# Waterbury Town and Village, VT Local Hazard Mitigation Plan
# December, 2011
# Prepared by the Town and Village of Waterbury 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 Local Hazard Mitigation Plan is to provide a local mitigation plan that makes the Town and Village of Waterbury 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.

## 2. Purpose

The purpose of this Local Hazard Mitigation Plan is to assist the Town and Village of Waterbury in recognizing hazards facing the region and the municipality and identify strategies to begin reducing risk..

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

## 3. Community Profile

The Town and Village of Waterbury are located in the northwestern corner of Washington County. Although the two are separate municipalities, the two are socially, economically, and politically intertwined. Village residents are also town residents, but not all town residents are village residents. Throughout this document, references to “Waterbury” include both the town and village; references to the “village” refer only to the incorporated area of Waterbury Village.

Waterbury is bordered by the Lamoille County Town of Stowe to the north, by Middlesex to the east, by Duxbury and Moretown to the south and by the Chittenden County Town of Bolton to the west. The area of Waterbury is 49.85 square miles and the landscape varies from prominent

mountains to broad river valleys. According to the Municipal Plan for Town & Village of Waterbury "the Green Mountain and Worcester Ranges, extending north and south, respectively define the town's western and eastern boundaries. Waterbury's settled areas are more gently rolling, except within Waterbury Village, which lies largely in the level floodplain of the Winooski River Valley." As like many New England towns and villages, much of Waterbury's historic commercial and residential structures were developed in the relatively flat floodplain areas adjacent to prominent waterways, such as the Winooski River and date back to the mid 1800's. Waterbury Villages Historic Downtown District is also listed on the *National Register of Historic Places*.

Elevations in town vary from around 400 feet near the Winooski River, to over 3,000 feet in the Worcester Range, to approximately 3,400 feet atop Ricker Mountain." The Town and Village of Waterbury lie entirely within the Winooski Watershed. The Winooski River runs from east to west and forms the southern boundary of the Town and Village. Mountain streams and brooks including the Thatcher Brook and Little River feed into the Winooski. The largest body of water is the Waterbury Reservoir located at the base of the Green Mountains in the eastern region of the town. Following the devastating flood of 1927 the Army Corps of Engineers constructed the Little River Dam thereby creating the 840-acre reservoir.

The majority of Waterbury's major transportation routes run parallel to the Winooski River, such as Route 2, Interstate 89 and the New England Central Railroad. US Route 100 is the municipalities other major thoroughfare which runs through a broad valley providing access to the Town of Stowe to the north. Much of Waterbury's commercial, retail and residential development is located along these transportation corridors. Waterbury has three main settlement areas where populations and services are concentrated – historic Waterbury Village, Colbyville (part of Waterbury Village), and Waterbury Center (unincorporated).

Waterbury Village, located at the intersection of Route 2 and Route 100 is the historic commercial, retail and residential hub of the town. It is home to the former Vermont State Hospital, a sprawling historic institutional campus comprised of almost 50 buildings, which is now the Waterbury State Office Complex. Prior to recent flooding from Tropical Storm Irene the Office Complex employed over 1,500 people. Waterbury Center village, located along Route 100, in relation, is a smaller yet defined historical settlement with a combination of retail, commercial and residential development.

According to the US Census, the population of Waterbury in 2010 numbered 5,094 living in 2,385 housing units. From the 2000 census, the population grew by 3.6%, but the number of housing units grew by 18.6%. Recent residential development continues to be scattered, low-density development within the Town's Medium and Low Density Zoning Districts. . Commercial development primarily occurs along Routes 2 and 100, and within the Village area.

Waterbury's public wastewater facilities serve land only within the Village of Waterbury. All other development relies upon on-site waste disposal systems. In regards to water supply, the municipal system serves the Village and portions of Waterbury Center. Supply sources include

three drilled wells in Waterbury off Sweet Road near the Stowe Town line and three surface water sources over the town line in Stowe. Source protection plans have been developed to prevent water supply contamination. Green Mountain Power (GMP) provides electricity for the entire Town and maintains three power substations and two hydroelectric facilities in or partly in Waterbury.

In regard to public safety the municipal plan states "the Village of Waterbury is patrolled by a police department, which also provides 250 hours of service to the Town under contract." According to the 2010 Annual Report of the Village and Village Officers of Waterbury the police department responded to 2,116 incidents which represents a 5% increase over 2009. There is one municipal fire department in Waterbury with two fire stations, one located on South Main Street in the Village of Waterbury and one located on Maple Street in Waterbury Center. Both stations provide dual response for calls in the Town and Village. The Fire Department also provides mutual aid assistance to surrounding communities as part of the Capital Fire Mutual Aid System. The Town Report indicates that the Fire Department responded to a total of 201 incidents in 2010. The Waterbury Ambulance Service Inc (WASI) provides 24-hour ambulance service to the Town. WASI owns two ambulances which are housed at the Ambulance Station in Waterbury Center. According to the municipal plan "due to a substantial increase in the number of calls in the area involving mountain or back country rescues, WASI members have been working with local firefighters to develop and train a Waterbury-based back-country rescue team."

The 2008 Municipal Plan includes a description and proposed implementation strategies in regards to preservation of historic and natural resources and protecting public safety. The Town and Village of Waterbury Zoning Amendments, dated March 30, 2011 contains Flood Hazard Regulations. Waterbury has developed an Emergency Operations Plan and approved a Rapid Response Plan in 2006. In response to the devastating effects of recent flooding from Tropical Storm Irene, the Federal Emergency Management Agency (FEMA) designated Waterbury for the development of a Long Term Community Recovery (LTCR) Plan. FEMA staff have been working with our local officials, non-profit organizations, and residents to carry out this Plan and help develop a group of projects to be implemented as part of the long-term recovery effort.

## 4. Planning Process and Maintenance

### *4.1 Planning Process*

The Central Vermont Regional Planning Commission (CVRPC) coordinated the Waterbury Local Hazard Mitigation Plan process. CVRPC was contacted by the Community Planner, Steve Lotspeich, and sent Town-Specific hazard mitigation material for review. After assessing the material, CVRPC staff held a meeting along with members of the municipal staff on December 8, 2011 at the Municipal Offices. The Waterbury Hazard Mitigation Meeting focused on assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities. The committee for the 12/8/2011 meeting 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.

Attendees included:

- Steve Lotspeich, Community Planner
- Rebecca Ellis, Town Select Board Chair & State Representative
- Alec Tuscany, Public Works Director
- Bill Shepeluk, Town Manager
- Annie Geratowski, FEMA Long Term Community Recovery
- Shannon Burke, FEMA Long Term Community Recovery
- Clare Rock, Zoning Administrator
- Jen Mojo, CVRPC

Preparation for the meeting included a review of the Waterbury Municipal Plan, Waterbury Rapid Response Plan, 2010 Town Report, 2001 Waterbury All Hazards Mitigation Plan, 2011 Waterbury Zoning Regulations, 2011 Vermont State Hazard Mitigation Plan, Winooski Basin Plan Draft 2011, Mid Winooski Phase 1 Stream Geomorphic Assessment 2007, and newspaper articles. Information from these documents was incorporated into this plan. The Waterbury Hazard Mitigation Meeting focused on assessing past mitigation projects and compiling information on its current and future hazard mitigation programs, projects and activities.

The meeting indicated that the Town and Village are most vulnerable to dam failure, flood/flash flood/fluvial erosion, hurricane/tropical storm/severe storms, winter storm/ice storm/extreme cold with power failure. Damages from flood-related events pose the greatest threat to the municipality, as demonstrated by the effects of the recent tropical storm Irene, and will therefore be the focus the Hazard Mitigation Plan.

Additionally, long term flood mitigation strategies were discussed during the FEMA sponsored long term recovery meetings. A “flood mitigation” committee was formed during the process and met on four separate occasions during the months of December and January. Committee members included residents of Waterbury, representatives from the Regional Planning Commission, and a representative from the State. Mitigation strategies identified from these meetings are outlined in the Hazard Mitigation Activities matrix.

Once the draft was developed, CVRPC placed a notice for public comments of the draft update on the CVRPC blog and newsletter. A notice of the draft update was also available through the Front Porch Forum web newsletter and the local newspaper, The Waterbury Record and by request from CVRPC for public review. Hard copies of the plan were available for review and comments from 12/26/2011 to 1/20/2012 at the Town Offices and Waterbury Library. 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 Moretown, Duxbury, Middlesex and Worcester. No comments were received from the public. Public comments submitted in the future will be reviewed by the Community Planner (and CVRPC Staff

dependant on funding) and attached as an appendix. In the future, the draft plan will be made available during Town Meeting and other 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.

This Waterbury Local Mitigation Plan will be submitted as a multi-jurisdiction plan for the Town and Village of Waterbury.

**Existing Hazard Mitigation Programs, Projects & Activities**
The ongoing or recently completed programs, projects and activities are listed by strategy.

Community Preparedness Activities

- Rapid Response Plan, 2006
- Emergency Operations Plan
- Capital Improvement Plan (including equipment replacement)
- Waterbury Safe Routes to School Team

Hazard Control & Protective Works

- Maintenance Programs (Bridge & Culvert Inventory – 2006)
- Mutual Aid Agreement

Insurance Programs

- Participation in NFIP

Land Use Planning/Management

- Waterbury Municipal Plan, adopted 2008
- Waterbury Zoning Regulations, amended 2011
- Source Protection Plan

Protection/Retrofit of Infrastructure and Critical Facilities

- Emergency Shelters – Thatcher Brook Primary School, Waterbury Congressional Church, St. Leo's Hall
- Flood proofed Village Fire Station
- Dry Hydrants

Public Awareness, Training & Education

- Motor vehicle accident response training
- First responder CPR & hazmat trainings
- School Fire Safety Program

### *4.2 Plan Maintenance*

The Waterbury Local Hazard Mitigation Plan will be updated and evaluated annually at a May joint meeting of the Planning Commission and Town Select Board and Village Board of Trustees. Updates and evaluation by the Planning Commission will also occur within six months after every federal disaster declaration and as updates to municipal plan, zoning regulations, and river corridor plans come into effect. The plan will be reviewed by the Select Board, Board of Trustees, Planning Commission, and public at the abovementioned meeting. CVRPC will help with updates or if no funding is available, the Waterbury Community Planner 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 and at the municipal offices, Front Porch Forum web newsletter, Waterbury Record 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 major business owners (Ben & Jerry's, Green Mountain Coffee Roasters, State of Vermont, etc), Revitalize Waterbury, and Thatcher Brook Primary 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 Community Planner.

Monitoring of plan progress, implementation and the 5 year update process, will be undertaken by the Community Planner. Monitoring updates may include changes in community mitigation strategies; new municipal 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 to FEMA for re-adoption following the process outlined the schematic found in the Attachments section.

Waterbury shall incorporate mitigation planning into their long term land use and development planning documents. It is recommended the Town reviews and incorporates elements of the Local Mitigation Plan when updating the Municipal Plan and Flood Hazard Area Bylaws. The incorporation of the Local Mitigation Plan into the municipal plan, possible future zoning regulations and additional flood hazard bylaws will also be considered after federally declared or local disasters. The municipality shall also consider reviewing future Winooski River Corridor planning documents for ideas on future mitigation projects and hazard areas.

## 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 hazards can be found in the State of Vermont's Hazard Mitigation Plan.

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

The following hazards were found to be most significant in the Town and Village of Waterbury:

- Dam Failure
- Flood/Flash Flood/Fluvial Erosion
- Hurricane/Severe Storms
- Winter Storm/Ice Storm/Extreme Cold with Power failure

Due to the frequent and severe nature of flooding events, Waterbury has identified flooding is the worst natural hazard within the municipality and will focus on mitigation efforts to reduce the impacts from flooding events.

Moderate threat hazards include:

- Avalanche/Landslide
- High Winds

[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**

**Dam Failure**

Dam failure is the breeching of a structure retaining water which may potentially cause loss of life and property to those downstream. The largest dam of concern is the Waterbury dam that was built in response to the 1927 flood. The dam generates an average of 15,000,000 kilowatt hours annually. The dam is 1,845 feet long and 190 feet high. At normal water levels (592 feet), the reservoir behind the dam contains an of 36, 800 acre feet of water. During maximum high water level periods (629.5 feet) the reservoir contains 82,100 acre feet of water. The dam was modified in 1957 and 1958 to provide safety for larger floods than were originally anticipated. To date there have been no failures of the dam and maintenance/repair work is performed on an ongoing basis by the State of Vermont.

[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 major property damage (more than 50% destroyed); some minor 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.

Inundation modeling of the dam was performed by Vermont Center for Geographic Information in 2008 and identifies areas that maybe flooded if the dam were to breech. Within the inundation area are 646 structures and 720 properties. The total acreage of these areas is 1,633 acres. The total damage costs if the dam were to breech is $187, 200, 200 and represents 32% of the properties in Waterbury. The extent of flooding from a dam breach was not determined in CVRPC/VCGI model. Future modeling efforts undertaken could determine the flood depths. . The map of the modeled area is an attachment in this plan.

The municipality has little communications with the operator, Green Mountain Power. There are currently sirens at the base of the dam to warn those nearby of water releases; however, the sirens are difficult to hear downstream. In 2010, a fisherman was killed during a release. The municipality is concerned about those (fishermen, swimmers, campers who are out of hearing distance of the siren.

| Hazard | Location | Vulnerability | Extent | Impact | Probability |
|---|---|---|---|---|---|
| Dam Failure | Waterbury Dam – Little Brook | Properties and infrastructure Downstream – see attached map | Area - 82,100 acre feet of water, depth of flooding is unknown | $187,200,000 in potential property losses | Low |

**Winter Storm / Ice Storm/Extreme Cold with Power Failure**

History of Occurrence (from NCDC website and FEMA DR List):

| Date | Event | Location | Extent |
|---|---|---|---|
| 3/6/2011 | Winter storm | County wide | 12-18” of snow, 10,000 customers lost power statewide |
| 2/23/2010 | Winter Storm | County wide | 20” of snow and 50,000 customers lost power statewide |
| 2/22/2009 | Winter Storm | County Wide | 10-18” of snow, 30 mph wind gusts |
| 2/1/2008 | Winter storm | County wide | 3-7” of snow and ice ¼-1/2”thick, 50 mph wind gusts |
| 2/14/2007 | Winter storm | County wide | 18-22” of snow |
| 1/4/2003 | Winter storm | County wide | 12-20” of snow |
| 3/5/2001 | Winter storm | County wide | 15-30” of snow |
| 12/31/2000 | Winter storm | County wide | 15” of snow |
| 12/29/1997 | Winter storm | County wide | 8-21” of snow |
| 12/7/1996 | Winter Storm | County wide | 12” of snow |
| 3/21/1994 | Winter storm | County Wide | 5-11” of snow |
| 11/1/1993 | Winter storm | County wide | 10-20” of snow |
| 1/3/1993 | Freezing Rain | Statewide | |

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.

The extent of winter storms on Waterbury is difficult to estimate as it is dependent on the size and path of the storm. For the next plan update, Waterbury will more closely monitor winter storms to determine the worst impacts possible on the municipality.

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.

In Waterbury, the water supply and associated infrastructure are at risk of freezing. The main source of Waterbury's water supply is surface streams. If the surface streams freeze, the Town must switch to backup water supplies from underground wells. However, the pumps for the wells do not have back up power generation if there is power failure. Frost at utility line depths can cause service and main line failures.

Other major problems include closed roads and restricted transportation.

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 Waterbury. 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. Waterbury should plan and prepare for these emergencies. That planning and preparedness effort should include the identification of mass care facilities and necessary resources such as cots, blankets, food supplies and generators, as well as debris removal equipment and services. The Thatcher Brook Primary School, Waterbury Congregational Church and St. Leo's Hall are all possible shelters; however, these locations do not have back up power supplies. Buildings with backup generators include the fire, highway, and water and sewer department buildings.

| Hazard | Location | Vulnerability | Extent | Impact | Likelihood |
|---|---|---|---|---|---|
| Winter Storm/Ice Storm | Town Wide, Water supply surface streams | Utilities, trees, roads, old/under insulated structures, sensitive populations | 18+" snow in March 2011 storm, depends on severity | 5-10% damages – routine emergencies | High/ Medium |

**Fluvial Erosion/Flash Flooding/Flooding**

History of Occurrences: Local and County Wide Data – nearest flood gauges are Winooski Gauge, Waterbury and Mad River Gauge, Moretown (from NCDC website and FEMA DR List)

| Date | Event | Location | Extent |
|---|---|---|---|
| 8/28/2011 | Flood/Tropical Storm | Statewide, Waterbury | Winooski Flood gauge knocked out – above 423.3 feet (flood stage is 419 feet) – DR 4022 |
| 5/27/2011 | Flood | Waterbury | Winooski flood gauge at 423.3 feet DR 4001 |
| 4/11/2011 | Flood | Waterbury | Winooski flood gauge at 421.0 feet |
| 10/01/2010 | Flood | Waterbury | Winooski flood gauge at 421.8 feet |
| 1/19/2006 | Flood, Ice jam | Waterbury | Winooski flood gauge at 421.9 feet |
| 12/17/2000 | Flood | County Wide | 3" of rain, $1 M in damages |
| 6/27/1998 | Flash Flood | County Wide | 3-6" of rain over 2 day period – Mad River flood gauge at 14.13 feet (flood stage is 9 feet) DR 1228 |
| 1/19/1996 | Flood; ice jam | County Wide | |
| 8/4/1995 | Flood | County wide | $1.5 M damages; Mad River gauge at 8.12 ft |
| 8/10/1976 | Flood | County Wide | Mad River flood gauge at 13.47 feet DR 518 |
| 9/22/1938 | Flood | County Wide | Mad River flood gauge at 16.34 feet |
| 11/03/1927 | Flood | County Wide | Mad River flood gauge at 19.40 feet |

Flooding/flash flooding/fluvial erosion is Waterbury'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 areas. 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.

The worst anticipated flooding varies throughout the Waterbury. The worst flooding event in Waterbury's recorded history occurred in 1927, followed closely by T.S. Irene in 2011. Data from the Winooski flood gauge during both of these events is not available. During the 1927 flood, flood waters reached as high as 17 feet on certain State Complex buildings. During T.S. Irene up to 8 feet of flooding occurred in on these same buildings. Lesser but more regular flooding occurs in Waterbury, with generally 1 -2 feet of flooding in low lying areas every two or three years. In the future, Waterbury can better gather data for flooding extent by having individuals call in flood levels in areas around Waterbury.

Waterbury is located within the Winooski River Watershed. The Winooski River forms the border between Waterbury and the towns of Duxbury and Moretown on the south side of the river. Waterbury is drained by the Thatcher Brook, Little River and Graves Brook, which empty into the Winooski. A Phase I Stream Geomorphic Assessment has been performed on sections of these rivers and streams to date. The State and Waterbury are interested in performing Phase II studies and developing a river corridor plan for the area. A corridor management plan will provide strategies for river protection and restoration, as well as mitigate impacts of flooding and fluvial erosion.

The Phase I Assessment revealed extensive channel straightening and armoring of the Winooski River on the Waterbury border and tributaries within Waterbury. Development along river and tributary banks was also high in Waterbury. The majority of reaches in Waterbury were rated as fair to poor due to numerous impacts such as: river corridor development, berms and roads, riparian buffers, channel modifications, bank erosion and ice debris jam potential.

Waterbury entered into FEMA's NFIP program on April 15, 1982 and has maps dating from April 6, 1990 and April 6, 1998 (Village only). The Town and Village have recently developed interim flood hazard regulations and had a hearing in January, 2012 for final adoption. The new regulations continue to limit development in the NFIP 100 year flood plain area. The Zoning Administrator is responsible for enforcement of the regulations.

Based on Waterbury's FIRMs, there are 221 structures and 585 properties located within the 100 year floodplain. The estimated loss for a severe flooding event is $152,100,000 based on average grand list values. There are no repetitive loss properties in Waterbury. Waterbury Town has 10 active NFIP policies for a total coverage amount of $1, 879,900. Waterbury Village has 72 active policies for a total coverage of $15,817,000. The Town does currently own some floodplain properties with conservation easements.

The municipality does currently have some flood protection measures in place. Dascomb Rowe Fields, although recreation fields, serve as floodplain and helps prevent flooding of the State Complex. Also there are flood control reservoirs on three tributaries of the Winooski – Jail Branch in East Barre, North Branch in Wrightsville, and Little River in Waterbury.

**Fluvial Erosion**

Fluvial erosion is occurring primarily on the Thatcher Brook. Severe rain events cause greater rates of fluvial erosion along the stream banks. The most notable fluvial erosion areas along Thatcher Brook are:

- Perry Hill Road – undermining of culvert
- Route 100 – back of antique shop property is eroding away
- Kneeland Flats – scour
- Little River Road - $19,000 for repair work – rip rap
- Vicinity of Stowe St – area repaired with rip rap for stream bank stabilization and to protect highway; sewer line damaged - $50,000 to repair

**Flash Flooding**

Flash flooding events have occurred at least a half dozen times since the late 1980's. Waterbury's small streams can easily become overwhelmed during heavy rain events and cause localized flooding. The Thatcher Brook is especially prone to flash flooding due to channel alterations. Roads damaged by flash floods include:

- Barnes Hill Road – road washout
- Mountain View Drive.
- Guild Hill Road
- Little River Road – receiving $19,000 FEMA reimbursement
- Class IV Roads
- Ring Road
- Perry Hill Road
- Kneeland Flats – culvert washout

**Flooding**

Flooding is not a new hazard to Waterbury. Waterbury experienced its worst flood in November of 1927. The 1927 flood caused flooding in the entire Village area. Some buildings within the State Complex had 6 feet of water on their second levels. Water on Main Street was 10 to 15 feet deep. The peak flow of the Little River for that event was an estimated 23,400 cfs (previous recorded maximum was 6,520 cfs). It was estimated $2,000,000 of damage was incurred from the flood. As a result of the 1927 flood, the Waterbury Dam was built to reduce future flood impacts.

During Tropical Storm Irene, most of the Village of Waterbury was flooded. Its impacts were compared to those of the 1927 flood. The flood waters during Irene extended well beyond the mapped 100 year floodplain. Structures in the 100 year flood plain had anywhere from 3 to 7 feet of water on the first floor. The flood waters reached areas closer to the edge of 500 year floodplain. Major streets (and associated buildings) that were flooded during Irene were:

- Adams Court
- Batchelder Street
- Elm Street
- Foundry Street
- Healy Court
- Moody Court
- North Main Street
- South. Main Street
- O'Hear Court
- Randall Street
- Union Street
- US Route 2
- Winooski Street
- Whalley Trailer Park
- State Complex Roads (and buildings)

Because of the severity of damages caused by Irene, FEMA has designated Waterbury for involvement in the Long Term Community Recovery process. Additional infrastructure damage includes the main waste water pump station. The repair costs to the main pump station are estimated to be $300,000. The municipal building was also badly flooded. The town is looking to apply for HMGP funds to repair both the waste water treatment plant and municipal building, as well as purchase the Whalley Trailer Park. The total damage costs from Irene to Waterbury have yet to be calculated. It's expected that the cost to repair, renovate and flood proof the State Complex located in Waterbury Village will cost $60 to $80 million. The economic loss from the loss of State Complex workers has yet to be calculated as well. Waterbury also incurred millions of dollar in damages to private property. Flood mitigation strategies outlined in the hazard mitigation activities matrix address both public and private infrastructure projects.

| Hazard | Location | Vulnerability | Extent | Impact | Probability |
|---|---|---|---|---|---|
| Flood/Flash Flood/ Fluvial Erosion | NFIP 100 year floodplain, Waterbury Village, Individual roads listed above, State Complex, Waste water plant | Private property, mobile home parks, roads, culverts, utilities | 1927 flood – 10-15' on Main St. | $152,100,000 based on grand list values (does not include State Complex) | High/Medium |

**Hurricane/Tropical Storms/Severe Storms**

History of Occurrence (from NCDC website and FEMA DR List):

| Date | Event | Location | Extent |
|---|---|---|---|
| 8/28/2011 | TS Irene | Statewide | ~6" rain , Mad River flood gauge at 19.07 feet; 9 ft is flood |

| | | | |
|---|---|---|---|
| | | | stage (Winooski gauge damaged) DR 4022 |
| 5/27/2011 | Severe Storm, flash flooding | Waterbury Center | 1" hail, 3-5" of rain, 52 knot winds DR 4001 |
| 7/21/2008 | Severe storms, flooding | County Wide | |
| 8/25/2007 | Severe Storms | Waterbury Center | 65 mph wind gusts, 1" hail |
| 7/9/2007 | Severe Storms, hail, flooding | Duxbury, Waterbury, Middlesex | 1"-2.75" hail. $20k property damages, DR 1715 |
| 6/19/2006 | Severe storms | Waterbury | 55 knot winds, downed trees and power lines |
| 8/1/2005 | Severe Storm | Waterbury Center | 1" hail |
| 9/16/1999 | Tropical Storm Floyd | Statewide | Tropical Storm DR 1307 |
| 6/17/1998 | Severe Storms | County Wide | DR 1228 |
| 5/29/1998 | Severe Storms | Duxbury, Waterbury, Middlesex | 50 knot winds, heavy rains, downed trees and power lines |
| 7/15/1997 | Severe Storms | County Wide | |
| 8/4-6/1995 | Severe storms, flooding | County Wide | DR 1063 |
| 7/23/1990 | Severe Storms, flash flooding | County Wide | DR 875 |
| 8/4/1989 | Severe Storms, Flooding | County Wide | DR 840 |
| 6/7/1982 | Severe Storms | New England | 14" of rain, $276 M damages |
| 8/5/1976 | Hurricane Belle | Statewide | Gale force winds, 2 deaths, DR 518 |
| 7/3/1964 | Hail | County Wide | 1.5" hail |
| 9/22/1938 | Hurricane | Statewide | Category 1 force winds |

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 during the 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.

Similar to flooding, the extent of severe storms is not well documented in Waterbury. The impact of storms is usually flood related. See flood extent description in flood section above. Wind extent from storms is not well documented as there is no monitoring station in Waterbury. Estimates for wind are gathered from county wide data off the NCDC website and from NOAA spotters. In the future, Waterbury could consider installing a wind monitoring station to better gather data for events.

The impacts of the most recent tropical storm, Irene, are outlined in the flood/flash flood/fluvial erosion section of the plan. There were minimal high wind effects from Irene.

In 1999, Tropical Storm Floyd passed through Vermont. The primary impact from Floyd was downed trees and power lines due to high winds. 5-7" of rain fell over the Central Vermont Region; however, flood impacts were offset by drought conditions caused earlier in the year.

1n1938, a category 1 hurricane hit Vermont and caused severe flooding. Windham County received the brunt of the storm. High winds destroyed forests, agricultural lands and did major damage to public and private infrastructure. The State suffered about $15 M in damages from the storm.

| Hazard | Location | Vulnerability | Extent | Impact | Probability |
|---|---|---|---|---|---|
| Hurricane/ Tropical Storm/ Severe Storm | See flood locations for flooding areas, town wide for wind impacts | Large trees, power lines, culverts/ Bridges, private property | ~6" rain – TS Irene ; Mad River flood gauge at 19.07 feet; 9 ft is flood stage (Winooski gauge damaged); Category 1 hurricane in 1938 | 1938 - $15M Statewide; total Irene costs TBD | Medium |

**5.3 Moderate Threat Hazards**

**Avalanche/Landslide**

A landslide is the sliding of a large mass of rock material, soil, etc., down the side of a mountain or cliff. Landslides can be caused by rainstorms, fires, alternate freezing or thawing and/or by the steepening of slopes by erosion or human modification.

To date there have only been limited small slides in Waterbury, that usually occur after heavy periods of rain. Slides have occurred on the following roads over the past 10 years:

- Lincoln Street
- Perry Hill Road
- Keefe Lane
- Kneeland Flats
- Little River Road
- Reservoir Road

There have been no major slides.

These areas in Waterbury are susceptible to slides due to the underlying clay soil layers, which slide when wet. To mitigate slides, the Town stabilizes the susceptible areas with stone rip rap, additional fill and gravel. Over the past 10 years the Town has spent roughly $50,000 to repair slide areas.

| Hazard | Location | Vulnerability | Extent | Impact | Probability |
|---|---|---|---|---|---|
| Avalanche/ Landslide | Lincoln St, Perry Hill Rd, Keefe Ln, Kneeland Flats, Little River Rd, Reservoir Rd | Road, trail and culvert infrastructure | Data gap – only small slides to date | $50,000 over 10 years | Medium |

**High Winds**

History of Occurrence (from NCDC website and FEMA DR List):

| Date | Event | Location | Extent |
|---|---|---|---|
| 7/6/2011 | Thunderstorm winds | County Wide | Damaging winds, 15,000 customers lost power Statewide |
| 5/27/2011 | Severe Storm, flash flooding | Waterbury Center | 1" hail, 3-5" of rain, 52 knot winds |
| 8/25/2007 | Thunderstorm winds | Waterbury | 56 knot winds |
| 7/9/2007 | Severe storms | Duxbury/County wide | 2.75" hail, damaging winds |
| 6/19/2006 | Thunderstorm Winds | Waterbury | 55 knot winds |
| 9/16/1999 | TS Floyd | Statewide | Tropical Storm |
| 5/29/1998 | Thunderstorm Winds | Middlesex, Duxbury, Waterbury | 50 knot winds, downed trees and power lines |
| 7/15/1997 | Severe Storms | County Wide | |
| 5/19/1982 | Thunderstorm winds | County Wide | 56 knot winds |
| 7/3/1964 | Hail | County Wide | 1.5" hail |
| 9/22/1938 | Hurricane | Statewide | Category 1 force winds |

High wind is defined as an event with sustained wind speeds of 40 m.p.h. or greater lasting for 1 hour or longer or an event with winds of 58 m.p.h. or greater for any duration. Thunderstorms can generate high winds and down hundreds of large trees within a few minutes. The State can also experience tornadoes, which are capable of damaging or destroying

structures, downing trees and power lines and creating injuries and death from collapsing buildings and flying objects.

Tornadoes are less common than hail storms and high winds, but have occurred throughout Vermont. Across the State, however, 34 tornadoes have been recorded between 1950 and 1999, injuring 10 people and causing over $8.4 million dollars in estimated property damage. Nearly all of these incidents occurred from May through August with most of occurring in the afternoon.

As noted before, Waterbury's well water supply is susceptible if power failure occurs during a high wind event, as back up water supplies are without backup power generation.

| Hazard | Location | Vulnerability | Extent | Impact | Probability |
|---|---|---|---|---|---|
| High Winds | Town Wide, Water wells | Power lines, trees, structures, well water pumps | Depends on severity of event | Depends on severity of event | Medium |

## 6. Mitigation

### 6.1 Town Plan (2008) Polices that Support Local Hazard Mitigation

- The protection, maintenance, and continued functional use of Waterbury's historic structures, sites, and areas. (*Historic Development & Resources Goal*)
- Protect Waterbury's finite and renewable natural resources, and promote sound stewardship of public and private lands. (*Natural resources*)
- Provide and maintain safe, efficient, and integrated transportation facilities and circulation. (*Transportation Goal*)
- Provide public utilities, facilities, and services to ensure the public's health and safety, and to improve the quality of life in the Waterbury community. (*Community Facilities and Services*)

Waterbury's Municipal Plan will be updated no later than 2013. The Town in interested in adding goals which related to mitigation planning such as:

- To take actions to reduce or eliminate the long-term risk to human life and property from flooding.
- To take actions to reduce or eliminate the long-term risk to human life and property from hurricanes/severe storms/tropical storms.
- To take actions to reduce or eliminate the long-term risk to human life and property from dam failure.
- To take actions to reduce or eliminate the long-term risk to human life and property from winter storms/ice storms/extreme cold.

Specific hazard mitigation strategies contained within the Municipal Plan include:

- Ensure existing and future drainage systems are adequate and functioning properly
- Preserve and prevent development in areas where natural hazard potential is high
- Ensure that all residents and business owners are aware of the hazards that exist within Waterbury 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

**6.2 Identified Hazard Mitigation Programs, Projects & Activities**

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

| Hazards Mitigated | Mitigation Action | Local Leadership | Prioritization | Funding Resources | Time Frame |
|---|---|---|---|---|---|
| Flooding/ Severe Storms/ Dam Failure | Property acquisition of Whalley Trailer Park | Select Board | High | HMGP | 1 year |
| Flooding / Severe Storms | Floodproof main waste water pump station | Trustees | High | HMGP | 1 year |
| Flooding/ Severe Storms | Structural Elevation of 5 homes Village area (see locations in flood hazard analysis) | Trustees/ Select Board | High | HMGP | 1-2 years |
| Flooding/ Severe Storms | Mitigation reconstruction of municipal office building | Select Board | High | HMGP | 1 year |
| Flooding/ Severe Storms | Dry flood proofing of 3 non-residential structures in Village area (see locations in flood hazard analysis) | Trustees/ Select Board | High | HMGP | 1-2 years |
| Flooding/ Severe Storms | Re-engineer Winooski Street to construct dip at bridge | Select Board | High | HMGP | 1-2 years |
| Flooding/ Severe Storms/ Dam Failure | Transform cornfield on State Complex property into wetlands retention/detention | Trustees/ Select Board | High | HMGP | 1-2 years |

| | | | | | |
|---|---|---|---|---|---|
| | basin | | | | |
| Flooding/ Severe Storms | Structural retrofitting of residential and non residential areas (see locations on flood hazard analysis) | Trustees/ Select Board | High | HMGP | 1-2 years |
| Flooding / Severe Storms | Elevation of electrical systems on 20 properties (see locations on flood hazard analysis) | Trustees/ Select Board | High | HMGP | 1-2 years |
| Flooding / Severe Storms | Anchor fuel oil tanks on 50 properties (see locations on flood hazard analysis) | Trustees/ Select Board | High | HMGP | 1-2 years |
| Flooding / Severe Storms | Install sewer line valves on 50 properties (see locations on flood hazard analysis) | Trustees | High | HMGP | 1-2 years |
| Flooding/ Severe Storms | Watershed-wide flood study/River profile | Select Board, Trustees, CVRPC, ANR | High | EPA, USDA, ANR | 2 years |
| Severe Storms/Winter Storms | Develop sensitive populations survey and list | Select Board, Emergency Services | Medium | EMGP, Town funds | 2-3 years |
| Flooding, Severe Storms/Winter Storms | Develop back up power generation for well field, wastewater plant, and Thatcher Brook Primary | Trustees, Select Board Public Works | High | HMGP, Town funds | 2 years |
| Flooding/ Severe Storms | Study of Dascombe Rowe Fields – repurposing for multi use recreation activities and floodplain restoration | Trustees, Select Board, ANR | Med | HMGP, Town funds | 2-3 years |
| Dam Failure | Improve communication between State, GMP and Town regarding dam issues | Select Board | Med | Town funds | 2-3 years |

| | | | | | |
|---|---|---|---|---|---|
| Emergency Preparedness | Install sirens downstream of Waterbury dam to warn of releases | State, Public Works | Med | Town/ State funds | 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 | Planning Commission ANR | Med | HMGP | 2 years |

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.

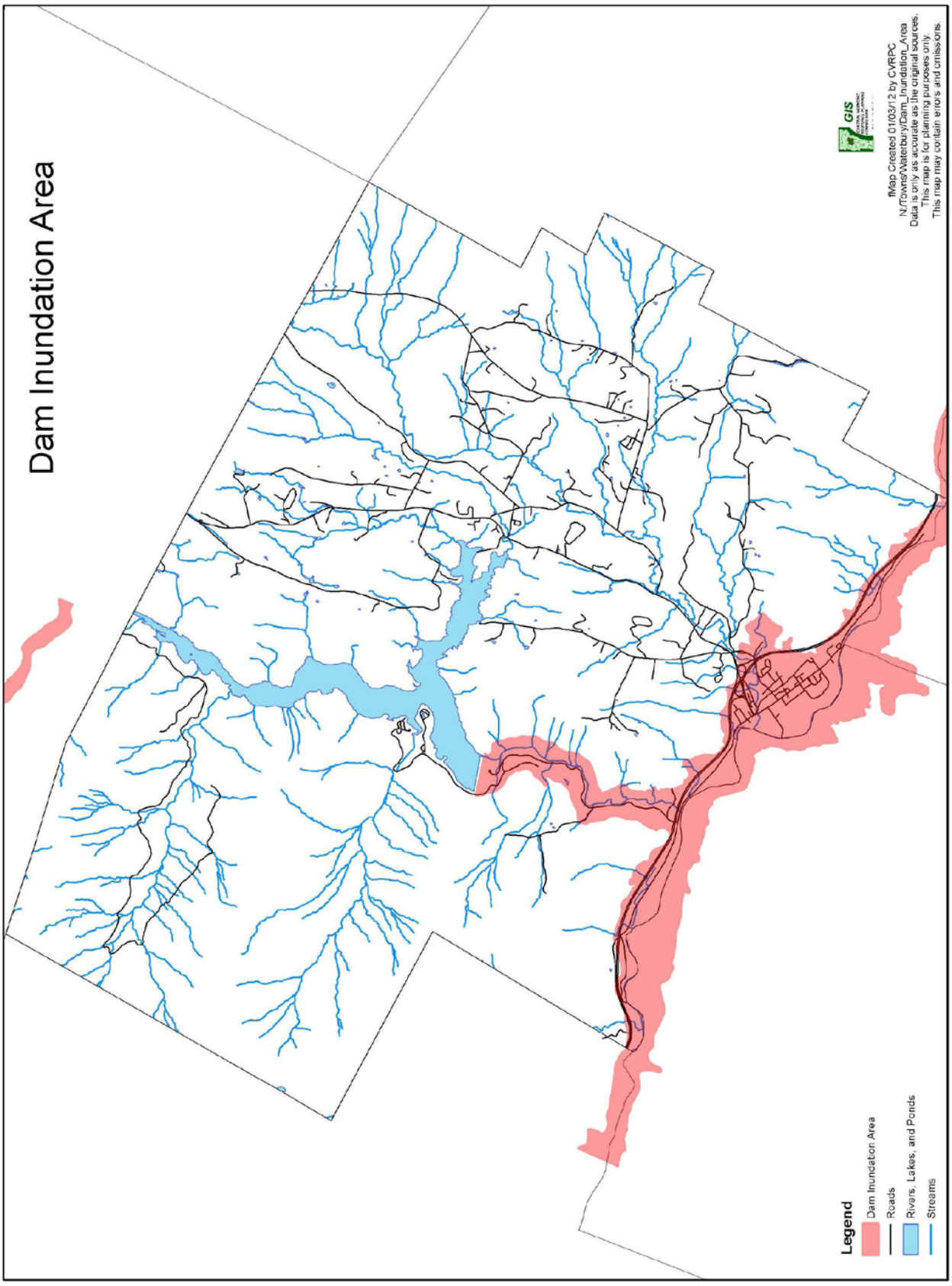
The mitigation activities listed are in regards to local leadership, possible resources, implementation tools, and prioritization. Prioritization was based upon the economic impact of the action, the Community's need to address the issue, the action's cost, and the availability of potential funding.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

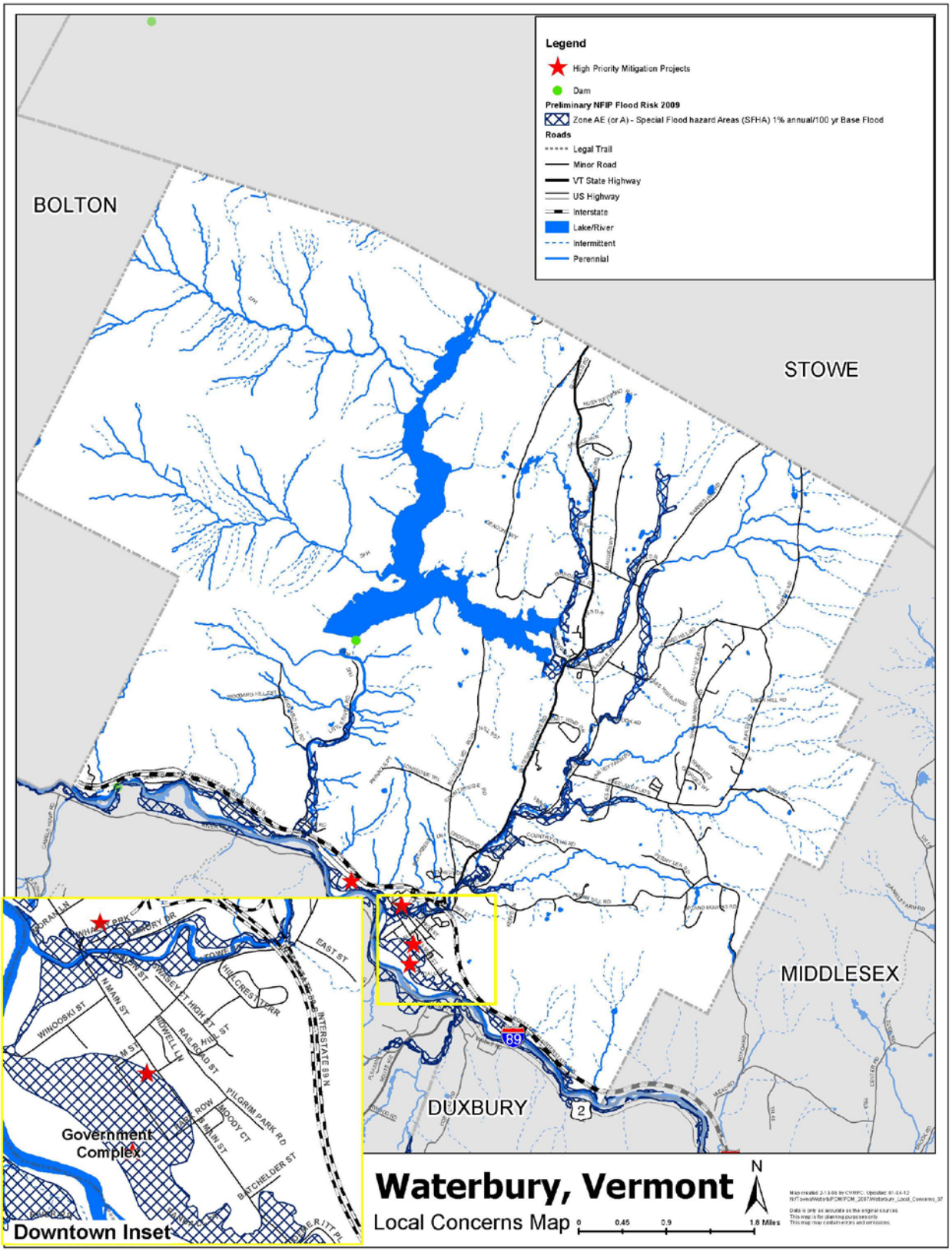
Waterbury understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA cost/benefit criteria. The Town and Village must also have a FEMA approved Hazard Mitigation Plan.

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**

Dam Inundation Map
Local Concerns Map
Irene photos
5 year plan review/maintenance process
Town Resolution Adopting the Plan


Dam Inundation Area
GIS
Map Created 01/03/12 by CVRPC
N:/Towns/Waterbury/Dam_Inundation_Area
Data is only as accurate as the original sources.
This map is for planning purposes only.
This map may contain errors and omissions.
Legend
Dam Inundation Area
Roads
Rivers, Lakes, and Ponds
Streams


Legend
High Priority Mitigation Projects
Dam
Preliminary NFIP Flood Risk 2009
Zone AE (or A) - Special Flood hazard Areas (SFHA) 1% annual/100 yr Base Flood
Roads
Legal Trail
Minor Road
VT State Highway
US Highway
Interstate
Lake/River
Intermittent
Perennial
BOLTON
STOWE
MIDDLESEX
DUXBURY
Government Complex
Downtown Inset
Waterbury, Vermont
Local Concerns Map
N
0
0.45
0.9
1.8 Miles

The Winooski River flows over Winooski Street in Waterbury, Vt. (Glenn Russell - AP)

Waterbury FD, Main Street, Waterbury - By Glenn Russell, Burlington Free Press

# 5-Year Plan Review/Maintenance

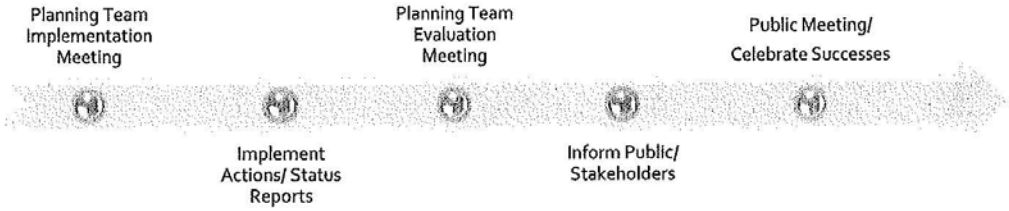

- Brief local leadership on plan approval
- Formally adopt plan
- Publicize plan approval and adoption
- Celebrate success

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

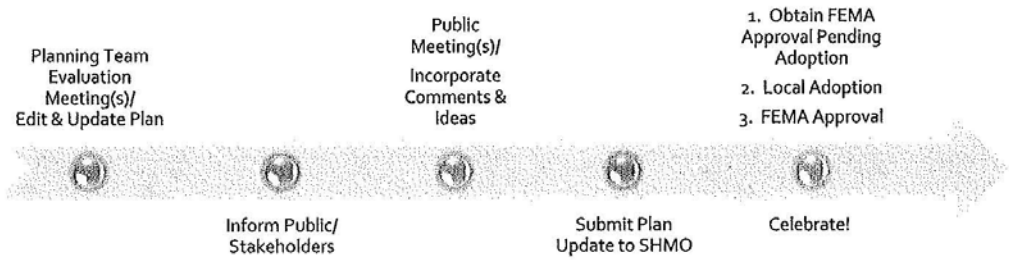
- Effectiveness of planning process
- Effectiveness of actions
- Document success & challenges of actions
- Update and involve community
- Celebrate successes

- 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 Waterbury Select Board
Village of Waterbury
Trustees
A Resolution Adopting the Local Hazard Mitigation Plan
_____ __, 2012

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

WHEREAS, a duly-noticed public meeting was held by the Town of Waterbury Select Board and Village of Waterbury Trustees on _____ __, 2011 to formally adopt the Waterbury Local Hazard Mitigation Plan;

NOW, THEREFORE BE IT RESOLVED that the Town of Waterbury Select Board and Village of Waterbury Trustees adopt the Waterbury Local Hazard Mitigation Plan.

_____
Chair of Town Select Board

_____
President of Village Trustees

ATTEST

_____
Town & Village of Waterbury Clerk