally severe storms with high intensity rain and flooding associated with them.

The topography and extent of several streams and tributaries make Orange susceptible to the danger of flash flooding. As noted in the Vermont State Hazard Mitigation Plan, these areas are not shown on the FEMA FIRMs. The Vermont Department of Environmental Conservation River Program is working to provide statewide coverage of fluvial erosion hazard (FEH) areas along the streams and river corridors. The river corridor is in the process of being delineated for the larger streams and rivers and setbacks have been established for the smaller upland streams. This data is due to be released within the next year and will be a valuable tool for Orange in their efforts to help mitigate the risk of flash flooding. Once the statewide river corridor digital map layer is finalized it will facilitate mitigation and river corridor protection planning and prioritization. Orange currently has Interim River Corridor regulations with the adoption of the town of Orange Inundations Hazard Area Regulation of 2014. The town's regulations are avoidance–based flood hazard bylaws that prohibit construction of new structures and fill in the entire Special Flood Hazard Area. Under a Water Quality grant, CVRPC will assist Orange in

the development of river corridor regulations that incorporate the Vermont mapped Fluvial Erosion Areas once these maps are released. CVRPC expects to begin work with the town in the fall of 2017. The following matrix provides an overview of the Flood/Flash Flood/Fluvial Erosion hazard:

FLOOD/FLASH FLOOD/FLUVIAL EROSION HAZARD OVERVIEW

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Type of hazard	General areas in community that may be vulnerable to the hazard	Community Structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard event	Strength or magnitude and general details of the most notable event(s): Minimal, Moderate; or Severe*	Dollar value or percentage of damages	Likelihood of hazard occurring based on past events: Occasionally: 1-10% probability of occurrence pre year, or at least one chance in next 100 years. Likely: >10% but <100% probability per year, at least 1 chance in next 10 years. Highly Likely: 100% probable in a year.
Flood/Flash Flood/ Fluvial Erosion	In most areas where roads cross waterways, including bridges and culverts. Areas of most concern include: Route 302 (east of the Village), George Street, Clement Rd, Emery Rd, Eastman Rd, Spencer Hill Rd, Provencher Rd, Manning Rd, Prechtl Rd, Bennett's Mill Rd, Smith Rd, and Reservoir Road.; upland streams and main rivers of Jail Branch and Waits.	Town road infrastructure: bridges, culverts and low lying roads. Existing 21 Homes in SFHA.	**TS Irene - 8/26/2011 - 9/2/2011;** Severe – water level of Lower Orange Reservoir 1147 (normal 1132 feet). 3-4 inches rain, Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet); **May 2011 - Flash Flood -** Severe. Montpelier Flood gauge at 17.59 ft., 3-5 inches rain. **July 2007 - Flash Flood.** Severe - 3-6 inches of rain over a 2 hour period.	2007 flood-damages =$115,163 2011 flood damages = $300,000	Highly Likely

SEVERE WEATHER (THUNDERSTORMS, LIGHTNING, HIGH WINDS, HAIL):

According to NOAA, severe weather is a destructive storm or weather that usually is applied to local, intense, and often damaging storms such as thunderstorms, hail storms, and tornadoes, but it can also describe more widespread events such as tropical systems, blizzards, nor'easters, and derechos. The Town of Orange has defined severe weather as the occurrence of two or more of the following hazards: thunderstorms, lightening, high winds and hail.

Thunderstorms are further defined in the Vermont State Hazard Mitigation Plan as follows, "Thunderstorms range in size and type. An ordinary cell thunderstorm consists of one cell with an updraft and downdraft and produce strong winds, rain, lightening, and even hailstones. Multicell cluster thunderstorms consist of several ordinary cell thunderstorms in the vicinity of each other. Multicell cluster thunderstorms are extremely prone to causing flash flooding. Squall line thunderstorms move in a linear front that can exceed 100 miles in length, with the strongest rains and winds at the front of the storm. Supercell thunderstorms are the largest, longest lasting, and most devastating thunderstorms. Nearly all tornadoes are formed from supercell thunderstorms. Supercell thunderstorms can also form hailstones larger than golf balls. These Supercell storms have a clockwise rotating winds that exacerbate the storm. Lightning, hail, flash flooding, and tornadoes are all associated with this type of thunderstorm." Thunderstorm activity in Orange causes power outages, damaging winds, hail, and transportation and economic disruptions, particularly from blown down trees.

Lightning produces thunder. Lightning is the electrical charges in the atmosphere between clouds, the air, or the ground. In the early stages of development, air acts as an insulator between the positive and negative charges in the cloud and between the cloud and the ground. When the opposite charges builds up enough, this insulating capacity of the air breaks down and there is a rapid discharge of electricity that we know as lightning (as defined by NOAA). The discharge of electricity produces light (lightning) and sound (thunder). Lightning can kill, cause forest fires, and damage property.

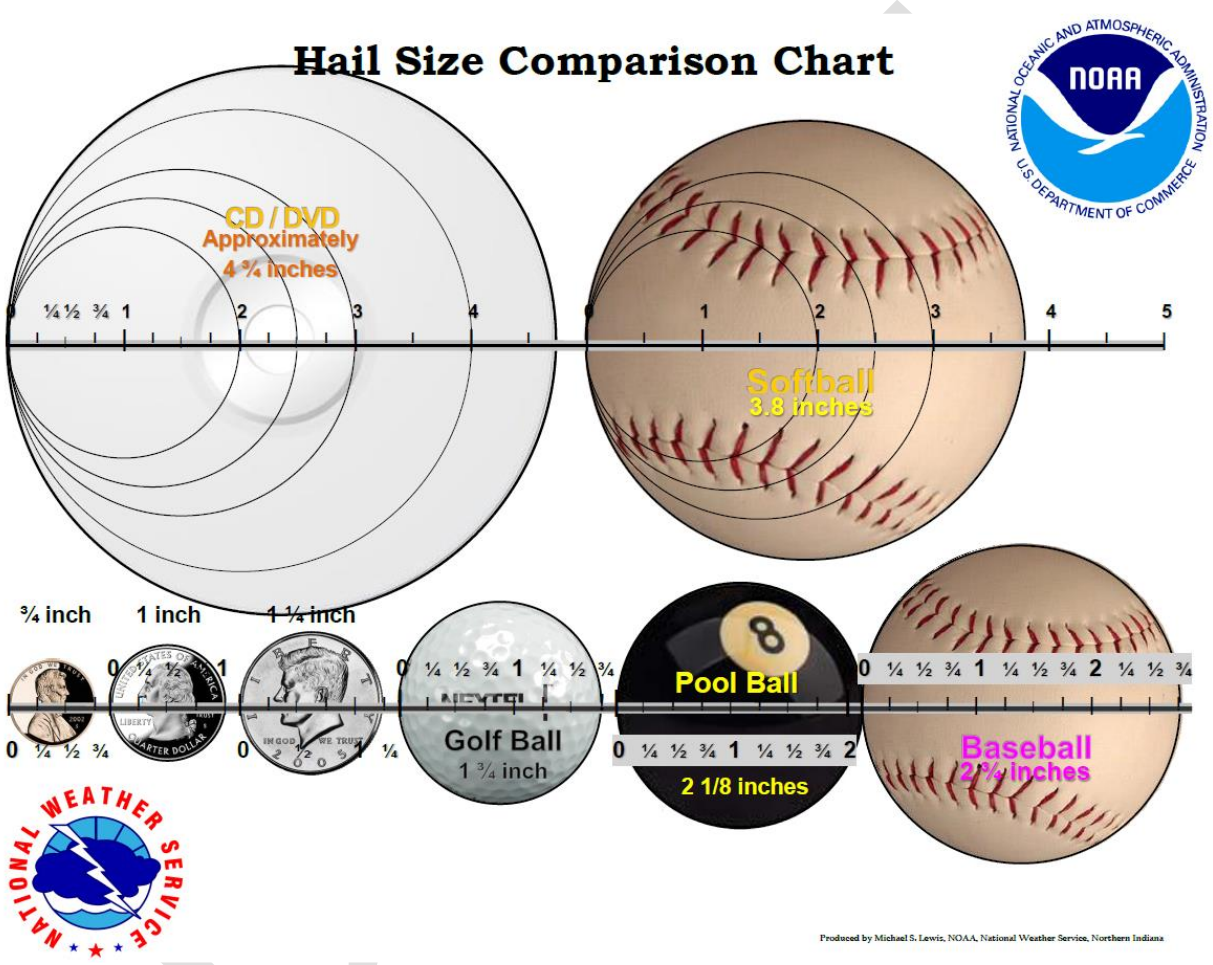
High Winds are usually associated with severe thunderstorms in Vermont. When winds are sustained at 31 to 39 mph for at least an hour or any gusts at 46 to 57 mph, the National Weather Service will issue a wind advisory. If winds reach 58 mph or more, the National Weather Service will issue a High Wind Warning. The National Weather Service has classifications for hurricane and tropical storm winds which can be found in the Saffir-Simpson Scale graphic found later on in this Plan as well as the Beaufort Wind Chart used to estimate wind speeds. High winds cause damage to property and personal safety, and are a concern for the electrical and telecommunication utilities in Orange County and throughout the state due to customer power outages and damage to infrastructure.

Beaufort Wind Chart – Estimating Winds Speeds

Beaufort Number	MPH Range	MPH Average	Terminology	Description
0	0	0	Calm	Calm. Smoke rises vertically.
1	1-3	2	Light air	Wind motion visible in smoke.
2	4-7	6	Light breeze	Wind felt on exposed skin. Leaves rustle.
3	8-12	11	Gentle breeze	Leaves and smaller twigs in constant motion.
4	13-18	15	Moderate breeze	Dust and loose paper is raised. Small branches begin to move.
5	19-24	22	Fresh breeze	Smaller trees sway.
6	25-31	27	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Umbrella use becomes difficult.
7	32-38	35	Near gale	Whole trees in motion. Some difficulty when walking into the wind.
8	39-46	42	Gale	Twigs broken from trees. Cars veer on road.
9	47-54	50	**Severe gale**	**Light structure damage.**
10	55-63	60	**Storm**	**Trees uprooted. Considerable structural damage.**
11	64-73	70	**Violent storm**	**Widespread structural damage.**
12	74-95	90	**Hurricane**	**Considerable and widespread damage to structures.**

Webpage: http://www.weather.gov/iwx
Twitter: @nwsiwx
Facebook: NWSNorthernIndiana

Hail is defined in the Vermont State Hazard Mitigation Plan as, "a form of precipitation composed of spherical lumps of ice. Known as hailstones, these ice balls typically range from 5-50 mm in diameter on average, with much larger hailstones forming in severe thunderstorms. The size of a hailstone is a direct function of the severity and size of the thunderstorm that produces it." Hail is known to cause devastating crop damage, property damage, and bodily injury if one is struck. NOAA has created a diagram to help visualize the size of hail in relation to common items like a softball or golf ball or coins as depicted below.



Similar to flooding, the extent of severe weather is not well documented in the Town of Orange. The impact of severe weather is usually flood related. According to the Vermont State Hazard Mitigation Plan, thunderstorms are the most prevalent hazard event occurring in Vermont and "severe summer thunderstorm winds occur more frequently than any other natural hazard incident within Vermont." Precipitation associated with thunderstorms often causes flash flooding due to the large amount of precipitation over a short period of time coupled with the mountainous and steep terrain of Vermont. In Vermont, severe thunderstorms occur most often in the spring and summer. Damage from flooding is covered under that hazard threat of this Plan and can include property and structure damage, erosion, and loss of life. Flash floods cause rapid rises in water levels with little time to prepare but

generally recede quickly. The worst flood event was the 1927 storm when the Winooski River in Montpelier was 12 feet above flood stage. Data from Orange is not available. Orange has experienced flash flooding on numerous occasions over the years and has a high likely hood of this occurrence to continue. Lesser but more regular flooding occurs in Orange, with generally 1 foot of water in areas designated on the areas of concern map during severe weather events. A river monitoring station is located in East Orange.

Severe thunderstorms also produce high winds and hail. Both can damage crops, trees, structures, and property. High winds and hail tend to be localized but can cause significant damage and loss, especially to farmers and woodlot owners who can lose their whole crop in a single event. In Vermont, hail storms have seen hail the size of .75 inches up to 3 inches and hail the size of 1.5 inches is not uncommon. High winds during thunderstorms have been common in recent years in Orange County causing numerous downed trees and power outages. During 2000 – 2010, Orange County was impacted on four different dates by thunderstorms causing more than $200,000 in damage (Table 4-7 Vermont State Hazard Mitigation Plan 11/2013). In 1999, Tropical Storm Floyd passed through Vermont. The primary impact from Floyd was downed trees and power lines due to high winds. Approximately 3,000 people were without power in the Central Vermont Region. About 7" of rain fell over Orange; however, flood impacts were offset by drought conditions from earlier in the year. There were no high wind impacts associated with the 2011 events of Tropical Storm Irene and the May 28, 2011 storm. The power generation of the two utilities in Orange is based on substations which are not set by jurisdictional lines. As a result, frequency and specific dates of power shortage/failure could not be attained.

As stated in the Orange Town Plan, "Orange is fortunate to have large blocks of timberland" such as the Butterfield Black of Groton State Forest (1,934 acres located in the northeastern quadrant of Orange), the Orange Town Forest (306.4 acres located on the north side of US Route 302), and the Barre City Forest (1,200 acres surrounding the Thurman W. Dix Reservoir and the Lower Orange Reservoir) plus extensive tracts of privately owned timberlands/woodlands. The Orange Land Use Map depicts Orange as mostly forested.
High winds threaten the viability and productivity of this cash crop and can affect the local economy. Downed trees can make transportation corridors impassable and cut power service to town residents and neighboring communities. Lightning, with the potential for strikes to the trees within the forested area, also threatens this resource.

Information to complete the history of occurrences was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, the FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
2/25/2017	✓		✓		County-wide; Orange County	55kts; heavy rain showers and severe thunderstorms across portions of CT River Valley- downed trees and power lines with structural damage to camps along lake Fairlee; strong to severe winds, damaged roofs, trees and power line; ice jam in Waits River caused flooding.
9/11/2016	✓	✓	✓		County-wide; Orange County	50kts; heavy rain and scattered severe thunderstorms with cloud to ground lightening strikes; ground to cloud lightening strikes; numerous trees down and power outages; historic barn destroyed by fire at Shelburne Farms.
7/23/2016	✓		✓		County-wide; Orange County	55kts-60 kts; intense thunderstorms, Significant and widespread damage occurred with more than 20,000 utility outages. Reports of numerous trees downed or snapped along Interstate 89 between mile markers 50 in Barre to mile marker 25 near Bethel.
7/18/2016	✓		✓	✓	County-wide; Orange County	50 kts, scattered intense thunderstorm with wind damage to trees and utility lines. Scattered Hail 1.5 inches in diameter
2/29/2016	✓		✓		County-wide; Orange County	39 kts; wind gusts in excess of 35 to 40 mph across large portions with a few scattered wind gusts that approached 50 mph. Damage to trees, tree limbs down fell on power lines and accounted for isolated power outages across much of the state but scattered to numerous power outages in the Connecticut River Valley with nearly 20,000 outages reported.
7/19/2015	✓		✓	✓	County-wide; Orange County	scattered thunderstorms with a few containing isolated damaging winds and hail up to one inch in diameter. The greater impact of these storms was the training of storms traveling across the same areas over and over with torrential rainfall that lead to flash flooding in Barre and Plainfield.
5/27/2015	✓		✓		State-wide; Orange County	50 kts; rain and thunderstorm winds damaged trees and power lines.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
10/7/2013	✓		✓		State-wide; Orange County	43 kts; showers and thunderstorms; Several reports of tree branches on utility lines in several communities in Orange county, scattered wind gusts of 50 mph or greater across portions of Vermont; numerous downed trees or tree limbs on utility lines resulting in more than 25,000 customers without power at the peak of the storm.
9/11/2013	✓		✓		State-wide; Orange County	55 kts; thunderstorms produced damaging winds of downed trees and utility lines. Numerous trees down across central and southern Orange County.
6/2/2013	✓		✓	✓	County-wide; Orange County	50kts, 1.5 inch hail; widespread thunderstorms with pockets of damaging winds and large hail. Trees down. At the peak of the event, roughly 20,000 customers had lost power.
1/20/2013			✓	✓	State-wide; Orange County	39 kts; strong winds >50 mph; Scattered reports of tree limbs, tree branches down and power outages across the region (Orange County); statewide ~ 10,000 customers lost power.
10/29/2012			✓		State-wide; Orange County	35-60 mph winds; impact from Sandy Hurricane; a predominant east-northeast wind blew across the region with the strongest winds in northeast Vermont and along some Green Mountain western slope communities. scattered tree and power line damage; total of 35,000 residents without power.
9/8/2012	✓		✓		State-wide; Orange County	50kts; Numerous trees and power lines down by thunderstorm winds.
7/17/2012	✓		✓	✓	County-wide; Orange County	50 kts; numerous thunderstorms with some damaging winds and large hail. Numerous roads impassable due to multiple trees down.
7/4/2012	✓	✓	✓		County-wide; Orange County	50 kts; Several trees down along Route 5. Widespread wind damage and frequent lightning. Wind gusts in Champlain Valley and Lake Champlain 55-65 knots.
6/23/2012	✓	✓			Orange County	isolated thundershowers with lightening. 16 year old male farm worker struck by lightening and died from injury.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
5/29/2012	✓	✓	✓	✓	State-wide; Orange County	50 kts; numerous thunderstorms with heavy rain, damaging lightning and some isolated large hail and strong winds. Some of these thunderstorms deposited up to 2 inches of rainfall in portions of north-central and northeast Vermont. Numerous reports of hail greater than an inch in diameter, damaging winds, along with a confirmed EF0 tornado in West Glover VT.
1/18/2012			✓		State-wide; Orange County	strong, localized damaging west to southwest winds with gusts in excess of 60 mph in elevations above 2000 feet along the Green Mountains with numerous 40 to 50 mph in the valleys. The end result was scattered tree limbs, trees and power lines down along with nearly 2500 customers without power across Vermont.
8/28/2011 - 9/2/2011 *Tropical Storm Irene; DR 4022			✓		State-wide; Orange County	43 kts Orange Cnty; Frequent wind gusts of 35 to 50 mph, especially across exposed higher terrain, along with saturated soils caused widespread downed and uprooted trees.
8/21/2011	✓	✓	✓	✓	County-wide; Orange County	50 kts; Numerous showers and thunderstorms with some containing large hail and damaging winds. Downed trees and power lines; The strongest storm was in Rutland county near North Pawlet, where a microburst produced straight line winds estimated, by a NWS Storm Damage team, between 70 and 90 mph. Hundreds of trees were snapped or uprooted as well as downed power lines and damage to vehicles. In addition, a corn field was flattened by these damaging winds.
6/9/2011	✓		✓	✓	County-wide; Orange County	50 kts; scattered thunderstorms, a few isolated reports of damaging winds and large hail. Numerous trees downed by thunderstorm winds.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
5/26/2011 - 5/27/2011 DR 4001	✓		✓	✓	County-wide; Orange County	Severe weather over two days; 1- 2.5 inch hail; 50 kts wind; scattered severe thunderstorms and localized flash flooding in central and eastern Vermont. Quarter size hail reported. Numerous reports of damaging winds and very large hail. Some 25,000+ customers lost power. Several trees down within Allis State Park. 3 to 5+ inches of rainfall and severe flash flooding and resultant river flooding as well.
4/16/2011			✓		County-wide; Orange County	43 kts, strong winds; numerous reports of trees downed by high winds, reports of trees down and scattered power outages along elevated hillsides within the county.
2/18/2011			✓		State-wide; Orange County	40 kts; A strong cold front; scattered power outages and tree damage across the state with more than 10,000 customers without power. Some reported measured wind gusts included; 49 mph at Rutland airport in Clarendon (Rutland county), 45 mph in Middlebury (Addison county), Montpelier airport in Berlin (Washington county) and Springfield (Windsor county), 44 mph in Ludlow (Windsor county), 41 mph at the NWS office in South Burlington (Chittenden county).
7/21/2010	✓		✓	✓	State wide; Orange County	50 - 75 kts; .75 - 2 inch diameter hail. Thunderstorms developed rapidly, intensified and maintained longevity; scattered & numerous. Several storms strengthened into Super-cells producing widespread wind damage to trees, power poles and structures; large hail in excess of golf ball size in diameter. Winds damaged a farm along Route 5 in Orange County, including flattening one barn and severely damaging others. This thunderstorm caused more than $200,000 in damages in Orange County to crops and property.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
2/25/2010 2/27/2010			✓		County wide; Orange County	50 kts; Strong easterly winds of 80 to 100 mph along the peaks of the Vermont's Green Mountains and New Hampshire's White Mountains flowed downward across exposed higher terrain and western slope valleys with 45 to 60+ mph wind gusts. Numerous communities witnessed downed tree limbs. branches and some trees that resulted in downed power lines and power outages. Power outages in Vermont ranged from 20,000 to 40,000 customers.
11/28/2009			✓		County wide; Orange County	brisk to strong wind gusts in excess of 40 mph ushered in colder air during the early morning hours of the 28th and caused scattered power outages that affected nearly 8000 people.
8/21/2009	✓		✓		Orange County	50 kts; thunderstorm winds microburst; trees and power lines reported down by thunderstorm winds in and around Chelsea.
7/16/2009	✓	✓	✓	✓	County-wide; Orange County	50 kts;1 - 3.3 inch hail; Numerous thunderstorms across Vermont, including a few super-cell thunderstorms producing hail up to 3.3 inches in diameter with numerous reports of damage to vehicles, homes, crop and livestock. A brief EF-0 tornado along the Williamstown-Chelsea town line (Orange county). Quarter size hail in Brookfield. The 3.3 inch hail in Westford, had a circumference of 6.8 inches and is the largest recorded hail stone in Vermont.(NOAA)
5/31/2009			✓	✓	County-wide; Orange County	A strong cold front moved across Vermont during the afternoon and resulted in an brief period of strong winds with gusts of 40 to 55 mph along with a 20 degree temperature plunge. These strong winds accounted for numerous reports of fallen trees, scattered power outages throughout Vermont, as well as some accompanied property damage due to fallen trees. There were also numerous reports of pea size hail throughout the afternoon with the arrival of colder air and heavier rain showers.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
5/9/2009	✓		✓	✓	County-wide; Orange County	50 kts; Severe thunderstorms and a developing squall line produced large hail up to an inch in diameter as well as damaging winds that knocked down trees and power lines to portions of central Vermont. In addition, an EF1 tornado developed and briefly touched down in advance of the squall line in the town of Washington (Orange county). Some structural damage occurred to an apartment roof, school awning and destroyed a 60 foot hoop barn made of fabric and steel tubing.
12/24/2008			✓		State wide; Orange County	43 kts; strong winds, Scattered reports of tree limbs, power outages and torn roof shingles were reported across Vermont.
7/21/2008 - 8/12/2008 DR1790 VT	✓		✓		County-wide; Orange County	Severe storms and flooding across Orange County and surrounding counties; power outages.
8/7/2008	✓			✓	Orange County	numerous rounds of showers and thunderstorms. A few of these thunderstorms produced hail ranging from marble (half inch diameter) to quarter size (inch diameter). Damage to vehicles reported.
7/18/2008	✓		✓	✓	State wide; Orange County	50 kts; Severe thunderstorms across state with varying intensity and a tornadic storm with two very brief touchdown with EF0 and EF1 damage in Lamoille County. Another area of thunderstorms moved across central Vermont with pockets of significant damage across Addison, Washington and Orange counties. Tree and power line damage.
6/27/2008	✓		✓	✓	County-wide; Orange County	50 kts winds; Scattered thunderstorms across south central VT; damaging winds and power outages; some large hail in Addison and Rutland Counties.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
6/8/2008 - 6/10/2008	✓		✓		County-wide; Orange County	65 -50 kts; thunderstorm winds in Orange County; two rounds of widespread severe thunderstorms took place in AM and PM. Hundreds to thousands of trees were damaged, downed or uprooted; downed power lines; structural damage to numerous buildings and vehicles. Tens of thousands of customers lost power, with some outages lasting several days. Thunderstorm caused more than $200,000 in damages to crops and property in Orange County.
8/30/2007	✓			✓	County-wide; Orange County	widely scattered thunderstorms moved across the region with some isolated reports of large hail. Nickel size hail was reported in Wells River (Orange county) with quarter size hail reported in Benson (Rutland county).
8/25/2007	✓	✓	✓		County-wide; Orange County	55 kts; severe thunderstorms; wide-spread damaging winds;some large hail across central, southern and eastern Vermont. Lightning strikes in Chelsea destroyed a hay barn; Numerous trees downed by thunderstorm winds throughout Brookfield and immediate vicinity; downed power lines and blocked roads. Hay barn destroyed by thunderstorm winds. Thunderstorm caused more than $200,000 in damages to Orange County.
7/9/2007 - 7/11/2007 DR 1715 VT	✓	✓	✓	✓	County-wide; Orange County	Numerous areas of thunderstorms occurred across the region with a wide variety of weather conditions, which included very large hail, damaging winds and several structures struck by lightning. Baseball size hail was reported in Duxbury (Washington county). Lightning struck a house in Barre (Washington county), destroyed a barn in Bakersfield (Franklin county) as well as destroyed one camp and severely damaged another camp in Randolph (Orange county). Numerous trees and limbs downed.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
6/2/2007	✓	✓	✓	✓	County-wide; Orange County	55 - 60 kts; locally severe thunderstorms; damaging winds that knocked down numerous trees and power lines. A tin barn was collapsed by thunderstorm winds in Bradford (Orange county). Severe storms produced large hail 3/4 inch in diameter or greater, in surrounding counties.
4/16/2007 DR 1698 VT (4/15 - 4/21)			✓		County-wide; Orange County	45 kts; high winds combined with winter storm caused scattered damage in the form of trees or large limbs knocked down and scattered power outages throughout the state.
10/16/2005			✓		Orange County; Orange Town specific	40 kts; high winds from ocean storm system; Countywide tree damage was reported. In the Town of Orange trees were reported blown down on power lines. Power outages were reported across this areas.
9/29/2005	✓		✓		County wide; Orange County; Orange Town specific	35 kts; Showers and thunderstorms with large scale damaging winds. Trees and power lines were blown down countywide across the counties of Orange and Windsor, with numerous power outages. Winds were generally sustained at an estimated 35 to 45 mph with higher gusts. A few specific reports were trees and wires down in the Orange county towns of Bradford, Orange, Tunbridge, Williamstown and Corinth. In Randolph, a tree was blown down on a house with some damage.
8/1/2005			✓	✓	County-wide; Orange County, Town of Orange	55 kts; 1" hail; Severe thunderstorms across eastern Vermont. In Orange county, numerous trees were blown down on cars, especially in the Randolph area. Power was out with power wires blown down. Small hail was reported with the storm. This thunderstorm caused more than $200,000 in crop and property damage in Orange County.
6/10/2005	✓	✓			Orange County	severe thunderstorm and lightning; lightning strikes killed 17 cows in Stafford
6/29/2003	✓	✓			Orange County	thunderstorm with numerous lightning strikes causes tree fires in Randolph and Braintree in Orange County.

Severe Weather History of Occurrence

SEVERE WEATHER DATE	EVENT				LOCATION	EXTENT
and FEMA declaration # if applicable	Thunderstorm	Lightning	High Winds	Hail		
8/24/1998	✓		✓	✓	County-wide; Orange County	1.75" hail; Orange county, numerous trees and power lines were blown down in Chelsea and Randolph, while strong thunderstorm winds damaged a barn in Tunbridge. In Bradford, a swath of hundreds of trees and power lines were blown down by strong thunderstorm winds with golf ball size hail. In addition, a tree and a sign was blown down in Randolph.
5/29/1998	✓		✓	✓	County-wide; Orange County	50 kts; high winds, heavy rain, thunderstorm, downed trees and power lines
7/31/1964				✓	County-wide; Orange County	1.5 inch hail.

In Orange, flooding, tree damage, crop and forest product damage, downed power lines and power outages are caused by the hazard of severe weather. The frequency and intensity of the severe weather experienced over the past five years is highly likely to continue into the future. Orange recognized this hazard as one of the top priorities for the community.

At the writing of this Plan, Orange experienced a severe storm on July 1, 2017 through July 2, 2017 which brought heavy rains (up to 4 inches) to already saturated soils, high winds, and thunderstorms. Preliminary damages estimates of $ _____. The Emery Road closed on July 1 due to damages caused by the washout of three culverts. Failure of one of these culverts resulted in the loss of a residential driveway. Portions of Richardson Road were also damaged as the water crossed over Richardson Road from Emery Rd. The town is in the process of assessing damages and repairing/replacing the culverts to open the town road again. By July 2 the resident driveway was restored and the culvert fixed in that location. *(Update paragraph as new information is obtained and prior to final submittal to FEMA)*

SEVERE WEATHER HAZARD OVERVIEW

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Type of hazard	General areas in community that may be vulnerable to the hazard	Community Structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard event	Strength or magnitude and general details of the most notable event(s): Minimal, Moderate; or Severe*	Dollar value or percentage of damages	Likelihood of hazard occurring based on past events: Occasionally: 1-10% probability of occurrence pre year, or at least one chance in next 100 years. Likely: >10% but <100% probability per year, at least 1 chance in next 10 years. Highly Likely: 100% probable in a year.
Severe Weather (Thunderstorm, Lightning, High Winds, and Hail)	In most areas where **roads cross waterways,** including bridges and culverts. Areas of most concern include: Route 302 (east of the Village), George Street, Clement Rd, Emery Rd, Eastman Rd, Spencer Hill Rd, Provencher Rd, Manning Rd, Prechtl Rd, Bennett's Mill Rd, Smith Rd, and Reservoir Road.; upland streams and main rivers of Jail Branch and Waits. **Forested areas** incluing the Orange Town Forest, Groton Sate Forest, Barre City Forest and private landowner woodlots. **Power lines and poles** - town wide	Town road infrastructure: bridges, culverts and low lying roads. Existing 21 Homes in SFHA. Vulnerable populations such as elderly and medically dependent persons. Farmers and loggers who earn livelihood from forest products and crops. Business Utility Companies, GMP and WEC, and town utilities.	**TS Irene - 8/26/2011 - 9/2/2011;** Severe – water level of Lower Orange Reservoir 1147 (normal 1132 feet). 3-4 inches rain, Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet); **May 2011 - Flash Flood** - Severe. Montpelier Flood gauge at 17.59 ft., 3-5 inches rain. **July 2007 - Flash Flood.** Severe - 3-6 inches of rain over a 2 hour period. ---------- Winds up to 55 knots; hail up to 1.75 inches; numerous trees blown down onto power lines causing power outages. ---------- Over 17,280 acres of forested land	2007 flood-damages =$115,163 2011 flood damages = $300,000 ---------- Thunderstorms costing more than $200,000 in crop and property damages in Orange County in 7/21/2010, 6/8/2008, 8/25/2007, and 8/1/2005. Specific cost of power outages in the Town of Orange is unknown. ---------- Data gap exists;	Highly Likely

5.3 Moderate Threat Hazards

DAM FAILURE

Manmade and natural dams exist in the Town of Orange. The two manmade dams of concern are the Thurman W. Dix Reservoir Dam (State of VT Dam # 147.01) and the East Barre Dam (State of VT Dam #14.02). Barre City owns the Thurman W. Dix Reservoir Dam. The reservoir serves as the municipal water supply for the city. The dam structure and water reservoirs are located in the Town of Orange. The State of Vermont owns the East Barre Dam with operation by the Department of Environmental Conservation (DEC). It serves as a flood control dam. The dam structure is located in Barre Town and a significant portion of the flood reservoir is located in the Town of Orange. Beaver dams occur throughout the Town of Orange.

The Thurman W. Dix Reservoir Dam is located in the northwest quadrant of town. The Agency of Natural Resources (ANR) Dam Safety Program identifies it as a "high hazard dam". The Thurman W. Dix Reservoir has three dams located on it – top, middle and spillway. The spillway is a dam of concern, which received damage in the May 2011 rain event. Barre City has since repaired the spillway. The spillway is an earthen dam and has had several slow leaks repaired over the years to prevent leaks onto the road below the dam. It is important to note, when water levels in the reservoir are high, inlet culverts to the reservoir become flooded. It is not well documented; however, high water levels and leakage from the dam and reservoir have impacted the town roads and infrastructure.

The Thurman W. Dix Reservoir Dam #147.01 Emergency Action Plan (EAP) provides information on the potential impacted area and the people and businesses at risk of flooding if the dam should fail and provides the estimated time for the flood wave to travel from the dam to the impacted locations. The EAP identifies one home, one business, and four roads (with the extent of overtopping that will occur), if dam failure should happen. The notification process outlined in the EAP does not specifically mention the Town of Orange or provide a specific Town of Orange contact name and method of contact for use when activating an emergency notification. The lack of communication with the Town of Orange by the dam owner is a big concern for the elected officials and the community. The Town of Orange would like to be better informed on the procedures and evacuation that are identified in the EAP if an event were to occur. In addition, the EAP misidentifies one of the impacted roads, which the Planning Team discovered while reviewing the EAP document as part of updating this Plan. Had the Town been involved and participated in the EAP development process this oversight could have been corrected.

Information taken from the dams EAP dated 1/29/2009, summarizes the Thurman W. Dix Dam description.

Height: 48 ft.
Built: 1950
Legal Description: Not Applicable
Latitude: 44.18082
Longitude: 72.42586
National Inventory of Dams No: VT00069

Drainage Area: 9.1 mi^2
Hazard Classification: High
Dam Operator: City of Barre
Major Property Owner: N/A
Dam Designer: City of Barre

The East Barre Dam is located in the Town of Barre on the Jail Branch approximately 4.4 miles up from the confluence with the Stevens Branch at the City of Barre. A significant portion of the flood reservoir is in the Town of Orange. Looking from VT Route 110 and US Route 302 the dam and reservoir are visible. The dam was primarily constructed for flood control but also has a small conservation pool maintained for recreational use and hydropower. The State of Vermont owns the dam and the DEC operates it. As noted in the EAP prepared by DuBois & King, Inc., the East Barre Dam "consists of a rolled earth embankment, having a maximum height of 65 feet and an embankment length of 1,460 feet, exclusive of the spillway. The spillway consists of a concrete overflow-section. The concrete over-flow section has an effective crest length of 174 feet. The low-level outlet at the dam consists of a reinforced concrete rectangular conduit 4.0 feet wide by 7.0 feet high…" It too is categorized by the State of Vermont as a "high hazard" dam.

The EAP for East Barre Dam was last updated in 2012. Like the Thurman W. Dix Reservoir Dam, of concern is the lack of communication by the dam owner and operator with the Town of Orange. Again, the Town of Orange is not listed in the Contact list or Emergency Notification Chart and procedures. Although the majority of damage and risk is to the surrounding communities downstream of the dam with minimal risk of damage to the Town of Orange, Orange would like to be better informed on the procedures and evacuation that are identified in the EAP if an event were to occur. The *Impact of Breach,* detailed in Appendix B of the 2012 EAP, identifies the populations and major transportation corridors, as well as the level of water rise and inundation expected in the event of a dam failure.

The Table below, taken from the East Barre Dam EAP of 2012, summarizes the dam description.

EAST BARRE DAM
BASIC DATA

DESCRIPTION	DATA	COMMENT
Drainage Area	38.7 sq. mi.	At East Barre Dam
Dam Height	65 feet	Top of dam at maximum height
Surface Area at Conservation pool	20 acres	Water level at the conservation pool elevation is 1124.9
Storage at Conservation pool	40 acre-feet	Water level at the conservation pool elevation is 1124.9
Distance from fixed concrete spillway to top of dam	20.0 feet	Elevation of spillway 1165.0 Elevation of top of dam 1185.0

The ranking as a "high hazard" dam is based on DEMHS classification, "according to the dam's potential for causing loss of life and property damage in the area downstream of the dam if it were to fail" and uses a Downstream Hazard Classification system like that used by the U.S. Army Corps of Engineers as found in Table 4-24 in the Vermont State Hazard Mitigation Plan, November 2013 on page 4-95 and as shown below. The ANR Dam Safety Program inventory has 1240 dams of which 61 are high hazard dams. Of the 61 high hazard dams, ANR has jurisdiction for 40 of them including the Thurman W. Dix Reservoir Dam and the East Barre Dam. According to the State Hazard Mitigation Plan, none of the ANR regulated dams are in imminent danger of failure.

Table 4-24
Downstream Hazard Classification of Dams

Class	Hazard Category	Potential Loss of Life	Potential Economic Loss
3	Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structure or agriculture)
2	Significant	Few (No urban developments and no more than a small number of inhabitable structures)	Appreciable (Notable agriculture, industry, or structures)
1	High	More than few	Excessive (Extensive community, industry, agriculture)

Since the adoption of the 2012 Town of Orange Hazard Mitigation Plan, the ANR Dam Safety Program has updated and performed studies on the various dams throughout the state and has made available the EAP and inundation area maps to the communities and posted them on their website. Josh Cox, Critical Infrastructure Planner at DEMHS and Steven Hanna, Dam Safety Engineer with ANR DEC provided the EAPs and inundation area maps to the Town of Orange as part of this Plan update process. The inundation area map for the Thurman W. Dix Reservoir Dam is an attachment to this Plan. Because the East Barre Dam inundation area in the event of failure has minimal risk to the Town of Orange is it not attached to this Plan. The EAPs and the inundation area maps for each dam are now located in the Town Offices and available in hard copy and electronically by asking the Town Clerk for assistance.

Breached beaver dams also present the potential of flooding. According to Vermont Fish & Wildlife Department's website, "beaver populations in Vermont increased by more than 130% from 1980 to 1990, as a result of less trapping pressure." This increase also indicates an increase in beaver activity. In Orange, one beaver dam existed at the eastern end of Riddle Pond, located adjacent to Route 302, east of the village. This dam was removed to prevent flooding. In addition to the dam at Riddle Pond, the Town Plan states that "there exist numerous small ponds scattered throughout the Town," and "in many cases beaver dams have created these smaller ponds." To address this hazard, the Town hires trappers to control the beaver populations on a regular basis and this has become part of the routine maintenance to protect town roads. There currently exists no history of dam failure in regards to the manmade or beaver dams, but the potential exists. The following matrix provides an overview of the hazard.

DAM FAILURE OVERVIEW

Hazard	Location	Vulnerability	Extent	Observed Impact	Likelihood/Probability
Type of hazard	General areas in community that may be vulnerable to the hazard	Community Structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard event	Strength or magnitude and general details of the most notable event(s): Minimal, Moderate; or Severe*	Dollar value or percentage of damages	Likelihood of hazard occurring based on past events: Occasionally: 1-10% probability of occurrence pre year, or at least one chance in next 100 years. Likely: >10% but <100% probability per year, at lest 1 chance in next 10 years. Highly Likely: 100% probable in a year.
Dam Failure	Thurman W. Dix Reservoir Dam mapped Inundation Area: includes Lord Road, Reservoir Road, Town Highway 14, US Route 302, Jail Branch, area streams and residences within the vicinity.	Thurman W. Dix Reservoir, Lord Road, Reservoir Road, Town Highway 14, US Route 302, one household, one business, public infrastructure including Barre City water treatment facility structures; fluvial erosion of Jail Branch and area steams, town roads, private property;	No notable events have occurred. The potential if failure occurs is the overtopping of the Lord Road by 16.5 ft.; Reservoir Road by 13.5 ft.; Town Highway 14 by 25 ft. at the intersection with Reservoir Road; and US Route 302 by 11 ft.; Most notable event is minimal leakage; no minor or major failure has occurred to date.	Dollar value or percentage unknown. No known dam failure recorded occurrences.	Occasionally
Dam Failure	East Barre Dam mapped Inundation Area: includes area populations in Barre City, Barre Town, Montpelier, Middlesex, and Moretown; public and private infrastructure, roads, residences, businesses, natural features, rivers; historic structures;	Failure will impact communities downstream with minimal impact to Orange; In Orange - flooding of private and public lands adjacent to the flood reservoir as it rises. Appendix B *Impact of Breach,* found in the East Barre Dam EAP dated 2012 provides detail of the vulnerabilities as well as the extent.	No known event. Severe if failure happened with loss of life and property probable.	Dollar value or percentage unknown. No known dam failure recorded occurrences.	Unlikely
Dam Failure	beaver ponds in natural environment in rural areas of town; upland streams; culverts	town wide roads, driveways, culverts	Minimal - Annual trapping performed to reduce risk as part of routine road maintenance	X # of beavers trapped on average each year; X cost of contract between trapper and town (?)	Occasionally - Likely

HURRICANE/TROPICAL STORMS:

Hurricanes and tropical storms are violent rainstorms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. The Vermont State Hazard Mitigation Plan further defines a hurricane as, "a tropical cyclone with sustained winds that have reached speed of 74 mph or higher. A storm reaches hurricane status only after strengthening over a period of days or even weeks." In contrast, "a tropical storm has a maximum sustained one-minute wind speed of 39-73 mph. The National Weather Service names a tropical cyclone (hurricane) once it reaches the status of a tropical storm. Many hurricanes are downgraded to tropical storms before they reach Vermont. Hurricanes and tropical storms bring the additional hazards of flooding, high winds, heavy precipitation, and fluvial erosion. According to the Vermont State Hazard Mitigation Plan, severe hurricanes are not considered likely nor pose a recurring threat to Vermont but tropical storms do.

In Vermont, the storm season is between the months of June and November. These types of storms originate in the warm waters of the Caribbean and move up the Eastern seaboard where they lose speed in the cooler waters of the North Atlantic. Severe storm events can occur late spring and early summer as temperatures increase in the summer season. The frequency and intensity of hurricanes and tropical storms is expected to increase with climate change.

The Saffir-Simpson Hurricane Wind Scale is used to determine the rating of a hurricane based on sustained wind speed. There are five categories used to classify a hurricane based on the potential for significant loss of life and property damage. Category 1 is very dangerous, Category 2 is extremely dangerous, Category 3 is devastating (major), Category 4 is catastrophic (major), and Category 5, the worst, is catastrophic (major). For further detail on the types of damage due to hurricane winds go to the table 4-15 in the VT State Hazard Mitigation Plan.

Saffir-Simpson Scale for Hurricane Classification				
Strength	Wind Speed (Kts)	Wind Speed (MPH)	Pressure (Millibars)	Pressure
Category 1	64-82 kts	74-95 mph	>980 mb	28.94 "Hg
Category 2	83-95 kts	96-110 mph	965-979 mb	28.50 - 28.91 "Hg
Category 3	96-113 kts	111-130 mph	945-964 mb	27.91 - 28.47 "Hg
Category 4	114-135 kts	131-155 mph	920-944 mb	27.17 - 27.88 "Hg
Category 5	>135 kts	>155 mph	919 mb	27.16 "Hg
Tropical Cyclone Classification				
Tropical Depression		20-34 kts		
Tropical Storm		35-63 kts		
Hurricane		64+ kts or 74+ mph		

Information to complete the history of occurrences was taken from the National Oceanic and Atmospheric Administration (NOAA), National Center for Environmental Information (NCEI), formally the National Climate Data Center, the FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Hurricane/Tropical Storm History of Occurrence

Hurricane / Tropical Storm Date and DR #	EVENT	LOCATION	EXTENT
8/27/2011 - 9/2/2011 (DR 3338 VT) (DR 4022 VT)	Hurricane Irene Tropical Storm Irene	State-wide	5-7 inches rain across Orange County; 3-4 inches of rain in Town of Orange; flash flooding, fluvial erosion; power outages; downed trees; property and crop damage; significant damage to roads and bridges. Winds 43 knots. Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet). Town of Orange federal share obligated $7,125.58. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage ((approx. $500. million statewide vs. $350. million (1927 in 2010 dollars)). There were nearly 2400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene.
9/16/2009 - 9/21/2009 (DR 1307 VT)	Tropical Storm Floyd	State-wide	3 - 6 inches of rain state-wide; 5 1/2 to 6 1/2 County-wide. Montpelier flood gauge at 9.3 feet. High winds, 51 knots reported in Orange County. Town of Orange federal share obligated was $27,766.54. Strong winds combined with saturated soils from heavy rain resulted in many trees and power lines being blown down. A death occurred when a tree fell on a mobile camper in Randolph. Power outages were reported, especially in Randolph, Bradford and Wells River. Schools were closed in Bradford and Wells River. The annual "World's Fair", held in Tunbridge, Vermont was closed due to weather and power outages.
8/9/1976	Hurriane Belle	State-wide County-wide	intense rains over much of the state, numerous power outages. Detailed rainfall and power outage data are unknown for this event. Montpelier flood gauge at 12.31 feet.
9/22/1938	Hurricane ("Long Island Express")	State-wide	The Great New England Hurricane hit Vermont as a Category 1 storm. High winds severly damaged trees, power lines and buildings. Montpelier flood gauge at 14.11 feet. Detailed rainfall and power outage data are unknown for this event.

The most recent tropical storm to reach Vermont was Tropical Storm Irene in August of 2011. A federally declared disaster resulted (DR 4022 VT). The state saw up to 11 inches of rain with the heaviest rainfall occurring in the mountains of central and southern Vermont. The town of Orange received 3-4 inches of rain on August 28 and overall during the storm 7.4 inches of rain fell on Orange. The Orange reservoir was 15 feet above normal levels. The Montpelier flood gauge was at 19.05 feet; flood stage is at 15 feet. Town-wide flooding, fluvial erosion, and flash floods resulted. Winds of 43 knots were reported in Orange County. This tropical storm caused major damage statewide with catastrophic flooding and fluvial erosion causing state and local roads to be devastated, washed out and closed with massive damage to the entire transportation network including bridges and railroads. Major property damage to the public and private sector with the destruction and damage to homes and businesses, infrastructure, and crops. Three deaths resulted from the storm with many people injured. Orange County received over 5 million dollars of damages. The federal share obligated to the Town of Orange was $7,125.58. Additional hazard mitigation grant funds were awarded to upgrade and expand the box culverts on George Street, Manning Rd, and Prechtl Rd and the work has been completed. See flood hazard section for further details.

In September of 2009, Vermont was hit with Tropical Storm Floyd and a federally declared disaster resulted (DR 1307 VT). This storm caused flooding and wind damage state-wide. Approximately 3,000 people were without power in the Central Vermont Region. About 7" of rain fell over Orange; however, flood impacts were offset by drought conditions from earlier in the year. The Montpelier flood gauge was at 9.3 feet. The federal share obligated to the Town of Orange was $27,766.54. There was one fatality during this storm (not in Orange).

Hurricane Belle brought intense rains to the state in 1976 resulting in numerous power outages. The Montpelier flood gauge was at 12.31 feet. In 1938, the hurricane known as the "Long Island Express" hit Vermont with devastating winds and up to 4 inches of rain. It was a fast moving hurricane that caused severe flooding, took out power lines, downed trees, and destroyed buildings. The Montpelier flood gauge was at 14.11 feet.

HURRICANE / TROPICAL STORMS OVERVIEW

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hurricane/ Tropical/ Severe Storms	Town Wide - Route 302 (east of the Village), George Street, Clement Rd, Emery Rd, Eastman Rd, Spencer Hill Rd, Provencher Rd, Manning Rd, Prechtl Rd, Bennett's Mill Rd, Smith Rd, Town Forest, Groton State Forest, Barre City Forest, reservoirs	Large trees, power lines, culverts/bridges, forested areas in town, crops, roads, tall buildings, steeples.	Irene - 7.4" rain, Lower Orange Reservoir – 1147 feet (normal 1132 feet), significant road/ culvert damage, power outages. Floyd – Wind gusts recorded at 31 mph, 7" of rain, Montpelier flood gauge at 14.11 feet	2011 damages in Orange County over 5 million in property damages. In Town of Orange: Irene – Federal share obligated $7,125.58 w/4 projects as well as HMGP funds. Floyd – Federal share obligated $27,766.54 w/6 projects	Likely

EXTREME COLD/WINTER STORM / ICE STORM

Vermont is known for its cold snowy winters and Vermont towns and their residents are generally equipped to handle this weather. It is when the winter weather becomes extreme that a hazard is created. Severe winter storms bring heavy snow loads, ice, damaging winds, dangerous wind chills, below zero temperatures, power outages, downed trees and power lines, collapsed roofs and buildings, stranded motorists and vehicles, and school closings.

A winter storm is defined as a storm that generates sufficient quantities of snow, ice or sleet to result in hazardous conditions and/or property damage. Ice storms are sometimes incorrectly referred to as sleet storms. Sleet is similar to hail only smaller and can be easily identified as frozen rain drops (ice pellets) that bounce when hitting the ground or other objects. Sleet does not stick to wires or trees, but in sufficient depth, can cause hazardous driving conditions. Ice storms are the result of cold rain that freezes on contact with the surfaces coating the ground, tress, buildings, overhead wires and other exposed objects with ice, sometimes causing extensive damage. Periods of extreme cold tend to occur with these events.

One of the major problems associated with ice storms is the loss of electrical power. Major electric utility companies have active, ongoing programs to improve system reliability and protect facilities from damage by ice, severe winds and other hazards. Typically, these programs focus on trimming trees to prevent encroachment of overhead lines, strengthening vulnerable system components, protecting equipment from lightning strikes and placing new distribution lines underground.

Wind chills can be life threatening. The wind chill temperature is how cold a person or animal feels when outside. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As wind increases, it draws the heat from the body through exposed skin and reduces the body's skin temperature and eventually the body's core temperature. Often times exposed skin can freeze within minutes of exposure.

Orange experiences frequent occurrences of severe winter weather, extreme cold temperatures, and ice storms. The chart of historical occurrences in this Plan identifies some of the more significant events from 2017 - 1998. Information to complete the history of occurrences was taken from the NOAA NCEI, FEMA Declared Disasters in Vermont database, the State of Vermont Hazard Mitigation Plan dated November 2013, and town records.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
3/31/2017	Winter Storm	County-wide Orange County	6 to 12 inches of a heavy, wet snow fell across the region. Significant snowfall accumulations above 1000-1200 feet. Scattered power outages and numerous vehicle mishaps.
3/14/2017 - 3/15/2017	Winter Storm	State-wide; Orange County	A major nor'easter with heavy intense snowfall. Total snowfall across Vermont was 12 to 36+ inches with northwest Vermont experiencing the heaviest snowfall. Snowfall totals across Orange County were largely 12 to 18 inches. . Blizzard to near blizzard conditions in areas. Numerous schools, businesses and local government offices closed for March 14th and 15th with numerous vehicle accidents and stranded vehicles
2/12/2017 - 2/13/2017	Winter Storm	State-wide; Orange County	6 to 12 inches of snow statewide with some localized higher amounts. Impacts were largely travel related with nearly all school districts closed on the 13th.
12/29/2016	Winter Storm	County-wide Orange County	6 to 12 inches of snow was observed in Orange County.
11/29/2016	Ice Storm	County-wide Orange County	Precipitation in the form of freezing rain moved into central and eastern VT around daybreak and lasted for several hours with less than one tenth ice accretion. Dozens of vehicle accidents and thousands of commuters stranded/impacted as state roads and Interstates 89/91 were closed or impassable in spots.
2/2/2015	Winter Storm/ Extreme Cold	State-wide; Orange County	Snowfall across Orange county was 6 to 12 inches. Cold temperatures only near zero degrees.
2/1/2015 - 2/28/2015	Winter Storm/ Extreme Cold	State-wide; Orange County	February 2015 record cold for much of VT. Recorded 15 to 20+ days below zero and on several days, dangerously cold wind chills of 30 below zero or colder occurred. Many communities witnessing the coldest month since December 1989 or January 1994. The average departure was 13 to 17 degrees below normal. Damage to infrastructure, frozen water mains, etc. totaled at least $1 million.
1/7/2015 - 1/8/2015	Extreme Cold	State-wide; Orange County; Town of Orange	Plummeting temperatures and brisk, strong winds (15 to 30+ mph) caused dangerously cold wind chills of 25 to 40 degrees below zero during the evening of January 7th into the morning hours of January 8th. Observed wind chills in the mountains ranged from 40 to 70 below zero. School closings and 2 hour delays. Actual morning low temperatures on January 8th were 15 below to 25 below zero in Orange county, including 25 degrees below zero at Corinth, 23 below zero in Brookfield, **22 below zero in** Newbury **and Orange,** 19 below zero in Randolph and Thetford and 18 below zero in Union Village.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
12/9/2014 - 12/12/2014 DR 4207 VT	Winter Storm	County-wide; Orange County	This storm was comprised of three phases. Phase 1 - (12/9/14) rain and wet snow changing to a heavy, wet snow; Phase 2 - (12/10/14) moderate snowfall in central and northern Vermont; and Phase 3 -(12/11 - 12/12 /2014) - scattered snow showers .Snow to water ratios of 8:1 or less accounted for snow-loaded trees that resulted in more than 175,000 power outages and numerous vehicular accidents. This was the 2nd most power outages due to weather in the state of Vermont. **Orange County:** Heavy, wet snowfall totals across Orange county ranged from 4 to 18 inches.
11/26/2014 - 11/27/2014	Winter Storm	County-wide; Orange County	Snowfall totals of 8 to 12 inches were common with 12 inches in Braintree, 11 inches in Randolph Center and 10 inches in Corinth. With holiday commuters, numerous vehicle accidents across the state.
3/12/2014 - 3/13/2014	Winter Storm	State-wide; Orange County	Heavy snow fall accumulation over two days with strong wind gusts up to 35-40 mph, considerable blowing and drifting of the snow. Snow mixed or changed to sleet and rain in southern Vermont. Numerous motor vehicle accidents, and school and business closures. Snowfall totals across Orange County: were generally 15 to 20+ inches.
2/13/2014 - 2/14/2014	Winter Storm	State-wide; Orange County	Two bands of heavy snowfall; snowfall rates of 1-2 plus inches an hour. Total snowfall ranged from 15 to 24 inches in central and eastern Vermont with the heaviest across the southern Green Mountains. Snowfall across Orange County was 12 to 18 inches. Hazardous travel, school closings
2/5/2014	Winter Storm	State-wide; Orange County	8 - 12 inches of snow fell across Orange county. Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel.
12/29/2013	Winter Storm	County-wide; Orange County	Orange County received 5 to 10 inches of wet heavy snow, especially in the higher terrain.
12/14/2013 - 12/14/2013	Winter Storm	State-wide; Orange County	A widespread 10 to 15 inches of snow fell across Orange county. Numerous vehicle accidents
3/19/2013	Winter Storm	County-wide; Orange County	6-12 inches of snow fell across the county, the lower amounts in the valleys and higher amounts above 1000 feet. There were an unusual high amount of vehicle accidents involving tractor trailers across portions of Vermont.
2/8/2013 - 2/9/2013	Winter Storm	State-wide; Orange County	This snowfall event was a two-part system across Vermont. The second event was a large, powerful Nor'easter. 6 - 15 inches of snow fell across Orange County with the higher totals across southern sections.
12/26/2012 - 12/28/2012	Winter Storm	State-wide; Orange County	This was the first widespread snowfall of more than 6 inches since March 2011.Snow fell heavily at times (snowfall rate of 1-2 inches per hour). Snowfall accumulations of 12 to 18 inches were common with 6 - 15 inches observed in Orange County.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
11/23/2011	Winter Storm	County-wide; Orange County	Snow mixed with freezing rain and rain at times, accounting for a heavy, wet accumulation. Snowfall accumulations in Vermont ranged from several inches in the Champlain Valley to 6 to 12 inches across central and eastern Vermont. Orange County: 5-10 inches observed. Numerous vehicle accidents during the morning commute. Isolated to scattered power outages w/ downed lines; bent and broken tree limbs.
3/6/2011 - 3/7/2011	Winter Storm Ice Storm	State-wide; Orange County	Mixed storm- rain to sleet to snow. Orange County snowfall amounts of 6 to 12 inches were reported as well as 1/4 inch of ice, especially Connecticut River valley. Most roads were impassable with numerous accidents and stuck vehicles with portions of Interstate 89 closed multiple times. Burlington Int'l Airport was closed from midday on the 6th to midday on the 7th. Nearly 10,000 customers lost electrical power, nearly all school districts were closed on the 7th along with local/state governments. Slightly more than a dozen dairy farms lost milk production due to trucks unable to reach farms and production facilities. Rapid snow melt and heavy rainfall accounted for ice-covered rivers to swell and cause ice flows. There were several reports of ice jams and flooding related problems in the Passumpsic, Missisquoi and Winooski river valleys.
2/25/2011	Winter Storm	County-wide; Orange County	Snowfall amounts of 6 to 10 inches were observed in Orange county.
2/5/2011 - 2/6/2011	Winter Storm Ice Storm	State-wide; Orange County	State-wide: quick-hit storm; snowfall rates up to 3 inches per hour. A heavy wet snowfall (8:1 snow/water ratios) of 6 to 12 inches occurred across the northern third of Vermont, 4 to 8 inches of snow and sleet with some freezing rain across the central third of Vermont and primarily sleet and freezing rain with a few inches of snow across southern Vermont. Orange County 6-9 inches snowfall accumulations. Several organized lines of thunderstorms containing snow, sleet or freezing rain that moved across the entire state between 830 and 10 pm EST. Snow depths (and Snow water equivalents) after this storm were generally 18 to 30 inches (4 to 6 inches in the valleys with 36 inches or greater (6+ inches) across the higher terrain. This resulted in heavy snow loads and nearly a dozen structure failures of garages, barns and carports. A few of these barn collapses injured or killed livestock
2/2/2011	Winter Storm/ Extreme Cold	State-wide; Orange County	Snowfall totals across Orange county = 10 to 15 inches. Snowfall rates in excess of 2 inches per hour at times, before ending during the evening. Snowfall totals of 10 to 20 inches were common across Vermont.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
12/26/2010 - 12/27/2010	Winter Storm	State-wide; Orange County	In Orange County snowfall totals of 6 to 15 inches with localized higher amounts, north winds of 15 to 25 mph with gusts approaching 40 mph caused blowing and drifting snow. Numerous vehicle accidents and some isolated to scattered power outages were witnessed.
2/23/2010 - 2/24/2010	Winter Storm	County-wide; Orange County	A heavy wet snow fell across Vermont that resulted in snowfall accumulations of 6 to 30 inches with the higher amounts in the higher terrain of central and southern Vermont. The weight of the heavy snow accounted for widespread power outages across the region that resulted in upwards of 50,000 customers without power. Some specific snowfall totals for Orange County include; 26 inches in Randolph Center and Brookfield
2/22/2009 - 2/23/2009	Winter Storm	State-wide; Orange County	Widespread heavy snows. Snow fall of 10 to 18 inches across much of central and eastern Vermont. Brisk northwest winds 10 to 20 mph with gusts to 30 mph resulting in considerable blowing and drifting of the snow which impacted travel across the region.
1/28/2009	Winter Storm	County-wide; Orange County	Snowfall accumulations generally 8 to 14 inches in Vermont with the higher amounts across the hilly terrain of central and eastern Vermont. Reported high snowfall amounts in Orange County of 13 - 17 inches. There were numerous reports of motor vehicle accidents throughout Vermont.
1/14/2009 - 1/16/2009	Extreme Cold	County-wide; Orange County	Temperatures dropped over 20 degrees within several hours. Temperatures averaged 20 to 25 degrees below normal values, which were already at climatological winter minimums. Surrounding communities got down to 29 below zero as recorded in Plainfield. Record cold daily temperatures were set on January 16th for the following sites; Morrisville-Stowe Airport with 32 degrees below zero, St. Johnsbury Fairbanks Museum with 30 degrees below zero, Montpelier-Barre Airport at 26 degrees below zero and Burlington International Airport at 21 degrees below zero. These extremely cold temperatures led to numerous cold weather related problems including numerous dead vehicle batteries and broken home/business water pipes.
1/7/2009	Winter Storm Ice Storm	County-wide; Orange County	Total snowfall accumulations were 6 to 10 inches in northern Vermont with no ice accretion and 4 to 7 inches in central and southern Vermont with up to 1/4 inch of ice accumulation. These wintry conditions led to numerous motor vehicle accidents as the storm occurred both during the morning and evening commutes.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
12/19/2008 - 12/21/2008	Winter Storm Ice Storm	County-wide; Orange County	12/19 & 12/20 Snowfall in the region reached 12 inches then a second significant snowfall accumulation of 6 to 10 inches across western Vermont with 10 to 18 inches across central and eastern Vermont occurred, leaving total snowfall of 2 - 2.5 feet. Vehicle accidents and snow removal resources were exhausted. Snowfall totals in excess of 24 inches within 36 hours led to blocked ventilation pipes, carbon monoxide injuries, and collapsed small farm structures due to the weight of the snow.
12/11/2008 - 12/12/2008	Ice Storm/ Winter storm mix	County-wide; Orange County	Freezing rain, freezing drizzle, and sleet across central and northern Vermont before it changed back to a brief period of snow. Combined snow and sleet accumulation in central and northern Vermont ranged from 5 to 9 inches along with a glaze coating of ice. Ice accumulation across southern Vermont ranged from one quarter to one half an inch. This storm caused hazardous driving conditions, numerous school closings, civic and government closings, and power outages.
12/8/2008	Extreme Cold	State-wide	Frigid temperatures of 5 above to 10 below zero along with brisk northwest winds of 10 to 20 mph with higher gusts at times. Wind chill readings during the early to mid-morning hours were 15 to 25 below zero across Vermont.
3/4/2008 -3/5/2008	Ice Storm	State-wide	Snow and sleet changing to freezing rain . Freezing rain accumulated around 1/4 of an inch across portions of Vermont. Strong winds which gusted to near 50 mph combined with accumulated ice on trees that resulted in scattered downed tree branches and limbs. School cancellations, scattered power outages and numerous vehicle accidents resulted from the very hazardous conditions.
2/26/2008 - 2/27/2008	Winter Storm	County-wide; Orange County	Snowfall accumulations across Vermont were 6 to 12 inches with localized amounts around 15 inches in favored northwest slopes. In addition, brisk northwest winds of 15 to 25 mph with higher gusts created blowing and drifting snow.
2/6/2008 - 2/7/2008	Winter Storm	County-wide; Orange County	Storm total snowfall across much of Vermont 10 to 16 inches with 6 to 10 inches closer to the Canadian border and 4 to 8 inches with some sleet and freezing rain along southern Rutland and southern Windsor counties. Snowfall amounts and intensity caused numerous vehicle accidents and school cancellations.
2/1/2008 - 2/2/2008	Winter Storm mix / Ice Storm	County-wide; Orange County	Significant wintry mix of snow, sleet and freezing rain across portions of north central and northeast Vermont with combined snow and sleet accumulations of 3 to 7 inches along with accumulating ice between 1/4 to < 1/2 inch. Hazardous road conditions, numerous vehicle accidents and multiple school, civic and government closings

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
12/16/2007 - 12/17/2007	Winter Storm	County-wide; Orange County	Storm total snowfall accumulations across Vermont were 8 to 18 inches. Regional high snowfall totals included 14 - 18 inches. Winds of 15 to 25 mph with stronger gusts accompanied the steadier snowfall that resulted in considerable blowing and drifting of the snow with greatly reduced visibilities.
12/2/2007 - 12/4/2007	Winter Storm mix snow/sleet/freezing rain	County-wide; Orange County	A mixture of snow, sleet and freezing rain. Wide-spread snowfall accumulations 6 to 12 inches across Vermont with localized higher amounts in favored upslope regions of the western slopes of the Green Mountains and higher elevations of northern Vermont. 16 inches reported in Orange County. Numerous vehicle accidents as well as cancellations of schools, businesses and civic organizations.
3/16/2007 - 3/17/2007	Winter Storm	County-wide; Orange County	Snowfall totals were generally 9 to 13 inches across Vermont.
3/9/2007	Extreme Cold	County-wide	Frigid temperatures 10 to 34 degrees below zero, which included record lows at the following three sites; Burlington, Montpelier and St. Johnsbury. Regional lows recorded 19 - 22 below zero.
3/6/2007 - 3/7/2007	Extreme Cold	State-wide; Orange County	Frigid temperatures along with blustery winds. Temperatures 5 to 30 degrees below zero. Winds 15 to 30 mph, dangerously cold wind chills of 20 to 40 degrees below zero. Regional lows reported 12 - 25 degrees below zero.
3/2/2007	Winter Storm mix	County-wide; Orange County	Combined snow and sleet accumulations across central and eastern Vermont 6 to 8 inches in the valleys, over 12 inches in upslope regions of higher terrain. Heavy wet snow and mixed precipitation created treacherous road conditions causing numerous vehicle accidents.
2/14/2007	Winter Storm/ Extreme Cold	State-wide	Heavy snow 15-35 inches across the state. Deep snow drifts 4 to 6 plus feet. Snowfall rates of 2 to 4 inches per hour and brisk winds of 15 to 25 mph with wind chill values of 10 degrees below zero or colder. Whiteout conditions at times, along with considerable blowing and drifting of the snow, making roads nearly impassable. The National Weather Service office in South Burlington set an all-time record 24 hour snowfall of 25.3 inches. Orange County recorded snowfalls of 21 - 31 inches. Numerous problems: blocked heat vents causing carbon monoxide poisoning sending dozens of people seeking treatment at area hospitals, vehicle accidents, cardiac arrests due to overexertion during snow removal, partial or total collapse of 20 or more barn roofs and the deaths of more than 100 cattle. Snow removal operations took several days and up to a week in some urban communities.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
1/25/2007 - 1/29/2007	Extreme Cold	State-wide	Extended period of extreme cold temperatures and wind chill factor. Temperatures 0 - minus 30 below zero with winds 10 - 15 mph creating wind chill factor of 25 - 40 degrees below zero.
1/15/2007	Winter Storm / Ice Storm	Orange and Windsor County	Snow mixed with sleet as it transitioned to freezing rain. Ice accumulation ranged from 3/8 to slightly over 1/2 of an inch. Snow and sleet accumulations were around 2 inches. Numerous vehicle accidents, and downed trees and power lines throughout the two counties.
1/1/2007	Ice Storm	State-wide	Freezing rain accumulated to between 1/4 to 3/8 of an inch across Vermont, resulting in slick roads and several vehicle accidents.
2/27/2006	Extreme Cold	State-wide	A combination of brisk winds and very cold temperatures produced wind chills of 15 to 30 degrees below zero.
1/15/2004 - 1/16/2004	Extreme Cold	State-wide	Wind chills during this period were generally between 25 and 45 below zero. Temperatures around state at -6 to -11 and -24 at the summit Mount Mansfield. Some sprinkler systems froze and burst in several area locations. One location on the University of Vermont campus resulted in 100,000 dollars of damage. Temperatures broke VT records.
1/13/2004 - 1/14/2004	Extreme Cold	State-wide	Wind chills were generally between 25 and 45 below zero.
12/15/2003	Winter Storm	Orange and Washington Counties	Heavy snowfall. Across both counties snowfall accumulations were generally 10 to 20 inches. Minor traffic accidents were reported.
12/06/2003 - 12/07/2003	Winter Storm	Orange and Windsor Counties	Steady heavy snow over two days. Snow accumulations were generally: between 12 and 20 inches in both Windsor and Orange counties.
1/4/2003	Winter Storm	Orange, Windsor, and Rutland Counties	Accumulations were generally between 10 and 20 inches. Brookfield (Orange county) reported 13 inches. Roads were treacherous. A few power outages were reported in Windsor county.
12/25/2002 - 12/26/2002	Winter Storm	Orange, Windsor, and Rutland Counties	Total accumulations ranged from 10 to 20 inches, with the heaviest amounts in the mountains. In Orange county, Thetford reported 14 inches. Local travel was difficult.
3/30/2001	Winter Storm	Orange, Washington, and Windsor Counties	Significant heavy wet snow fell across the area, especially across the elevated terrain with lesser amounts in the valleys. In general between 10 and 20 inches of snow fell. In Orange County, Brookfield reported 19 inches. Power outages and slippery roads with some accidents.
3/22/2001 - 3/23/2001	Winter Storm	County-wide; Orange County	Significant snow fell across the area. The snow was heavy and wet with power outages reported and a number of accidents. Snowfall was generally 10 to 30 inches with the greatest amounts in the mountains. In Orange County, Brookfield reported 23 inches.

Extreme Cold/ Winter Storm/Ice Storm Historical Occurrences

Winter Storm/Extreme Cold/Ice Storms Date and DR #	EVENT	LOCATION	EXTENT
3/5/2001 - 3/6/2001	Winter Storm	County-wide; Orange County	Generally, between 15 and 30 inches of snow fell. Many schools were closed and many towns postponed their Town meeting day. A number of accidents were reported including some on I-89
2/5/2001 - 2/6/2001	Winter Storm	Orange, Orleans, Caledonia Counties	Across the counties, generally 10 to 14 inches of snow fell, minor automobile accidents; barn roofs collapsed in the Orleans county due to the weight of the snow.
12/31/2000	Winter Storm	County-wide; Orange County	Storm total accumulations generally ranged from 7 to 12 inches.
3/21/1998	Winter Storm	County-wide; Orange County	Snow accumulations 12 to 20 inches. Numerous traffic accidents and brief power outages.
1/6/1998 DR 1201 VT	Ice Storm	County-wide; Orange County	Significant icing was generally restricted between elevations of 1500 and 2500 ft. Ice accumulations 3/4 of an inch or less. Regional impact: ice accumulations damaging tens of thousands of trees; downed power lines, several thousands with out power; farmers who lost electricity were unable to milk cows suffering loss of income and damage to cows. Automobile travel was negatively impacted due to road closures from ice and fallen trees. There were numerous traffic accidents. Indirect injuries were reported from carbon monoxide poisoning while improperly using generators. Falling tree limbs and other debris was a significant hazard during and after the storm .

During the many winter storms, ice storms, and extreme cold, Orange has experienced school closings, increased road maintenance, pressure on the town highway budget, power outages (from downed lines and extreme cold), downed trees and tree limbs, increase medical needs due to over exertion with clean up and snow removal, falls often with broken bones due to icy surfaces, vehicular accidents, collapsed structures from heavy snow and ice loads, frozen culverts and more.

To lessen the impact of snow, ice and sleet, and below freezing temperatures on the Town of Orange and its residents it is important that the community observe winter storm watches and warnings and take adequate preparations. The Town and State are well equipped and experienced to deal with winter conditions and snow/ice removal. Providing for the mass care and sheltering of residents left without heat or electricity for an extended time and mobilizing sufficient resources to clear broken tree limbs from roads, are the primary challenges facing community officials. The town successfully applied for a generator grant and was awarded federal dollars to purchase and install a generator at the Orange Center School to upgrade its capacity as the town's emergency shelter. The purchase and installation is scheduled to be completed by the fall of 2017. The Town encourages residents who are in remote locations to be equipped with generators and backup fuel, water, food, and medical supplies in the event of prolonged power outages and travel restrictions. In the event of an extended power outage, the Town is in the position to open its emergency shelter. Often, residents without power will seek family and friends to stay with during the duration of an outage.

Green Mountain Power and Washington Electric Coop, Inc. follow a regular tree-trimming schedule and line-clearing program that has reduced the number and severity of power outages in the community. The lack of power and telecommunications throughout the town is especially concerning for the most vulnerable populations; the elderly, disabled and medically dependent. Lack of access to power and telecommunication services can hinder response efforts.

The Town of Orange recently purchased a thawing machine to increase its capacity to handle frozen culverts and other town infrastructure. The Town equipment (trucks, plows, etc.) is maintained on a regular schedule and the Selectboard with the input from the Road Foreman, budget for equipment replacement.

Many of the impacts from these hazards can be reduced by using common sense and practicing preparedness measures such as staying off the snow and ice covered roads until they are cleared, having vehicles equipped with proper winter gear and snow tires, using moderation and resting when removing snow and cleaning up from a storm, keeping heating pipes cleared and well ventilated, keeping roofs clean of heavy snow/ice loads, checking on and helping the elderly and disabled residents of the community, and listening to the local weather forecast for storm updates. Participating in the free VTAlert system is highly encouraged and an important resource in emergency preparedness.

Extreme Cold/ Winter Storm/Ice Storm Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Probability
Winter Storm	Town-wide, 83% of all roads, utility poles and lines, Town Forest, Private woodlots/ timber stands, Groton State Forest, Barre City Forest, private residences and businesses.	Elderly & handicapped populations, remote structures, old/under insulated structures, public infrastructure and utilities, telecommunications, trees, school system.	*12/9/2014 - 12/12/2014 DR 4207 VT* 18 inches very wet heavy snow; *3/2011 event* 12+" of snow; *Feb. 14, 2007* event overall snow totals 18", wind chill 10º below zero;	12/9/2014 -12/12/2014 DR 4207 VT: statewide 175,000 power outages, roads closed, numerous accidents, schools closed, and building collapses. Feb. 2007 event: property damages for Orange county at $237,192.99.; severe winter storms impact- sheltering, travel, schools, plowing, highway budget, emergency services, power, and communications.	Highly Likely
Ice Storm	Town-wide, 83% of all roads, utility poles and lines, Town Forest, Private woodlots/ timber stands, Groton State Forest, Barre City Forest, private residences and businesses.	Elderly & handicapped populations, remote structures, old/under insulated structures, public infrastructure and utilities, telecommunications, trees, school system	*1/15/2007 –* 3/8 " – ½" ice accumulation, 2" sleet and snow accumulation. *1998 DR 1201 VT ¾ inch ice accumulation*	*1/15/2007* power outages, downed trees & power lines, vehicle accidents; *1998 DR 1201 VT - 6 counties including Orange county, <$6M damages, tens of thousands of trees damaged, economic losses to timber and dairy economy, power lines downs and thousands without power, road closures, CO poisoning, structural damages.*	Highly Likely
Extreme Cold	Town-wide, 83% of all roads, utility poles and lines, Town Forest, Private woodlots/ timber stands, Groton State Forest, Barre City Forest, private residences and businesses	Elderly & handicapped populations, remote structures, old/under insulated structures, public infrastructure and utilities, telecommunications, trees, school system	*February 2015 –* 15 – 20 days below zero with wind chill of -30 º below zero. *1/7/2015* – reported -22º below zero in Town of Orange; 1/15/2004 – 1/16/2004 - extreme cold statewide with -6º to -11º temps with wind chills at -25º to -45º below zero	*February 2015 –* $1M statewide property damage frozen infrastructure. frozen culverts 1/15/2004 – 1/16/2004 frozen pipes bursting waterlines and water related systems Data gap exists	Highly Likely

STRUCTURE FIRE

Structure fires are common in Vermont and a leading cause of deaths in the state. Despite mechanisms to prevent and alert occupants to a fire hazard, many structures are without working fire alarm systems or carbon monoxide detectors. Some, simply because the batteries have not been changed. The 2014 Braintree Hazard Mitigation Plan describes a structure fire in simple terms and it is included here. "Structure fires may occur at any point, and are typically initiated within a single fuel object. Smoke produced by the burning object forms a smoke plume and rises, creating a layer of smoke while also transporting heat to the smoke layer. Fire then spreads quickly by radiation from the flames, or from the smoke layer. Once other objects are engulfed, more smoke plumes are formed and heat radiates to other objects. Fire burns and moves across different materials depending on the material's composition, orientation, surface to mass ratio and air supply in the structure/room." Orange is most likely to have a residential structure fire since it is a bedroom community with a majority of housing structures present.

Orange relies on mutual aid from the fire departments of Barre Town, Washington, and Tri-Village on an as needed basis. The three surrounding fire departments offer the best coverage and fire protection to the Town of Orange based on Orange's topography and development patterns. Barre Town Fire Department provides service coverage to the western portion of Orange. The Washington Fire Department provides service coverage to the section of Town along Route 110. The Tri-Village Fire Department covers East Orange Village and much of the eastern portion of Town. The Town owns six dry hydrants. The Town does not have the capacity to support and operate their own department. The monetary cost and work force necessary to run a fire department is prohibitive. There is a lack of data on the actual number of calls and structure fires that have occurred in the Town of Orange. Barre Town is currently in the process of tracking calls by the towns they serve and will be able to provide data in the future that is specific to the Town of Orange. The nature of the majority of calls has not changed and remains as fire related incidents – chimney fires, smoke alarms, and carbon monoxide alarms.

Although many structures in Orange are less than 100 years old, many residents heat their homes with wood or pellet burning stoves. This coupled with the remote location of the majority of structures in the community and its rural character, increases the likelihood for property loss versus property damage. The reliance on providers outside of the community increases response time. All these factors leave Orange vulnerable to the impacts of structure fires. To date, there have been no large structure fires in the Town of Orange. The Town will capture and map, with GIS coordinates, the six dry hydrant locations when they perform their road and culvert inventory in 2017/2018. The town has explored the potential for future dry hydrant locations but developing new locations will be dependent upon site accessibility and securing grant funding. Currently there are no plans to develop additional dry hydrants.

Structural Fire Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Probability
Structure Fires	Town Wide, increased risk in village areas	Town and privately owned structures, especially 100 plus years old and of wooden construction; increased risk in structures that heat with wood or pellet burning stoves.	Data gap	$150, 000 per home based on Median grand list value (2012 figures); dependent upon structure and extend of damage and or loss.	Likely

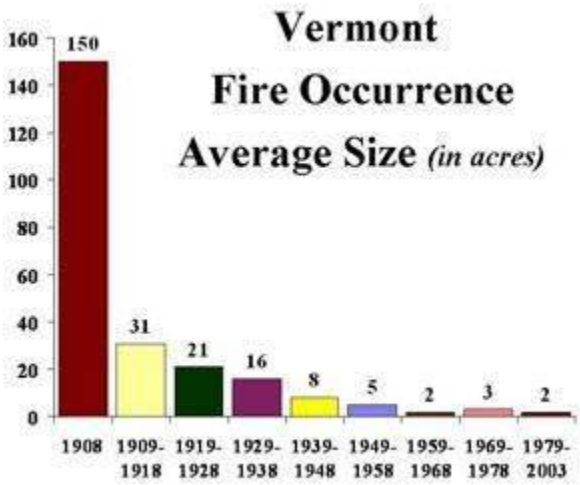
WILDFIRE/FOREST FIRE

The definition of a wildfire is the uncontrolled burning of woodlands, brush, or grasslands. FEMA classifies wildfires into four categories:

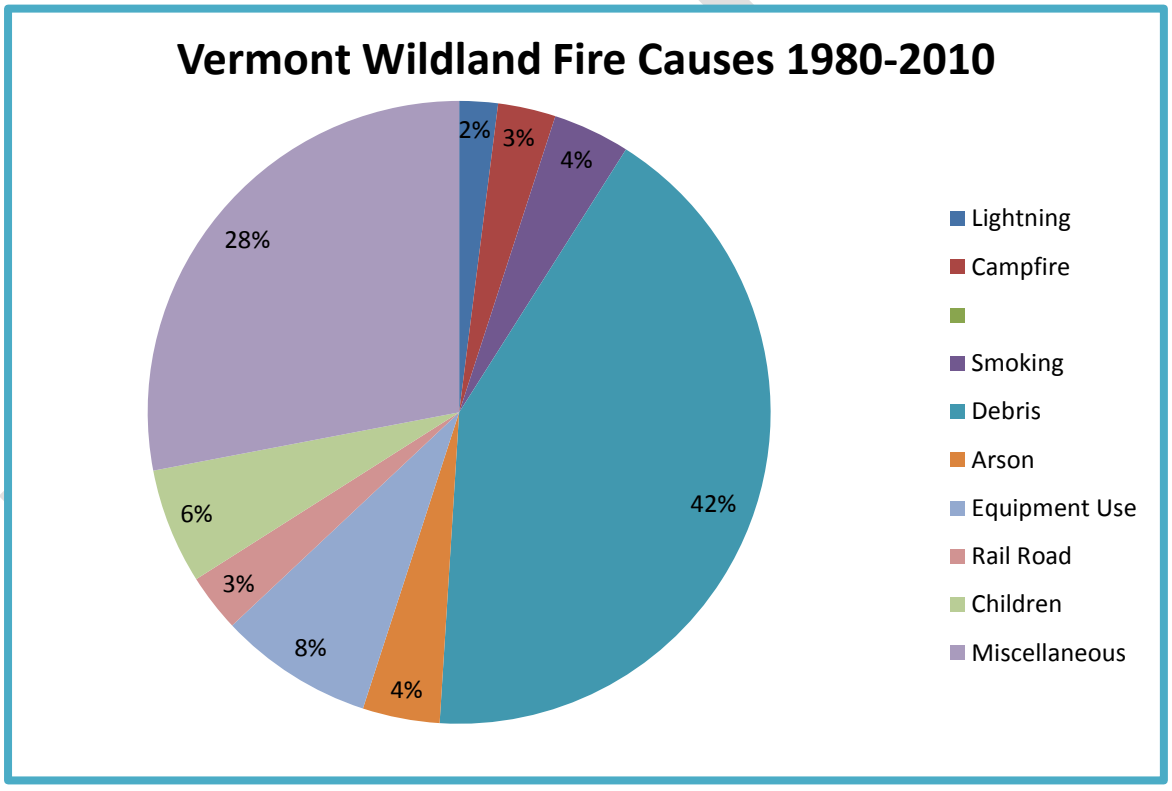
1. Wildfires – fueled by natural vegetation; typically occur in national forests and parks, where federal agencies are responsible for fire management and suppression.
2. Interface or Intermix Fires – Urban wildfires in which vegetation and built environment provide fuel.
3. Firestorms – Events of such an extreme intensity that effective suppression is virtually impossible; occur during extreme weather and generally burn until conditions change or the available fuel is exhausted.
4. Prescribed Fires and Prescribed Natural Fires – Fires that are intentionally set or selected natural fires that are allowed to burn for beneficial purposes.

Wildfires burn as a surface fire, ground fire, or crown fire. Surface fires burn slowly along the forest floor, killing and damaging trees. Ground fires burn on or below the forest floor and are usually caused by lightning strikes. Crown fires occur in the treetops or crown of the trees and spread quickly and effortlessly through the treetops. Crown fires are aided by wind. Wildfire causes can be natural (lightning, drought, extreme heat) or man-made (campfires, spark from a railroad track, smoking, arson, equipment).

In Vermont, wildfires are not a common occurrence. The Vermont State Hazard Mitigation Plan states there has not been a major wildfire in Vermont in the last 50 years. According to the Northeast Wildfire Organization, Vermont averages 200 - 400 fires a year with an average size of 1.5 to 2 acres. Back in 1908, the average fire size was 150 acres. The area of acres burned in Vermont has consistently gone down each year. The table to the right shows this decline and was taken from the Northeast Wildfire Organization website, http://www.northeastwildfire.org/vermont.



According to the Vermont Forest Parks and Recreation, burning debris is the most common cause of wildfires in Vermont. In Vermont, wildfires are most prevalent in the spring and late summer and early fall when conditions are most favorable. Drought conditions also increase the threat of wildfires. In 1903, Vermont experienced a devastating fire season, which prompted the state to pass legislation creating a town forest fire warden program. The forest fire warden program focuses on fire prevention, suppression, and fire safety at the local level. In 1939, an amendment to the law required the use of burning permits, issued by the local fire warden. In Vermont, forest fire wardens issue 20,000 burning permits annually. In 1966, 1999, 2000, and 2005 the state issued statewide bans on open burning due to the extreme vulnerability to the wildfire/forest fire hazard. In March of 2012, the threat of fire was severe due to the low humidity, warm temperatures, and strong winds prevalent in Vermont. The low occurrence of wildfires in Vermont is attributable to the local forest fire warden program, early detection measures, trained and equipped fire departments, and public education and outreach. The fires that do ignite tend to be small.



Reproduced from http://www.northeastwildfire.org/vermont

The Town of Orange actively participates in the Forest Fire Warden program under the VT Division of Forestry. The Commissioner of Forest, Parks, and Recreation appoints the Forest Fire Warden with the approval of the Selectboard for a five-year term, with unlimited reappointments possible. Orange Forest Fire Warden Fred Byrd has served in this capacity for ____ years. The area fire departments provide fire suppression services when needed. As the local fire warden, F. Byrd has total authority and jurisdiction over wildland fire suppression activities in Orange. He issues burning permits, "Permits to Kindle Fire," when conditions are safe to do so, monitors the daily fire danger level, and educates Orange residents on safe burning practices. On average, he issues ____ burning permits annually. He also has the authority to ban open burning in town when fire danger is high or when conditions are hazardous. The Division of Forestry offers annual training opportunities on the latest methods, technologies and trends in wildland fire. The state also provides F. Byrd with all the materials he needs to promote fire prevention and safe burning in the Town of Orange. The National Weather Service in Burlington VT posts daily fire danger levels and alerts. The fire warden program is instrumental in helping reduce and prevent the risk of forest fires in Orange, a heavily forested community. The town of Orange maintains a page on their website dedicated to the forest fire warden with information on safe open burning and the permitting procedure for residents in Orange. The fire warden contact information is posted there too. The Town of Orange does not have a Community Wildfire Protection Plan (CWPP).

Orange Forest Fire Warden: Fred Byrd, 354 Route 110, Barre VT 05641
Home: 802-622-0414, Cell: 802-595-1916
Email: greatbridgetroll@yahoo.com

The Orange Land Use map from the 2013 Town Plan indicates the majority of the town is forest land. There are over 17,280 acres of forested land in Orange. The forest is very dense and said to contain dense undergrowth, making it susceptible to lightning strikes. Given the volume of the Town's forested landscape in conjunction with dry and windy weather, and the potential for lightning strikes, Orange is vulnerable to wildfires and forest fires that can rapidly spread creating hazardous situations. Stress caused by disease, insect infestation, and changes in climate affect the health of the forest and can lead to die off, adding more fuel availability which can increase the risk, extent, duration, and severity of a wildfire or forest fire. . Although Orange has no large or small scale developments planned in the future, encroachment on forestlands presents greater threats of forest fire. As noted in the Municipal Plan, a buffer between future residential development and forest land should be maintained to reduce the threat of forest fire and also protect important watershed areas.

While a dry hydrant system does exist in Orange, much of the forestland is unreachable by road limiting firefighting measures. Private residences and timber related businesses are all located within forested areas. Additional impacts include loss of wildlife habitat and recreational amenities including hiking and snowmobiling trails. All impacting the local tourist economy and resident's quality of life.

VERMONT SPRING WILDFIRE STATISTICS		
10-year Average 2005 - 2014		
Official reports - reports have been verified by warden & VT FPR		
Month	# Fires	# Acres
March	9	29
April	62	142
May	19	30
TOTAL	90	201
Vermont Dept. Forest, Parks, & Recreation - 2015 Spring Fire Season Summary		

This table documents average wildfire occurrences over a recent 10-year period for the State of Vermont. Orange is identified in the 2010 Vermont Forest Resources Plan as a Town at Low to Moderate Risk for wildfire (Map 32: Vermont Wildfire Risk Assessment, May 26, 2010). Data on the magnitude of forest fires affecting Orange is not available. A data gap exists.

The 2010 State Forest Management Plan includes several goals regarding forest fire prevention. The Plan states that although the risk of forest fire is low in the State of Vermont, that the State still performs controlled burns on a small scale during the spring season. To help prevent local forest fires, the State works with local planning commissions to develop Community Wildfire Protection Plans (CWPP). These plans help towns to identify and mitigate wildfire risk. A common mitigation measure prescribed in the plan is through the use of controlled burns with onsite State support. A limited number of towns have a CWPP in the state. Orange does not.

Wildfire/Forest Fire Overview of Hazard

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Wildfire/ Forest Fire	Town Wide - Groton State Forest, Orange Town Forest, and Barre City Forest, private landowners.	Private homes on urban/forest interface, timber companies, recreational trails, and state, public and private forestland	potential - Over 17,280 acres of wooded area; To date #acres damaged or lost is unknown. Wooded area includes 306.4 acres of Orange Town Forest, 1,200 acres Barre City Forest, and 1,934 acres in Orange of the total 25,645 acres of the Groton State Forest, plus all private woodlands/ forestlands.	data gap, not known	Likely

6. Mitigation

6.1 Hazard Mitigation Goals and Strategies

The goal of this Plan is to update the local mitigation strategy that makes Orange more disaster resistant and reduces its risk from natural hazards. Further, it is the goal of this Plan to take actions to reduce or eliminate the long-term risk to human life and property from:

1. the natural hazard of flash flooding/flooding/fluvial erosion;
2. the natural hazard of severe weather (thunderstorms, lightning, high winds, and hail);
3. the natural hazard of hurricanes and tropical storms;
4. the natural hazard and man-made hazard of dam failure (Thurman W. Dix Reservoir Dam, East Barre Dam, beaver dams);
5. the natural hazard and man-made hazard of structure fire; and
6. the natural hazard and man-made hazard of wildfire/forest fire.

6.2 Orange Town Plan (May 13, 2013) Goals & Recommendations that Support Local Hazard Mitigation

The Orange Town Plan has a five-year life span and is currently under review for a 2018 plan update and adoption.

Section 1: Introduction to Orange Town Plan, Hazard Mitigation Plan, page 5.
The Orange Local Hazard Mitigation Plan Update of December 2011 as adopted and all subsequent adopted hazard mitigation plans are and shall be incorporated by reference and shall become a part of the Orange Town Plan.

Section 2: Orange Planning Goals,
Overall Goals and Objectives, p. 6.
The people of Orange desire to maintain the rural character of the community as much as possible while encouraging the economic well-being of its residents…The rural character is exemplified by … the vast amount of wooded and undeveloped areas, streams, ponds, and abundant wildlife; low volume of traffic; mixture of residential, agricultural, and small business uses…Growth that is good for the Town enhances the social, environmental, cultural, and economic values of our rural community. Growth and development shall not create a burden on the taxpayers' ability to support the Town.

Goal 1: To ensure development that maintains the rural atmosphere of the community and historic settlement pattern of compact village centers separated by rural countryside. p. 6.
Objectives:

3. Development that occurs in rural areas shall not have a negative impact on natural, cultural, and aesthetic resources. p. 6.
4. Business and industrial growth shall occur in areas adjacent to where business and industry now exist and/or where Town water and sewer are available or become available. p. 6.
5. Public investments, including the construction or expansion of the infrastructure, shall reinforce the general character and planned growth patterns of the area. p. 6.

Goal 4: Promote and maintain a safe, convenient, economic, and energy-efficient transportation network that respects the integrity of the natural environment, as well as the historical and esthetic value of the existing roads. p.7.

Objectives:

1. Improvement or expansion of public utilities and transportation shall occur in existing corridors to encourage desired development patterns. p.7.

Goal 5: To protect important natural and historic features of the Orange landscape, including woodland, wetlands, scenic sites, significant architecture, villages, wildlife habitats, view sheds, and agricultural land. p.8.

Objectives:

3. Develop additional policies and plans for the long-term protection of significant scenic roads and highways, waterways, and views; cultural and historic resources; and important resources and recreation lands. p. 8.

4. Development shall be prevented within floodplains that will cause damage to natural or manmade resources. p. 8.

5. Inventory and update the resources. p. 8.

Goal 6: To maintain and improve the quality of air, water, wildlife, and land resources. p. 9.

Objectives:

1. Insure that development in areas of natural, cultural, and scenic significance is not detrimental to the resources of the town. p. 9.

2. Protect and improve the water quality of the Town's rivers, lakes, ponds, streams, groundwater, and drinking water supplies. p. 9.

Goal 7: To promote the efficient use of energy through conservation and encourage the use of renewable energy resources, such as solar, wind, hydro and biomass. p. 8

Objectives:

2. Ensure that the design, location, and maintenance of existing and future transportation systems are consistent with the land use patterns recommended in this Plan. p. 9.

3. Promote alternative & energy efficient resources with residential development. p. 9.

4. Encourage the concentration of energy-intensive facilities, housing, and other uses to avoid the expense of distributing energy over large geographic areas. p. 9.

Goal 9: To strengthen agricultural and forest industries. p. 9.

Objectives:

1. Support the Current Use Program for agricultural and forest lands. p.9.

4. Encourage businesses and industries that add value to locally produce agricultural or forestry products. p.9.

Goal 11: To plan for, finance, and provide an efficient system of public facilities and services to meet present and future needs. p. 10.

Objectives:

1. Analyze current facilities and assess future needs to determine potential demands of infrastructure. p. 10.
2. Enact a Capital Program and Budget Plan for public utilities and facilities. p. 10.

Concluding statement paragraphs: p. 10.

"Successful implementation of the goals, policies and recommendations outlined in this Plan depends on the combined efforts of Town residents and local officials, as well as the resources of the Central Vermont Regional Planning Commission, and other regional, state, federal and private entities involved in land use planning activities.

At the state and federal levels, the Plan can be used to justify and prioritize the use of federal funds for community development, transportation improvements, natural resource protection and management, hazard mitigation, and other investments. In addition, Act 250 requires that developers shall show that projects conform to local and regional plans.

At the regional level, the Regional Planning Commission can review the Town Plan for compliance with the requirements of Act 200. Act 200 approval makes the Town eligible to apply for implementation funding from the State in the form of Municipal Planning Grants."

Some specific recommendations in the Orange Town Plan, 2013, that support local hazard mitigation are noted below.

- Maintenance and efficient use of the Orange Center School facility is imperative as it serves as the town emergency shelter. p. 26.
- Development on slopes >25% is discouraged. p. 27.
- Flooding prevents Winooski soils from being compatible with development. The Hadley-Winooski-Limerick association located along the Jail Branch and the Merrimac-Agawam-Windsor-Winooski soils located along the Waits River are subject to flooding and these too are not suitable for development. pp. 27-28.
- The Mapped Wetlands in Orange included on the National Wetlands Inventory Maps provide many benefits including flood regulation and storage and act as filters for sediment. Orange recommends the continued use of state and federal regulations to restrict activities in these areas. p. 29.
- Naturally vegetated buffer strips of at least 50-100 feet shall be left next to all rivers, lakes, and ponds, and at least 50 feet next to streams and wetlands, so as to filter pollution, prevent erosion, and protect fisheries and wildlife habitat. p. 30.
- Floodplains – p.30. –Flooding is capable of inflicting damage on inappropriately sited development in the mapped floodplains within Orange as depicted on the FEMA Flood Insurance Rate Maps but smaller unmapped tributaries are also at risk for flooding and are capable of inflicting damage on inappropriately sited development.

Policies:

1. Development plans for lands subject to periodic flooding must comply with local, state and federal flood hazard regulations in order to protect the health, safety and welfare of the public.

Recommendations:

1. Continually update and readopt the Orange Local Hazard Mitigation Plan (adopted 2011).

- The town recommends the use of cluster development and limited driveway length in the contiguous forested areas in an effort to minimize habitat fragmentation and parcelization in these large blocks of forested lands. p. 31.
- The town recommends the use of resource sensitive site design, clustering of development, landowner participation in the Land Use Value Appraisal program, promotion of value added industries, Land Trusts activities, and adherence to best acceptable management practices for the forested lands under private ownership to help protect them. p. 33.
- Development in the Forested areas, which is the majority of the undeveloped lands in Orange, "shall be undertaken in ways that protect their value and ensure the continued presence of healthy forest ecosystems in the Town, Cluster development shall be incorporated in these areas for the maximization of forest preservation. p. 43.
- Special Considerations p.43. – the town identifies special resources including floodplains, wetlands, and vegetated areas next to surface waters where development shall be avoided and negative impacts minimized. Also the areas of high elevations (>1,800 feet in elevation) with steep slopes (>25%) shall be protected from any development that will cause soil erosion. pp. 43 - 44.
- With regard to the "Pace of Growth," it is recommended to have policies that support necessary transportation improvements, especially road and bridge maintenance …to utilize existing infrastructure. Also, to mitigate with buffer strips, development adjacent to significant natural resources (waterways, large forested area,…). p. 45.
- The town recommends energy education and outreach to residents to reduce energy consumption in their homes, be more efficient, and promote methods for weatherization. p. 48.
- The town recognizes the importance of an efficient and safe road network to its residents, especially when emergency services are needed to reach residents. It recommends local roads be improved for negotiability in winter, protected from washout and economy of maintenance. It also recommends the placement of any new lines relocated to the road side be placed underground. p. 50. The town policy is to encourage the installation of underground utility lines for new construction. p. 53.
- Under Fire Protection, the town shall encourage landowners to install fire hydrants in newly constructed ponds. p. 60.
- The Planning Commission at the direction of the Selectboard shall prepare and present bylaws and other regulations necessary for the implementation of the Orange Town Plan. p. 60.

6.2 Proposed Hazard Mitigation Programs, Projects & Activities

The state emphasizes a collaborative approach to achieving mitigation on the local level, by partnering with ANR, VTrans, ACCD, Regional Planning Commissions, FEMA Region 1 and other agencies, all working together to provide assistance and resources to towns interested in pursuing mitigation projects and planning initiatives.

The mitigation strategies identified by the Town are listed in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the feasibility of the action, the Community's need to address the issue and its capacity to address the issue, the action's cost, and the availability of potential funding. The planning team used a mitigation action matrix worksheet to help evaluate and prioritize each mitigation action being considered. The template is attached to this plan. In evaluating potential benefit and or likelihood of successful implementation the team ranked each criteria as to being highly effective or feasible, neutral, or ineffective or not feasible. The Team considered each prioritization in the scope of the other projects, LHMP priorities and overall community priorities.

A High prioritization denotes that the action is either critical or potential funding is readily available and should have a timeframe of implementation of less than two years. A Medium prioritization is warranted where the action is less critical or the potential funding is not readily available and has a timeframe for implementation of more than two years but less than four. A Low prioritization indicates that the timeframe for implementation of the action, given the action's cost, availability of funding, and the community's need to address the issue, is more than four years. Highest priority projects also enjoyed strong community support and staff capacity was available to carry them out. Lowest priority projects were of lower risk to the community, had solutions that did not mitigate very much of the problem, or were extremely expensive or with no financial assistance available. Projects for which there was little community support or available staff capacity would also be low priority.

Orange understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The Town must also have a FEMA approved Hazard Mitigation Plan in effect.

HAZARD MITIGATED	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
All Hazards	Ensure Local Emergency Operations Plan is maintained and up to date	Orange Town Selectboard, Emergency Management Coordinator, Town Clerk.	High	local resources with support and assistance from CVRPC	Annually, March - May 1
All Hazards	Update Orange Town Plan before it expires in May 2018 & include a Flood Resiliency element which will identify flood hazards to Orange & will identify goals, policies, and recommendations to mitigate risks to public health & infrastructure	Planning Commission, SB	High	local resources, VCDP Municipal Planning Grant funds, CVRPC	June 2017 - May 2018
All Hazards	Complete purchase and installation of Generator at Orange Center School town-wide emergency shelter	Selectboard, EMC, Town Clerk	High	DEMHS grant award	July - September 2017
All Hazards	Explore Town of Orange participation in VT Alert system	Selectboard, EMC, Town Clerk	High	Vermont Emergency Management, Local resources	Summer 2018
All Hazards	Initiate school age programs on Emerg. Prep. Use VEM School Crisis Planning Team resources. **Student Tools for Emergency Planning** (STEP) is for 4th & 5th grade students & includes a series of videos called "Disaster Dodgers" & subject specific worksheets. **Be a Hero** includes educator lessons for grades 1-12, Disaster Master & Build a Kit web-based games, & parent aids create a family plan & emergency checklist.	School Principal , TC, Selectboard	Medium	Emily Harris, VEM, School Crisis Planning Team	September 2018 - September 2022; annually during school year

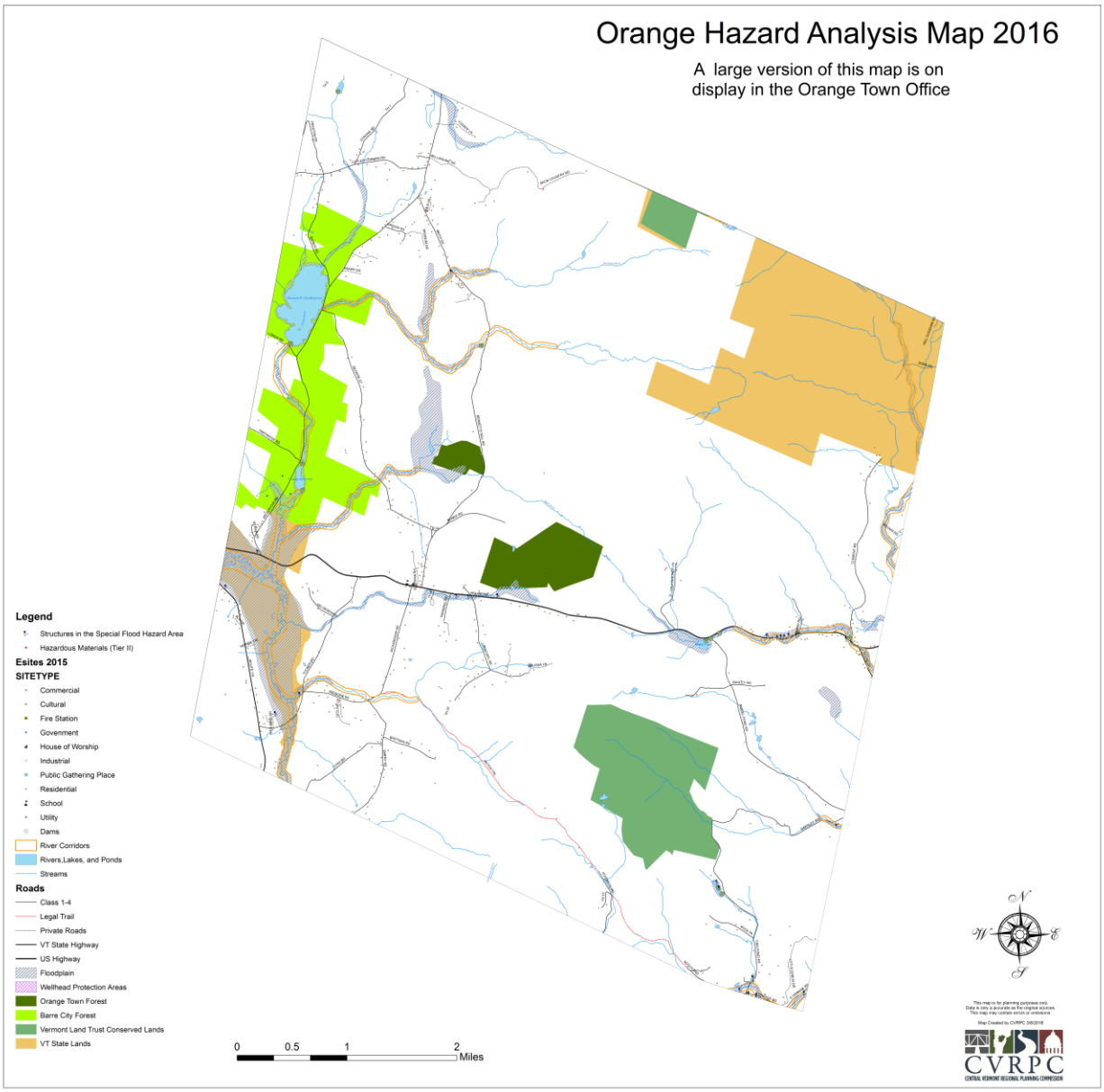
HAZARD MITIGATED	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
All Hazards	Obtain and keep copies available for distribution to local residents of the DEMHS publication booklet, "Family Emergency Preparedness"	Town Clerk	Medium	DEMHS /VEM, CVRPC	new printing Fall 2017
Flash Flood/Flood/ Fluvial Erosion; Hurricane/Tropical Storm; Severe Weather	Resurface and reditch Provencher Road, and work with the State of VT AOT to solve the problem of chronic flooding at the bottom of the road across state-owned land, Route 302.	Selectboard, Road and Foreman	High	AOT state road funds	*waiting on state funding; Fall 2017 - Spring 2019*
Flash Flood/Flood/ Fluvial Erosion; Hurricane/Tropical Storm; Severe Weather	Develop a Road Inventory Plan for the Town of Orange: perform road surface management inventory which includes connected roads inventory, culverts, bridges , ditches, road surface, road erosion, causes and	Road Foreman and Orange Town Selectboard	High	Better Roads grant, category A; 2016 Municipal Roads General Permit; CVRPC; Ditch Maintenance Program AOT.	summer 2017 - summer 2019
Flash Flood/Flood/ Fluvial Erosion; Hurricane/Tropical Storm; Severe Weather	repair road and repair and/or replace 3 culverts washed out on Emery Rd due to July 2, 2017 storm. Restore travel	Road Foreman, Town Road Crew and Orange Town Selectboard	High	FEMA PA if declaration happens; AOT Emergency funds, local funds (damage estimate $25 K - 30 K)	July - August 2017
Flash Flood/Flood/ Fluvial Erosion; Hurricane/Tropical Storm; Severe Weather	Consider adopting River Corridor regulations, which will incorporate VT ANR's River Corridor Map. These regulations will help residents and planners know what land is necessary for riparian functions and it will prevent the threat to current and future infrastructure.	Selectboard, Planning Commission, with input from Road Foreman, and EMC.	Medium	Local resources, CVRPC Water Quality grant award, Ned Swansberg CFM, ANR River Corridor Program	Fall 2017 -fall 2019 (initial drafting; regulation completion dependent upon Vermont release of river corridor maps)

HAZARD MITIGATED	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Severe Weather; Flash flood/Flood	repair Provencher Road and Little Pond Road from storm damage of July 2-3; washout; restore travel	Road Foreman, Town Road Crew and Orange Town Selectboard	High	FEMA PA if declaration happens; AOT Emergency funds, local funds (damage estimate $300 & $500)	July - August 2017
Severe Weather; Extreme Cold/Winter Storm/Ice Storm	Work with Barre City to purchase small piece of land near intersection of Lords Road and Reservoir Road to straighten out the curve, deemed a High Risk Rural Road area; high accidents but undocumented; need to develop a measure to document high accident counts to satisfy eligibility criteria in program.	Selectboard, Road and Foreman	Medium	CVRPC TAC, AOT, traffic accident counter or install video camera to record accidents	2021 - 2022; *requires data to bring to TAC for consideration for placement on state priority list*
Extreme Cold/Winter Storm/Ice Storm; Severe Weather; Hurricanes/Tropical Storms	Work with Green Mountain Power, Inc. and Washington Electric Coop, Inc. to continue regular tree line trimming and cutting along power lines throughout their service area to ensure clear and maintained utility corridors and to protect all customers, town and utility infrastructure. (preparedness/mitigation)	Selectboard, Road Foreman	Medium	Utility resources, local resources	Annually; fall or spring when leaves are off the trees is the best time to cut.
Structure Fire; Wildfire/Forest Fire	Develop one - two additional dry hydrant site in rural area of Town to increase protection from fire for residents and infrastructure.	EMC and Town Selectboard with consultation from Troy Dare, VACD	Low	Rural Fire / Wildfire Protection grants NFS; VACD rural water supply grants, CVRPC	Winter 2019 - Summer 2020

HAZARD MITIGATED	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Structure Fire; Wildfire/Forest Fire	Gather GIS data points on all dry hydrants for incorporation into Town data set and map productions. This will assist in emergency response and provide an historical record of the dry hydrant system in Town.	EMC and Town Road Foreman	Medium	CVRPC, Municipal Roads General Permit, local resources.	summer 2017 - summer 2019 *(gather points while doing field work for Road Inventory Plan)*
Wildfire/Forest Fire	Purchase two-way radios for Orange Town Fire Warden and assistant to enhance communication capabilities and increase efficiency with response in an emergency.	Selectboard, Orange Town Fire Warden, Town Clerk	High	local resources, VT Association of Conservation Districts, George Aiken Resource Conservation & Development Grants, HEMG, Rural Fire / Wildfire Protection grants NFS.	Winter 2018/Spring 2019 to Summer/Fall 2019
Wildfire/Forest Fire	Budget for and Update the 1999 Town Forest Management Plan	Selectboard, Town Clerk	Medium	local resources, FPR UVM Extension Service, Orange County Forester (David Paganelli).	Fall 2019 - Fall 2020
Dam Failure	Meet with Dam owners to discuss maintenance, EAP, and evacuation procedures. Add Orange to Notification Contact list and emergency procedures flow chart in EAP for both dams. Open lines of communication between dam owners and the Town.	Orange Town Selectboard, EMC, TC, Road Foreman, School Principal	Medium	local resources, CVRPC, ANR Dam Safety Program, VEM Critical Infrastructure Planner, Barre City	At each update of EAP public participation process; Spring 2018 initial meeting.
Dam Failure	Attend trainings and seminars on Dam Safety provided by the state, Army Corp of Engineers and CVRPC, as offered.	Orange Town Selectboard, EMC, TC, Road Foreman, School Principal	High	ANR Dam Safety Program, VEM Critical Infrastructure Planner, local resources	September 2017, Waterbury VT

Attachments

Page


Orange Hazard Analysis Map 2016
A large version of this map is on display in the Orange Town Office
Legend
Structures in the Special Flood Hazard Area
Hazardous Materials (Tier II)
Esites 2015
SITETYPE
Commercial
Cultural
Fire Station
Govenment
House of Worship
Industrial
Public Gathering Place
Residential
School
Utility
Dams
River Corridors
Rivers,Lakes, and Ponds
Streams
Roads
Class 1-4
Legal Trail
Private Roads
VT State Highway
US Highway
Floodplain
Wellhead Protection Areas
Orange Town Forest
Barre City Forest
Vermont Land Trust Conserved Lands
VT State Lands
0
0.5
1
2
Miles
N
W
E
S
CVRPC
CENTRAL VERMONT REGIONAL PLANNING COMMISSION

Transportation Vulnerability Assessment Map 2016 to be inserted

Inundation Map three sheets to be inserted

Inundation Map three sheets to be inserted

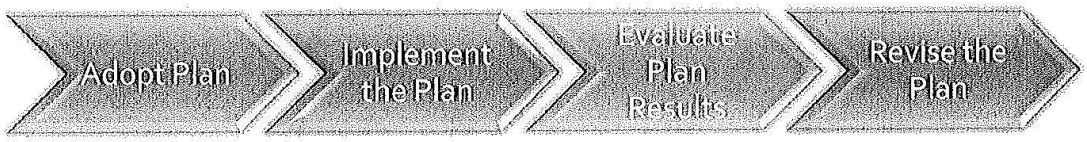
Inundation Map three sheets to be inserted

Hazard Ranking Methodology

Frequency of Occurrence Probability	**Warning Time** – amount of time generally given to alert people of a hazard	**Potential Impact** – Severity and extent of damage and disruption
1 = Unlikely < 1% probability of occurrence in the next 100 years. 2 = Occasionally 1-10% probability of occurrence per year, or at least one chance in the next 100 years. 3 = Likely > 10% but < 100% probability per year, at least one chance in the next 10 years. 4 = Highly Likely 100% probability of occurrence in a year.	1 = More than 12 hours 2 = 6-12 hours 3 = 3-6 hours 4 = None-Minimal	1 = Negligible Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, and potential for minor injuries. 2 = Minor Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, and potential for injuries. 3 = Moderate Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, and/or injury or fatalities. 4 = Major Severe property damage on a metropolitan or regional scale, shutdown of critical facilities, and/or multiple injuries or fatalities.

Mitigation Action Evaluation matrix template to be inserted

5-Year Plan Review/Maintenance



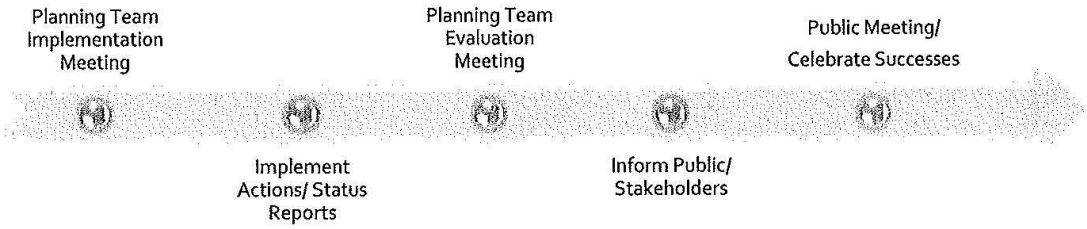
- Brief local leadership on plan approval
- Formally adopt plan
- Publicize plan approval and adoption
- Celebrate success

- Confirm/clarify responsibilities
- Integrate mitigaction actions
- Monitor and document implentation of projects and actions
- Establish indicators of effectiveness or success

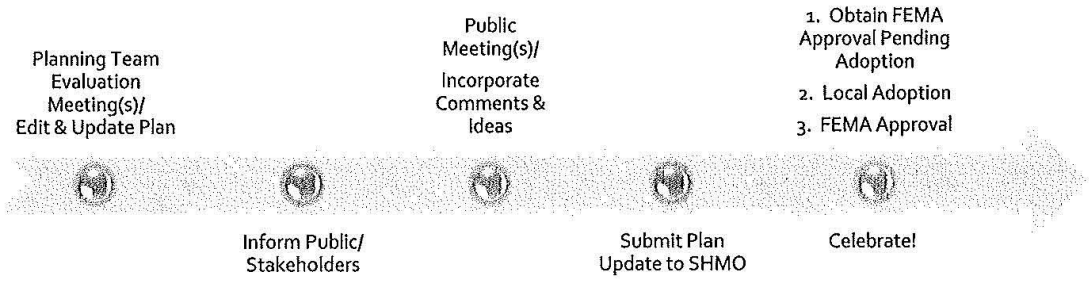
- Effectiveness of planning process
- Effectiveness of actions
- Document success & challenges of actions
- Update and involve community
- Celebrate successes

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

After Plan Adoption-Annually
Implement and Evaluate



Fifth Year, and After Major Disaster
Evaluate and Revise



Certificate of Adoption

The Town of Orange
Select Board
A Resolution Adopting the Local Hazard Mitigation Plan
_____, 2017

WHEREAS, the Town of Orange has worked with the Central Vermont Regional Planning Commission to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, and identify strategies for mitigating future losses; and

WHEREAS, the Orange Local Hazard Mitigation Plan contains several potential projects to mitigate damage from disasters that could occur in the Town of Orange; and

WHEREAS, a duly-noticed public meeting was held by the Town of Orange Select Board on _____, 2017 to formally adopt the Orange Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that:

1. The Orange Select Board adopts the Orange Local Hazard Mitigation Plan.

2. The municipal officials identified in the Hazard Mitigation Activities Matrix (page 37) of this Plan are hereby directed to pursue implementation of the projects assigned to them.

_____
Chair of Select Board

_____
Member of Select Board

_____
Member of Select Board

ATTEST

_____
Orange Town Clerk