Orange Local Hazard Mitigation Plan Update
December 2011
Prepared by the Town of Orange and CVRPC

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1. Introduction

The impact of expected, but unpredictable natural and human-caused events can be reduced through community planning. The goal of this Plan is to provide an all-hazards local mitigation strategy that makes the community of Orange more disaster resistant.

Hazard mitigation is any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. 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.

Hazard mitigation strategies and measures alter the hazard by eliminating or reducing the frequency of occurrence, avert the hazard by redirecting the impact by means of a structure or land treatment, adapt to the hazard by modifying structures or standards, or avoid the hazard by preventing or limiting development.

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2. Purpose

The purpose of this Local Hazard Mitigation Plan is to assist the Town of Orange in recognizing hazards facing the region and their community and identify strategies to begin reducing risks from acknowledged hazards.

Orange strives to be in accordance the strategies, goals and objectives of the State Hazard Mitigation Plan, 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 2011 Orange Local Hazard Mitigation Plan is an update of the 2007 plan. The plan has been reorganized and new sections have been added regarding:

- Plan Update Process
- Plan Maintenance
- Update of dam, flooding, severe storms, winter storm, wind, forest fire, structure fire hazards
- Updates of Local Areas of Concern Map
- Status update of 2007 mitigation strategies
- Identification of new mitigation strategies

3. Community Profile

The Town of Orange is located within the northeast corner of Orange County. It is bordered to the north by the Washington Country Town of Plainfield and the Caledonia County Town of Groton. To the east and south are the Orange County towns of Topsham and Washington respectively; and to the west is Barre Town of Washington County.

Comprising of rural mountainous terrain the Town of Orange covers 39.02 square miles and is predominantly located within the Winooski Watershed. The eastern portion of the town drains into the Steven, Wells, Waits and Ompompanoosuc Watershed. Mountains in the northeastern quadrant of the town reach elevations of over 3,000ft and give way to rolling hills, river valleys and wetlands in the southwestern quadrant. 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. Other smaller tributaries occur along the western slope. A number of other tributaries flow from the eastern slope of town before entering the Waits River."

The major transportation route through Orange is Vermont Route 302. The Orange Town Plan states that 302 "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.

According to US Census data the population of Orange in 2010 was 1,072 people living in 425 households. The population increased by 11% from 2000 to 2010. Two village centers exist in Orange. Orange Village is located in the west central region of the Town and is bisected by Route 302. It is host to a number of residential and commercial buildings, including the Town Hall and the Orange Center School. East Orange Village, located in the southeastern corner of Orange is less developed and comprised of mostly residential building.

According to the Orange Town Plan "Orange is a community in transition," as it strives to maintain its rural character, like the neighboring towns in Orange County, it feels the development pressure of the neighboring Washington County towns. Many residents commute to neighboring town for work. The population density is 27.5 people per square mile. Residential development is scattered sparsely throughout the Town. The Town does not have zoning and has had 3 new smaller subdivisions since the last mitigation plan. Orange foresees development to continue to be scattered rural residential. There are no pending commercial or residential developments.

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. There is a small municipal system with two wells which supports one house, the elementary school, the Town Hall, and the Town Clerk's Office. Disposal of wastewater is treated via individual sub-surface sewage disposal systems.

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. According to the *Washington Town Report,* dated December 31, 2006, the Washington "Fast Squad" responded to a total of twelve (12) calls in Orange during 2010. 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 and mass care trailer is owned by Barre City and is located at the East Barre Fire Station.

The 2005 Town Plan includes a description, discussion, and goals in regards to development on steep slopes, site design, and emergency services. The Town does not have Zoning By-Laws or a Subdivision Ordinance. The Town of Orange has a flood hazard by-law and an approved Rapid Response Plan that was adopted in 2006.

4. Planning Process and Maintenance

4.1 Planning Process

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Orange Local Hazard Mitigation Plan process. Rita Bisson, Town Clerk, contacted CVRPC to set up a hazard mitigation meeting. CVRPC sent Town-Specific hazard mitigation material for review. After assessing the material, Rita and CVRPC staff held a meeting along with members of the community on November 28, 2011 at the Municipal Offices. The committee for the 11/28/2011 was formed in an ad hoc manner to update the plan. For the next update, a committee will be formed in a similar manner with members from the planning commission, select board, road crew, and emergency services. The Orange Hazard Mitigation Meeting focused on assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities.

Attendees included:

- Lee Cattaneo, Orange representative on TAC
- John Barnes, Road Crew
- Shannon Davenport, Orange resident
- Francis Davenport, Orange resident
- George Wild, Select Board
- Brian O'Meara, Select Board
- David Childs, Select Board

- Rita Bisson, Town Clerk/Treasurer
- Jeff Booth, Road Crew
- John Spencer, Road Foreman
- Jennifer Mojo, CVRPC

The meeting indicated that the Town is most vulnerable to dam failure, flooding, hurricane/severe storms. Moderate threat hazards were identified as winter storms, high winds/power failure, structure fires and forest fires. Previously identified hazards include flooding, dam failure, high wind and winter storms. Winter storms and high winds are now considered moderate threat hazards because of town wide changes that have occurred over the past 3 years. Winter storms are no longer considered a worst threat because of improved funding and machinery for plowing and winter road maintenance. High wind events are no longer considered worst threat because of improved tree maintenance along power line corridors and an improved grid system by the power companies. Orange is making flood mitigation projects a priority as flooding is the most common and damaging event.

Once the draft was updated, CVRPC placed a notice for public comments of the draft update on the CVRPC blog and newsletter, Orange Center School, and telephone post at Rolands. The draft update was also available was at Orange Municipal offices and by request from CVRPC for public review and comments from 12/12/2011 to 12/29/2011. No comments were received for this update of the plan. In the future, public comments submitted will be reviewed by the Town Clerk (and CVRPC Staff dependant on funding) and attached as an appendix. The announcement of the draft update in the CVRPC newsletter reached over 150 people and businesses in the Region's 23 towns, including the adjacent towns of Barre Town, Plainfield and Washington. In the future, the draft plan will be made available during Town Meeting Day and local meetings with State and local officials to allow for more public comment and review. Once the plan is conditionally approved by FEMA, the plan will go before the Select Board for adoption.

4.2 Plan Update Process

The Orange Local 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 2008. The 2011 update is intended to be submitted as a single jurisdiction local mitigation plan.

The current plan is an extensive update of the 2008 plan. Below is a list of the revisions that have been made from the past plan and the appropriate sections for reference. New hazards identified include non worst threat hazards of forest fire and structure fire.

General Updates

- General reorganization/restructuring of the plan according to future FEMA/VEM checklist
    - New sections added – 4.2 Plan Update Process, 4.3 Plan Maintenance, 5.2 Worst Threat Hazards – dam failure, flooding, severe storms 5.3 Moderate Threat Hazards – winter storms, high winds, forest fire, structure fire
- Update of all data and statistics using 2010 Town Report and US Census Data (Section 3)
- Revaluation, identification and analysis of all significant hazards (Section 5)

- Acknowledgment of implemented mitigation strategies since 2007 – see matrix below (section 4.2)
- Identification of on-going mitigation projects and strategies – see Existing Mitigation Programs, Projects and Activities section (section 4.2)

Hazard Analysis Updates (Sections 5 and 6)

- Updated location/vulnerability/extent/impact/likelihood table for each hazard to summarize hazard description (Section 5.1-5.3 – after each hazard)
- Review of Vermont Hazard Mitigation Plan (Section 5 – hazard analysis table)

Maps

- Review of 2007 Areas of Concern map and update of hazard location

Preparation for the meeting included a review of Orange's planning documents, including the Orange Municipal Plan (2005), Orange Rapid Response Plan (2006), flood hazard bylaw, Orange Annual Report, Stevens/Jail Branch Corridor Plan (2009), and the Waits River Corridor Plan (2008).

The following chart provides an overview of Orange's proposed 2007 local hazard mitigation actions along with their current status. Additionally since the 2007 plan, the Town is in the process of updating their flood regulations to be compliant with basic NFIP regulations to maintain NFIP compliance.

2007 Mitigation Action	2011 Status
Replace bridge on Reservoir Road	Replaced both Reservoir Rd bridge and Bisson Road Bridge to the reservoir in 2009 with FEMA and State funds ($143,665 - total for both projects)
Replace culvert on Lower Reservoir Road	Replaced 2011 - $7,000
Stabilize stream banks along Eastman Road, Fish Pond Road and George Street	Added rip rap to banks – performed in 2008
Purchase additional generator for the Orange Center School	Still interested, but lack of funding available
Cut back and maintain trees along power lines and road along Reservoir Road	Ongoing maintenance program by Town and power companies
Implement strategies to reduce the risk of beaver dam failures	Trappers are hired annually

Existing Hazard Mitigation Programs, Projects & Activities

The ongoing or recently completed programs, projects and activities are listed by mitigation strategy.

Community Preparedness Activities

- Emergency Operations Plan – updating 2011
- School Safety Evacuation Plan
- Mutual Aid agreement with surrounding communities

Insurance Programs

- Participation in NFIP

Land Use Planning/Management

- Municipal Plan, 2005 – working on update

Protection/Retrofit of Infrastructure and Critical Facilities

- Dry Hydrants - 6
- Shelters wired for back-up generator (one mobile generator for multiple sites) –
- Adoption of Vermont Agency of Transportation "Codes & Standards for Roads" – adopted new expanded standards in Spring 2011
- Culvert Survey - 2009

Public Awareness, Training & Education

- "What To Do Until The Ambulance Arrives" – a program for 8 – 10 year olds
- "Healthy Home Initiative" – awareness program for environmental and safety hazards at home

4.3 Plan Maintenance Process

The Orange Local Hazard Mitigation Plan will be updated and evaluated annually at a June Select Board meeting along with the review of the Basic Emergency Operations Plan. Updates and evaluation by the Select Board will also occur within three months after every federal disaster declaration and as updates to town plan/zoning and river corridor plans come into effect. The plan will be reviewed by the Select Board, Planning Commission, Town Clerk, and public at the abovementioned June Select Board meeting. CVRPC will help with updates or if no funding is available, the Town Clerk 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 Country School, Washington World newspaper and CVRPC newsletter and blog inviting the public to the scheduled Select Board (or specially scheduled) meeting. Additional stakeholders invited to the meeting will be the Orange Country School. Also invited in the future will be the VT Agency of Natural Resources (VT ANR), 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 Select Board

Monitoring of plan progress, implementation, and the 5 year update process will be undertaken by the Town Clerk and Select Board. Monitoring updates may include changes in community mitigation strategies; new town bylaws, zoning 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 Select Board meetings. After a five year period, the plan will be submitted for re-adoption following the process outlined the schematic found in the Attachments section.

Orange shall also consider incorporation of mitigation planning into their long term land use and development planning documents. It is recommended the Town review and incorporate elements of the Local Hazard Mitigation Plan when updating the municipal plan, zoning regulations, and flood hazard/FEH bylaws. The incorporation of the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/FEH bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing future Waits and Winooski River planning documents for ideas on future mitigation projects and hazard areas. Currently, those river documents do not address tributaries within Orange.

5. Risk Assessment

5.1 Hazard Identification and Analysis

The following natural disasters were discussed and the worst threat hazards were identified based upon the likelihood of the event and the community's vulnerability to the event. Hazards not identified as a "worst threat" may still occur. Greater explanations and mitigation strategies of moderate threat hazards can be found in the State of Vermont's Hazard Mitigation Plan.

Hazard	Likelihood [1]	Community Vulnerability[2]	Worst Threat
Avalanche/ Landslide	Low	No	
Dam Failures	Low	Yes	X
Drought	Low	No	
Earthquake	Low	No	
Extreme Cold/Winter Storm/Ice Storm/Power Failure	High	No	
Flash Flood/Flood/Fluvial Erosion	High	Yes	X
High Wind/no power	High	No	
Hurricane/Tropical Storm/Severe Storms	Med	Yes	X
Structure Fire	High	No	
Tornado	Low	No	
Water Supply Contamination	Low	No	
Wildfire/Forest Fire	Med	No	

The following hazards were found to be most significant in the Town of Orange:

- Dam Failure
- Flash Flood/Flood/Fluvial Erosion
- Hurricane/Tropical Storm/Severe Storm

Moderate threat hazards include:

- Extreme Cold/Winter Storm/Ice Storm
- High Wind/No power
- Structure Fire
- Forest Fire

[1] High likelihood of happening: Near 100% probability in the next year.
Medium likelihood of happening: 10% to 100% probability in the next year or at least once in the next 10 years.
Low likelihood of happening: 1% to 10% probability in the next year or at least once in the next 100 years.

[2] Does the hazard present the threat of disaster (Yes)? Or is it just a routine emergency (No)?

A discussion of each significant hazard is included in the proceeding subsections and a map identifying the location of each hazard is attached (See map titled *Areas of Local Concern.*) Each subsection includes a list of past occurrences based upon County-wide FEMA Disaster Declarations (DR-#) plus information from local records, a narrative description of the hazard and a hazard matrix containing the following overview information:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Type of hazard	General areas within municipality which are vulnerable to the Identified hazard.	Types of structures impacted	Magnitude of hazard: -Minimal; -Moderate; or -Severe[3]	Dollar value or percentage of damages	Likelihood of hazard occurring based upon past events: HIGH = 10% to 100% probability within the next year or at least once in the next 10 years. MED = less than 10% to 100% probability within the within the next year or less than once in the next 10 years.

5.2 Worst Threat Hazards

Flood/Flash Flood/Fluvial Erosion

Flooding/flash flooding/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 other. 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.

[3] -Minimal: Limited and scattered property damage; no damage to public infrastructure contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.
-Moderate: Scattered property damage (more than 50% destroyed); some major infrastructure damage; wider geographic area (several communities) essential services are briefly interrupted; some injuries and/or fatalities.
-Severe: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.

Recent History of Occurrences:

Date	Event	Location	Extent
8/28/2011	Flood/Tropical Storm	Statewide, Orange	Montpelier Flood gauge at 19.05 feet (flood stage is at 15 feet) – DR 4022
5/27/2011	Flash Flood	Orange, County Wide	Montpelier flood gauge at 17.59 feet, 3-5" of rain – DR 1995
8/02/2008	Flash Flood	Barre Town, Orange	No data – route 302 flooded
7/11/2007	Flash Flood	Orange, County wide	3-6" of rain in 2 hrs, DR 1715
4/14/2002	Flood	County wide	1-3" of rain across the county
12/17/2000	Flood	County Wide	3" of rain, $1 M in damages
9/16/1999	Tropical Storm Floyd	County Wide	Montpelier flood gauge at 9.30 feet, 5-7" rain county wide
6/27/1998	Flash Flood	County Wide	$2M in damages, 3-6" rain across county
7/15/1997	Flash Flood	County Wide	$500k in damages
1/19/1996	Flood; ice jam	County Wide	Montpelier flood gauge at 14.64 feet
8/10/1976	Flood	County Wide	Montpelier flood gauge at 12.31 feet
6/30/1973	Flash Flood	Barre Town	Montpelier flood gauge at 17.55 feet
9/22/1938	Flood, Hurricane	County Wide	Montpelier flood gauge at 14.11 feet
11/03/1927	Flood	County Wide	Montpelier flood gauge at 27.10 feet

Specific extent data for flood levels in Orange is lacking as the closest flood gauge is located in Montpelier. During Tropical Storm Irene, the levels of Orange reservoir 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 areas of concern 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, 23 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. As previous events have made clear, however, even areas beyond the NFIP designated 100-year floodplain may be vulnerable to flood related hazards. There are no repetitive loss properties in Orange. Orange has 3 active NFIP policies for a total coverage amount of $225,000.

The flood of July 11 and 12, 2007 is one of most significant flooding events in recent 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 include 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 ft culverts and head walls plus the loss of road surface on several roads.

In 2011, Orange roads and culverts were flooded during two events. In May, Orange was hit by a severe thunder storm. Roads that were damaged include:

- George St
- Clement Rd
- Emery Rd
- Eastman Rd
- Spencer Hill Rd
- Provencher Rd
- Manning Rd
- Prechtl Rd
- Bennett's Mill Rd
- Lord Rd
- 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.
On August 28, 2011, Orange received 3-4" of rain from TS Irene. Both Eastman and Emery roads held better during TS Irene. The Town received $60,000 from FEMA from the May floods and $8,000 from TS Irene damages

Because of May and Irene damages, the Town will be applying for hazard mitigation grant funds to upgrade and expand the box culverts on George Street, Manning Rd, and Prechtl Rd. The estimate to replace all three culverts is $200,000.

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 Local Areas of Concern Map (see attached) identifies areas that have experienced flooding in the past.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Flash Flood/ 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	Town road infrastructure: bridges, culverts and low lying roads.	TS Irene – water level of Lower Orange Reservoir 1147 (normal 1132 feet)	2007 flood damages= $115,163 2011 flood damages - ~$300,000	High

Hurricane/Tropical/Severe Storms

History of Occurrence (from NCDC website):

Date	Event	Location	Extent
8/28/2011	TS Irene	Statewide	~6" rain , Montpelier flood gauge at 19.05 feet (flood stage is at 15 feet)
5/27/2011	Severe Storm, flash flooding	County Wide	1" hail, 3-5" of rain, 50 knot winds
7/21/2008	Severe storms, flooding	County Wide	
8/25/2007	Severe Storms	Orange, County Wide	55 knot wind gusts, 1" hail
7/9/2007	Severe Storms, hail, flooding	Orange, County Wide	1"-2.75" hail
6/19/2006	Severe storms	County Wide	50 knot winds, downed trees and power lines
8/1/2005	Severe Storm	Orange, County Wide	1" hail, 55 knot winds
9/16/1999	Tropical Storm Floyd	Statewide	Tropical Storm
6/17/1998	Severe Storms	County Wide	
5/29/1998	Severe Storms	County Wide	50 knot winds, heavy rains, downed trees and power lines
7/15/1997	Severe Storms	County Wide	
8/4/1989	Severe Storms, Flooding	County Wide	
6/7/1982	Severe Storms	New England	14" of rain, $276 M damages
8/1976	Hurricane Belle	Statewide	Gale force winds, 2 deaths

7/3/1964	Hail	County Wide	1.5” hail
9/22/1938	Hurricane	Statewide	Category 1 force winds

Similar to flooding, the extent of severe storms is not well documented in the Town of Orange. The impact of storms is usually flood related. The worst flood event was the 1927 storm when the river in Montpelier was 12 feet above flood stage. Data from Orange is not available. During TS Irene, the Orange reservoir was 15 feet above normal levels. 7.4” of rain fell in Orange during TS Irene as documented from rainfall maps. Lesser but more regular flooding occurs in Orange, with generally 1 foot of water in areas designated on the areas of concern map. Wind extent from storms is not well documented as there is no monitoring station in Orange. Estimates for wind are gathered from county wide data off the NCDC website. In the future, Orange could consider installing a monitoring station to better gather data for wind events.

Hurricanes and tropical storms are violent rain storms with strong winds that have large amounts of rainfall and can reach speeds up to 200 mph. Hurricane 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, tropical storms, and severe storms is expected to increase with climate change.

The impacts associated with hurricanes and severe storms are mainly associated with flooding impacts. Damage locations from TS Irene and the May 28, 2011 storm events are outlined in the Flood/Flash Flood/Fluvial Erosion hazard section. There were no high wind impacts associated with the 2011 events.

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.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Hurricane/ Tropical/ Severe Storms	Town Wide for Wind impacts, Roads - Route 302 (east of the Village), George Street, Clement Rd, Emery Rd, Eastman Rd, Spencer Hill Rd, Provencher Rd, Manning Rd,	Large trees, power lines, culverts/bridges, fire station, village buildings	7.4” rain from Irene; Lower Orange Reservoir – 1147 feet (normal 1132 feet) Floyd – Wind gusts	2011 damages - ~$300,000	Medium

	Prechtl Rd, Bennett's Mill Rd, Smith Rd		recorded at 31 mph; 7" of rain		

Dam Failure

In addition to flooding events, dams exist in the Town of Orange. One major man-made dam, located in the northwest quadrant of town, located on the Thurman W. Dix Reservoir has been identified as "Dams of Concern" (see Local Areas of Concern Map). The Thurman W. Dix Reservoir has three dams located on it – top, middle and spillway. The spillway is a dam of concern and was damaged in the May 2011 rain event. The spillway is an earthen dam and has several slow leaks that leak onto the road below the dam. The A "Dam of Concern" is identified by the Agency of Natural Resources Vermont Dam Inventory (VDI) as a dam where failure or mis-operation will result in a high probability of a loss of human life and/or can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns. Currently, the State of Vermont does not maintain a database that delineates potential inundation areas and/or indication to the extent of possible impact. Additionally, when there are high level waters in the reservoir, inlet culverts to the reservoir become flooded. Dam inundation modeling for the Thurman W. Dix reservoir is not available. The extent of flooding that could occur is not available.

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." The Town hires trappers to control the beaver populations. There currently exists no history of dam failure in regards to the man made or beaver dams, but the potential exists.

The following matrix provides an overview of the hazard:

Hazard	Location	Vulnerability	Extent	Impact	Probability
Dam Failure	Thurman W. Dix Reservoir/Lords Road, several smaller private ponds	Roads, private property.	Thurman W Dix Reservoir capacity averages 1070 acre feet – max capacity 2280 acre feet	Dollar value or percentage unknown. No known recorded occurrences.	Medium

5.3 Moderate Threat Hazards

High Wind

Recent History of Occurrences (within Central Vermont, town specific data is not available)

- April 15, 2007 DR1698
- September 16, 1999 DR1228
- July 15, 1997 DR1184

High winds can come in the form of hurricanes, summertime thunderstorms and winter Nor'easters. High winds impact the rural community by downing timber crops and impacting transportation corridors and power utilities.

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 the town), the Orange Town Forest (306.4-acreas located on the north side of Route 302) and the Barre City Forest (1,200-acres surrounding the Thurman W. Dix and the Lower Orange Reservoirs) plus extensive tracts of privately owned timberland. The Orange Land Use map indicates the majority of the town is forest land.

High winds threaten the viability and productivity of the cash crop and could impact the local economy. High winds also threaten the town infrastructure and utilities. The Power generation of Washington Electric Cooperative and Green Mountain Power Corporation is based upon substations which are not set by jurisdictional lines. As a result, frequency and specific dates of power shortage/failure could not be attained. This level of detail could be provided in the future by working directly with the utilities in order to research this data. As mentioned above the majority of the town is forested and downed trees can make transportation corridors impassable and cut power service to town residents.

Hazard	Location	Vulnerability	Extent	Impact	Probability
High Wind	Town-wide	Timber (cash crop) and Town Utilities.	Over 17,280 aces of forested land	Dollar value or percentage unknown (data gap)	High

Winter Storm / Ice Storm

Snow and/or ice events occur on a regular basis. Recent significant events have included:

- January, 16 1998 – DR 1201
- December 31, 2000
- March 22-23 2001
- January 4, 2003
- February 14, 2006
- March 7, 2011

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.

By observing winter storm watches and warnings, adequate preparations can usually be made to lessen the impact of snow, ice and sleet, and below freezing temperature conditions on the Town of Orange. 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. Shelter locations include the Orange Center School. The Town encourages residents who are in remote locations to be equipped with generators and backup fuel supplies in the event of prolonged power outages and travel restrictions.

Despite frequent occurrences of significant winter/ice storms, Town residents are adequately prepared to face this type of events. Yet the Town of Orange is responsible for maintaining 83% of the roads within town boundaries and ensuring emergency vehicle access to all residences and providing clear passage for commuters in severe winter/ice storms can be challenging for the rural community.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Winter Storm/ Ice Storm	Town-wide, 83% of all roads.	Elderly & handicapped populations, remote structures, old/under insulated structures, utilities, trees	12+" of snow on March 2011 event; 22+" on Feb. 2006 event	Depends on severity – additional sheltering/ plowing/ emergency services costs for town	Medium

Structure Fire

About one third of the calls received in 2010 by Orange's fire department were 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. The remoteness and distance from fire and emergency services of many homes also increases the likelihood of a home being completely, opposed to partially, destroyed by a fire. To date, there have been no large structure fires.

Hazard	Location	Vulnerability	Extent	Impact	Probability
Structure Fires	Town Wide	Wood structures, especially older than 100 yrs, homes that use wood burning stoves for heat	Data gap	$150, 000 per home based on median grand list value	Med

Forest Fire

The Orange Land Use map from the 2005 Town Plan indicates the majority of the town is forest land. There are over 17,280 acres of forested land in Orange. Despite the absence of recent forest fires of significant size, the volume of the Town's forested landscape in conjunction with dry and windy weather has the potential to rapidly spread fire and create a hazardous situation. 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.

The State of Vermont does have a Forest Management plan in place which addresses forest fire concerns. 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 during the spring season. To help prevent local forest fires, the State works with local planning commissions to develop Community Wildlife Protection Plans. These plans help towns to identify and mitigate wildfire risk. A common mitigation measure prescribed in the plan is through controlled burns with onsite State support.

The Forest Division also runs the Town Forest Fire Warden program. This program requires towns to have appointed fire wardens. In Orange, the Fire Warden is Brian O'Meara and Key Man is John Barnes. The forest fire program focuses on prevention, fire awareness and fire fighter safety.

The greatest threat of a forest fire comes from human error – such as smoking, improper campfire etiquette or sparks from tree cutting equipment. However, lightning is also a threat as the forest is very dense and is said to contain dense undergrowth. Although Orange has no large or small scale developments planned in the future, encroachment on forest lands presents greater threats of forest fire. 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.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood
Wildfire/ Forest Fire	Groton State Forest, Orange and Barre City town forests	Private homes on urban/forest interface, timber companies, recreational trails	Over 17,280 acres of wooded area	Unknown – data gap	Medium

6. Mitigation

6.1 Town Plan (July 2005) Goals & Recommendations that Support Local Hazard Mitigation

- To support public investments in the construction or expansion of infrastructure such as fire and police protection, emergency medical services, schools, solid waste disposal, and others, to meet future needs, and to reinforce the general character and planned growth patterns of the town.
- To encourage safe, convenient, economic and energy efficient transportation systems that respects the integrity of the natural environment.
- To encourage safe, convenient, economic and energy efficient transportation systems that respects the integrity of the natural environment.
- To protect important natural and historic features of the landscape including air, water, wildlife, land resources and ridge lines from undue adverse impacts.
- To lay a foundation for town ordinances and bylaws that protects residents and the value of their land.

The next time the Town of Orange updates its Town Plan, it may consider adding additional mitigation goals. Additional mitigation goals could include:

- To take actions to reduce or eliminate the long-term risk to human life and property from natural hazards.

Specific hazard mitigation strategies related to the goals of the plan include:

- Ensure existing and future drainage systems are adequate and functioning properly
- Ensure that all residents and business owners are aware of the hazards that exist within Orange and ways they can protect themselves and insure their property
- Ensure that emergency response services and critical facilities functions are not interrupted by natural hazards
- Provide adequate communication systems for emergency personnel and response units
- Provide residents with adequate warning of potential hazards

6.2 Proposed Hazard Mitigation Programs, Projects & Activities

Hazard mitigation programs, projects and activities that were identified for implementation at the Town Local Hazard Mitigation meeting:

Hazard Mitigated	Mitigation Action	Local Leadership	Prioritization	Possible Resources	Time Frame
Flooding, Severe Storms	Upgrade and expand George Street Bridge	SB, Road Foreman	High	HMGP	1 year
Flooding, Severe Storms	Upgrade and expand Manning Street culvert	SB, Road Foreman	High	HMGP	1 year
Flooding, Severe Storms	Upgrade and expand Prechtl Rd culvert	SB, Road Foreman	High	HMGP	1 year
Severe Storms, Winter Storms, High Winds	Install 100 kw generator and transfer switch for Orange Center School	SB,	Med	EMGP	1-2 years
Flooding, Severe Storms, Dam Failure	Work with Barre Town to clean dam channel/reservoir around Nelson Brook inlet	Road Foreman	Med	Town Funds	2-3 years
NFIP Compliance	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	SB, PC	Med	Town, USDA	2-3 years
Emergency preparedness, Severe Storms, Winter Storms	Obtain Red Cross shelter certification for Orange Center School	SB	Low	EMGP	3-4 years
Emergency preparedness	Upgrade all town radios and town truck radios to narrowband	SB, Road Foreman	High	EMGP, PSIC/NTIA, USDA	<2 years until mandate

VEM also 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.

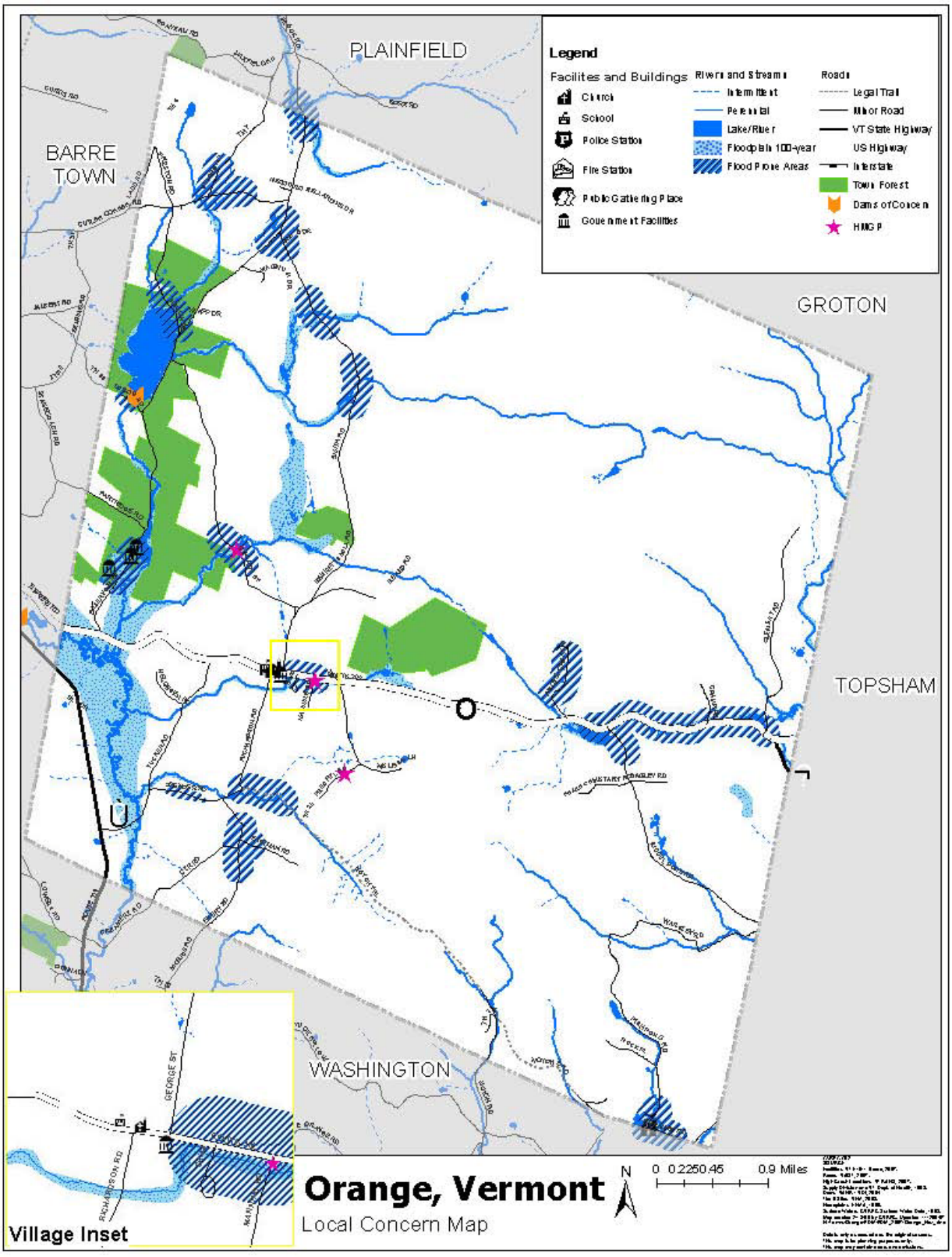
The mitigation activities are listed in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the Community's need to address the issue, the action's cost, and the availability of potential funding. The action's cost was evaluated in relation to its benefit as outlined in the STAPLEE guidelines.

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 as well.

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.

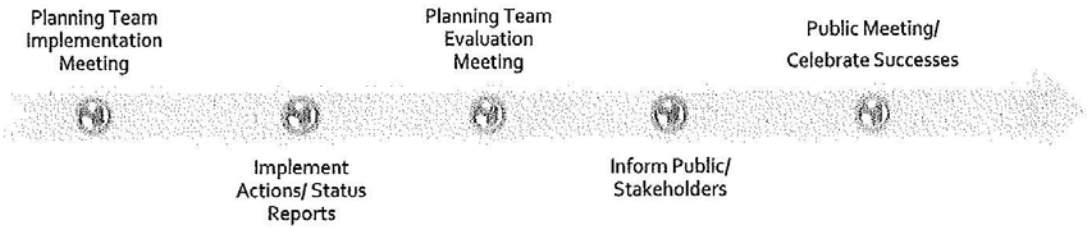
Attachments

- Areas of Local Concern Map
- 5 year Plan Maintenance and Review Process
- Town Resolution Adopting the Plan

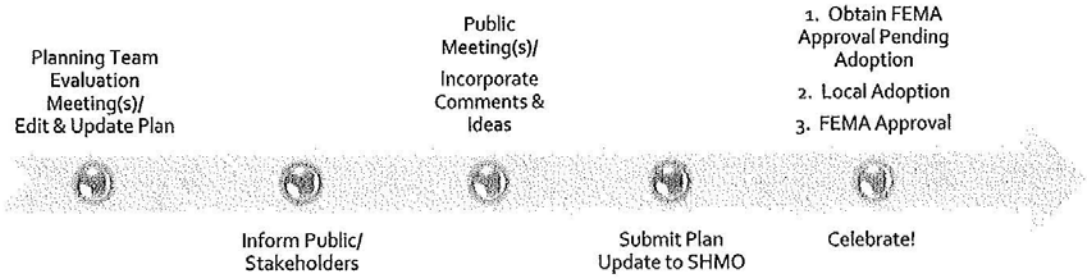

PLAINFIELD
BARRE TOWN
GROTON
TOPSHAM
WASHINGTON
Legend
Facilites and Buildings
Church
School
Police Station
Fire Station
Public Gathering Place
Government Facilities
Rivers and Streams
Intermittent
Perennial
Lake/River
Floodplain 100-year
Flood Prone Areas
Roads
Legal Trail
Minor Road
VT State Highway
US Highway
Interstate
Town Forest
Dams of Concern
HMGP
Village Inset
Orange, Vermont
Local Concern Map
N
0 0.225 0.45 0.9 Miles

5-Year Plan Review/Maintenance

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
_____ __, 2011

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 _____ __, 2011 to formally adopt the Orange Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Orange Select Board adopts the Orange Local Hazard Mitigation Plan.

_____
Chair of Select Board

_____
Member of Select Board

ATTEST

_____
Orange Clerk