TUNBRIDGE HAZARD MITIGATION PLAN

ACKNOWLEDGMENTS

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Cover Art

"Tunbridge, VT 1941" by David Wright http://www.nostalgia-usa.com/
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CERTIFICATE OF PLAN ADOPTION

Town of Tunbridge Selectboard
Formal Resolution Adopting the 2014-2019 Tunbridge Hazard Mitigation Plan

WHEREAS, the Town of Tunbridge has worked with local officials, residents and regional partners to identify hazards, analyze past and potential future losses due to natural and manmade-caused disasters, to identify strategies for mitigating future losses, and to prepare an updated hazard mitigation plan for the town; and

WHEREAS, a duly-noticed public meeting was held by the Tunbridge Selectboard on August 20, 2013 to present and receive public comment on the draft 2013-18 Tunbridge Hazard Mitigation Plan; and

WHEREAS, the updated 2013-18 Tunbridge Hazard Mitigation Plan was submitted to the Vermont Division of Emergency Management and Homeland Security and received for review at the Federal Emergency Management Agency on January 2, 2014; and

WHEREAS, after several requested revisions, FEMA approved the updated 2014-19 Tunbridge Hazard Mitigation Plan on _____, pending adoption by the Tunbridge Selectboard;

NOW, THEREFORE BE IT RESOLVED that the Tunbridge Selectboard hereby adopts this 2014-19 Tunbridge Hazard Mitigation Plan for municipal use and implementation.

Dated this _____ day of _____, 20____.

_____

Chair, Tunbridge Selectboard

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1. Introduction

Hazard mitigation planning identifies actions that a community can take to reduce or eliminate long term risk to people and property from natural and manmade hazards. The Federal Emergency Management Agency (FEMA) further describes it as a process state and local governments can use to identify risks and vulnerabilities associated with natural disasters, in order to develop long-term strategies to protect people and property from future hazard events (www.fema.gov/plan/mitplanning).

Purpose. The purpose of this hazard mitigation plan is to identify and plan for hazards facing the town, including the development of strategies intended to reduce long-term risks from known hazards. Hazards cannot be eliminated, but it is possible through planning to determine what hazards are most frequent, where they may be most severe, and what actions can be taken to reduce their impact on the community. Benefits of hazard mitigation planning include:

- increased public awareness and understanding of natural and manmade hazards, associated risks and community vulnerabilities,
- reduced physical, financial and emotional losses caused by disasters,
- improved understanding of potential risks and possible risk reduction measures associated with future development,
- increased community and voter support for specific actions the town may take to reduce future losses,
- strengthened partnerships and lines of communication among diverse interests, including opportunities to leverage and share resources, and
- community eligibility for federal hazard mitigation grants and aid prior to and following federally-declared disasters.

Process. The previous Tunbridge Hazard Mitigation Plan was adopted on June 23, 2011 as a six-page "annex" to the multi-jurisdictional All-Hazard Pre-Disaster Mitigation (PDM) Plan adopted by the Two Rivers-Ottauquechee Regional Commission (TRORC) in 2008. The regional plan and Tunbridge annex both expired on September 30, 2013.

Since the last plan was adopted and approved by the Federal Emergency Management Agency (FEMA), Vermont was hit hard by two major floods, including Tropical Storm Irene in August 2011. During the intervening period FEMA also adopted a new "National Mitigation Framework" and, in 2013, updated guidance for local hazard mitigation planning. Vermont's ongoing recovery efforts and FEMA's new mitigation framework both focus on strengthening community "resilience" – to not only understand and reduce risks of future events, but to also empower communities to recover quickly and effectively when disasters occur.

Of particular note – the state recently adopted new Emergency Relief and Assistance Fund (ERAF) rules, effective October 2014, that provide additional matching funds for federal disaster relief under FEMA's Public Assistance Program for municipalities that have adopted updated bridge and culvert standards, flood and fluvial erosion hazard area regulations, local emergency operation plans, and a local hazard mitigation plan approved by FEMA. Under changes to state planning law (24 V.S.A. Chapter 117), as of July 2014, all comprehensive plans must include a "flood resilience" element that may reference a locally adopted and FEMA-approved hazard mitigation plan.

This plan represents a complete rewrite of the previous Tunbridge Annex, as a standalone, single jurisdiction hazard mitigation plan that updates and builds upon previous mitigation plans, and augments the recently readopted 2013 Tunbridge Town Plan. The planning process resulting in this update was part of a FEMA-funded Hazard Mitigation Planning Grant awarded post-Irene to:

- strengthen community involvement in hazard mitigation planning,
- better incorporate social and economic considerations,
- identify and address manmade as well as natural hazards, and to
- better integrate local comprehensive and hazard mitigation planning.

Tunbridge agreed to participate under the FEMA grant, as an example of a small, rural community with strong social ties and limited staff and technical resources, to help test and hone public outreach tools, and to help develop mitigation strategies appropriate in communities that have not adopted traditional zoning and subdivision regulations.

The process of developing the plan has been as important as the plan itself, by drawing the community together to identify and agree on actions to be taken to reduce and mitigate hazards. The four parts of the planning process included:

- **Public Involvement** – to receive and consider community-wide input from diverse stakeholders.
- **Risk Assessment** – to identify and plan for the most probable hazards, estimate the potential frequency and magnitude of hazard events, and their potential impacts on both the built environment and the local community.
- **Mitigation Strategies** – to develop goals, objectives and strategies aimed at mitigating future disaster losses that are cost-effective, technically feasible, and environmentally sound – and timed to allow for strategic investment of scarce resources.
- **Implementation and Monitoring** – to identify which actions will be taken by whom and by when.

This plan reflects local priorities for hazard mitigation, as determined from the community planning process, and currently available federal, state and local information.

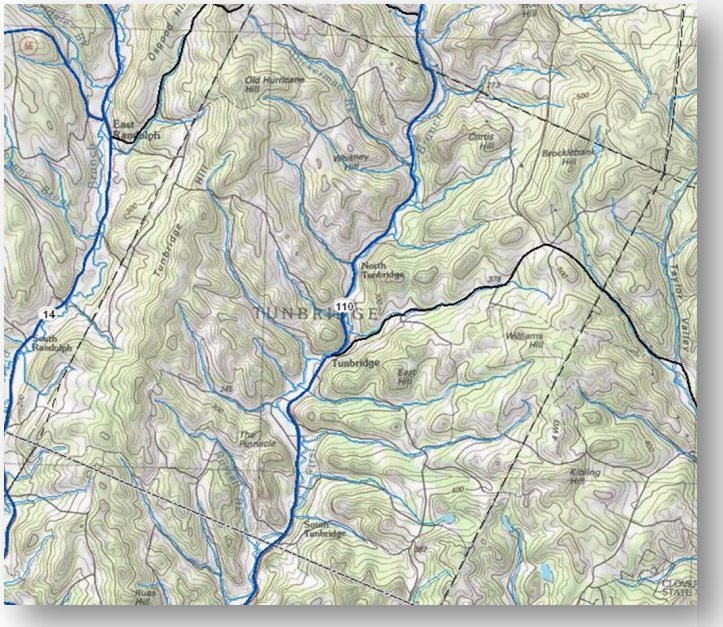
Action items are included to monitor the success or effectiveness of implementation and results, to inform the next update of the plan.

2. Community Profile

Topography and Drainage. The Town of Tunbridge, consisting of approximately 45 square miles or 28,665 acres, is situated on the First Branch of the White River in Orange County, Vermont. Neighboring towns include Randolph, Chelsea, Strafford, Royalton, and Bethel. The town's highest peak, at 2,120 feet, is Brocklebank Hill near Chelsea. Other high points include Old Hurricane Hill (1,920 feet) at the northern end of the ridge running along the town's western border, and East Hill (1,544 feet) just east of Tunbridge Village.

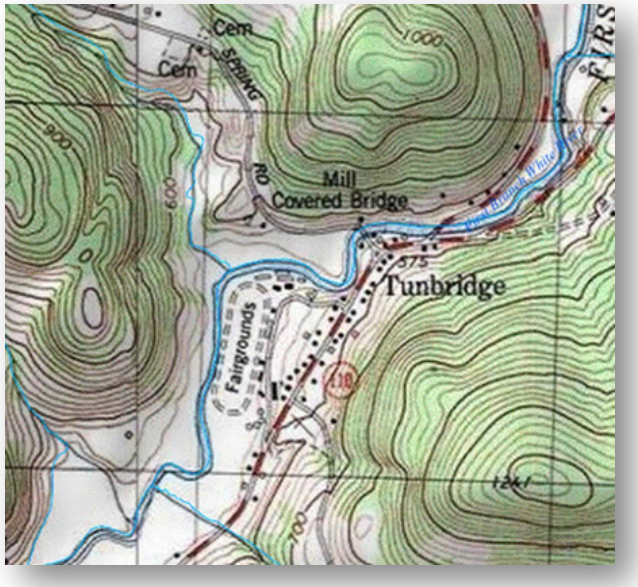
The First Branch drops 200 feet as it flows south through town, from an elevation of 700 feet at the northern border, to a low of 500 feet where it crosses the southern town line. Vermont Route 110 (VT 110) following the river is the main route in and out of town. Strafford Road, running over the eastern ridge, is the other major road in town. Local roads generally follow tributaries of the First Branch into the surrounding hills. Much of the terrain outside of the river floodplain is hilly and fairly steep.

Development Pattern. Tunbridge is a rural community with three distinct centers located along VT 110 including the small hamlet of South Tunbridge and larger villages of Tunbridge and North Tunbridge. South Tunbridge includes a few homes and a church. The centrally-located village of Tunbridge sits on a bluff



Tunbridge is a quiet Vermont town, surrounded by a mixture of large open fields and tracts of woodlands. Development within Tunbridge Village and North Tunbridge Village is typical of small New England villages. Buildings are built close together, with minimal setbacks from the road. In areas outside Tunbridge's villages, development is much more diffuse, and has taken place along Tunbridge's dirt roads, leaving much of the land open. — 2013 Tunbridge Town Plan.

overlooking the Tunbridge Fairgrounds, which are located directly on the river. North Tunbridge, nestled closer to the river, is about two miles to the north. Tunbridge and North Tunbridge both have general stores, church buildings and a number of dwellings. The centrally-located main village also hosts the town office, library, post office and town meeting hall. The Tunbridge Central School is located in North Tunbridge.



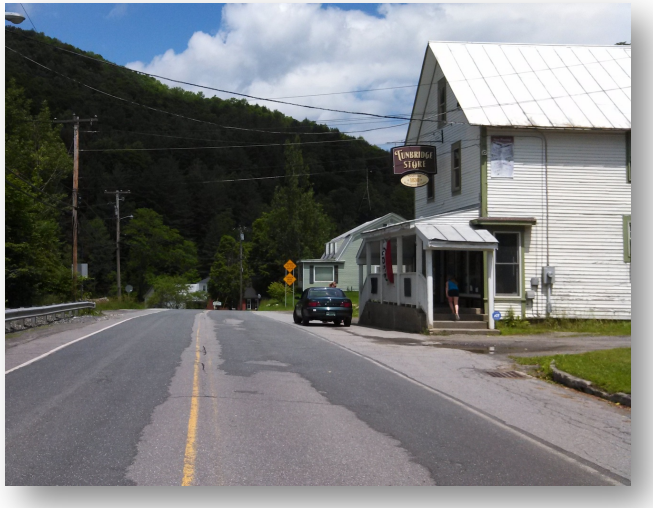
Tunbridge Village, though not separately incorporated, is listed on the National Register of Historic Places. Both Tunbridge and North Tunbridge are state-designated "Village Centers" as shown on accompanying maps.

Tunbridge Fairgrounds

The Tunbridge Fairgrounds, located along the First Branch, has hosted the Tunbridge World's Fair since 1875. The Tunbridge World's Fair (incorporated in 1902 as the nonprofit Union Agricultural Society) is a revered state-wide institution that supports agriculture and community. Up to 30,000 people attend the fair daily during the four-day event in September. Other events held on the grounds from May through October include horse shows, draft animal days, sheep trials and musical events. The grounds are also used by the Fire Department for training. The Vermont History Expo is also held here every other year. The fairground property is privately-held, and is supported and maintained through the Friends of the Tunbridge World's Fair.

The Fairgrounds are included in the Tunbridge Village National Register Historic District – there are no other fairgrounds of the same historic value or setting left in Vermont. Because of their location next to the river, the grounds and its 60 buildings are susceptible to flooding – in the past the water has come up high enough to flow through the horse barns, and has left a lot of silt and debris in its wake.

The town has retained its traditional rural character which, as described in more detail in the 2013 Tunbridge Town Plan, is highly valued by local residents. Outside of its historic village centers homes are dispersed along dirt roads, surrounded by working farms and forestland. The VT 110 corridor is not yet overburdened by development – commercial development in town is sparse. There is support for more village- and home-based businesses, but local residents prefer that the town remain rural, with most of the land devoted to agriculture, forestry and outdoor recreation.



	2000	2010	Change
Population	1,309	1,284	25 (-1.9%)
Households	513	556	43 (8.4%)
Housing Units	679	764	85 (12.5%)

Population. Although Tunbridge is not immediately located near Interstate 89, it is a lovely town within easy commuting distance of major employers in the Upper Valley, and continues to attract new year-round and seasonal residents. The local population grew by 41% during the 1980s and 1990s, but has since leveled off, reflecting regional trends. Today Tunbridge's year-round population numbers around 1,300 – well below its historic peak of 2,003 in 1820. No significant population growth is anticipated over the next five to ten years.

There are no estimates of the town's seasonal population, but assuming a seasonal household size of two persons per unit, seasonal units may easily add more than 300 people to the town's population. Special events, such as the Tunbridge World's Fair, bring more than 30,000 people to town. The local population, like that of the county and state, is aging – the median age of town residents increased from 38.2 years in 2000 to 45.5 years in 2010. The number of residents 65 years and older increased by 12% over the same period (US Census).

Households. While Tunbridge experienced a slight decline (-1.9%) in year-round population in the 2000s,

the number of households in town increased by more than 8% – reflecting an increasing number of smaller households. Of the 556 households counted in 2010, only 134 (24%) were families with children; another 147 (26%) were single-person households. The average household size in 2010 was 2.31 persons, down from 2.55 in 2000.

Housing. Residential development is the dominant form of development in town – residential properties comprise 78% of listed properties on the town's grand list. According to US Census counts, the number of dwelling units in Tunbridge increased by more than 12% in the 2000s – higher than the county average of 11% – due in part to an increase in the number of seasonal or vacation units. Of the 764 dwellings identified in 2010, 160 (21%) were for seasonal, recreational or occasional use – much higher than the county average of 14%. Tunbridge is clearly an attractive community for seasonal residents who both add to the local population and to community life.

Single family dwellings make up an estimated 98% of the town's current housing stock – the remaining are duplexes (ACS 2005-11 estimates). There were 65 mobile homes identified on the town's 2012 grand list, including 19 without land. There are no multifamily dwellings, mobile home parks, nursing homes or other congregate living facilities (group quarters). The majority of the town's housing stock was constructed prior to 1980 – before many state and federal codes and local flood regulations went into effect. Many homes are historic – 31% were built prior to 1960 and are listed, or may be eligible for listing as historic structures (ACS 2005-11 estimates).

Around 15% of the town's year-round housing is rental housing. The high vacancy rate reported for rental units in 2010 (11%) suggests an oversupply of available rental stock, including some second homes; but housing for new homebuyers is limited – as reflected in a 1.7% vacancy rate for sale units (2010 US Census). This low vacancy rate, and the high demand for vacation homes, has created a tight housing market that affects housing availability and affordability.

Local Economy. Tunbridge is largely a bedroom community – the majority of local residents travel out of town to work. Local businesses include Anichini (a luxury linen manufacturer), thirteen commercial properties, including two general stores, and several farms and home based businesses, including craftspeople, contractors, and professional and service businesses. A local business directory is included on the town website. According to 2011 data from the Vermont Department of Labor, in 2011:

- There were 24 establishments (reporting units for unemployment insurance) in town, employing 139 workers.

- Public employers include town government, the school and the post office, accounting for 46 local jobs (33% of the total).
- The Tunbridge Central School (K-8) is the town's largest employer, with 29 employees.
- Of the town's 21 small business establishments, 12 (57%) are in the service sector, 7 (33%) are in construction trades – including both general and specialty contractors – and 2 (10%) are in agricultural and forestry support activities.

This does not include farmers, farmworkers and self-employed persons who are not covered by unemployment insurance.

Town Government. A local assessment of community capabilities is included in Appendix A. Much of the work of town government is accomplished by local volunteers. Tunbridge is governed by an elected, three-member selectboard. The town has limited staff, including an elected town clerk who handles the daily administration of town affairs. The town also has an appointed road foreman, health and fire officers, a tree warden and an active planning commission.

Elected listers track and assess property values in town. The town's one state representative, Sarah Buxton, resides in Tunbridge and also represents Royalton. She was instrumental in local recovery efforts following Irene. The town's state senator, representing Orange County, does not live in town. Tunbridge, as all Vermont towns, relies almost solely on the local property tax base (valued in 2012 at $159.3 million) and state aid to fund town government – including town offices and facilities, schools and local roads. The town's property tax also supports local fire and rescue services through annual appropriations. Tunbridge is an active member of the Two Rivers-Ottauquechee Regional Commission (TROC) and the 22-town Local Emergency Planning Committee (LEPC #12).

The town has a newly updated comprehensive municipal plan, readopted in April 2013, but few local ordinances in effect. This reflects local culture, the lack of significant development pressure, and the town's limited capacity to administer and enforce more extensive regulations. The selectboard has an adopted road ordinance that regulates access to and work within town highway rights-of-way. This includes minimum road, bridge and culvert standards that have not yet been amended to reflect updated (post-Irene) state standards. The town also has flood hazard area regulations, last updated in 1998, as necessary to participate in the National Flood Insurance Program (NFIP). These are administered locally with technical assistance from the state.

The town relies on Act 250 and other state regulations to regulate larger development and subdivisions in town, including commercial development on more than one acre of land, and subdivisions that create six or more lots or housing units. Act 250 requires that

development conform to the 2013 Tunbridge Town Plan, including specific policies regarding land use and new development within mapped flood hazard areas.

Tunbridge Community. Tunbridge is an extremely well-networked community that supports a number of very active local committees and organizations – for a small community, Tunbridge has a remarkable amount of social capital. Information about town affairs is distributed through the town website and the "Tunbridge Quarterly" newsletter. A town bulletin board is also maintained outside the post office. Annual Town Meeting in Tunbridge is a social event; school and athletic programs also draw people together. The Recreation Committee oversees the town's recreation facilities and programs, and holds monthly community breakfasts.

The Tunbridge Church has a large, diverse and socially active congregation that supports many local activities. The Tunbridge Library hosts regular well-attended events year-round, and is also an art gallery. The Tunbridge Historical Society also offers family events, such as fall ghost walks in local cemeteries. The Tunbridge Womens' Group (TWG) meets once a month, as does an informal sewing group. Mountain Folk offers regular concerts and "The Shindig" – a monthly dance held during the colder months – at the Tunbridge Town Hall.

Community support services include a food shelf and "Neighbors Helping Neighbors"– a local group that keeps track of and helps people in need.

Community Facilities. Community facilities include the Tunbridge Town Office (former Market School) and the Tunbridge Town Hall, used for town meetings and public gatherings – both are historic, well preserved buildings of importance to the community. These are located outside of mapped flood hazard areas. There are two schools in town, both located above North Tunbridge, including the Tunbridge Central School serving grades K-8 – which also serves as the town's designated emergency shelter – and the Wellspring School, a private school. Local schools are also out of mapped flood hazard areas.

The Town Garage is located at the end of Recreation Road, near the river. The garage itself may not be at risk of flooding, but access to it may be. During Tropical Storm Irene in August 2011, the road foreman moved key equipment up to his house in the village. The town's Recreation Field is also located on Recreation Road along the river. The town recently purchased a parcel adjacent to the Recreation Field, removed a snow-damaged building on the property, spruced up the land and added a picnic area and playground.

Tunbridge has no public water supply or wastewater treatment systems. Public facilities, local residences and businesses are served by individual wells and on-site septic systems. The Tunbridge Town Office and Town Hall, located in Tunbridge Village, share a well on the Tunbridge Fairgrounds property. A complete list of critical facilities and other facilities of local significance to the community is included in Appendix B; these facilities are also identified on the accompanying map.

Road Network. The town maintains 71 miles of road – just slightly higher than the county average. The Vermont Transportation Agency (VTrans) maintains eight miles of state highway (VT 110) through town, which follows along and crosses the First Branch over twelve bridges. A VTrans garage is also located on VT 110. Five covered bridges, all of which are listed on the National Historic Register of Historic Places, span the First Branch. These are maintained through a joint collaboration between the town and VTrans.

The adequacy of existing highway bridge crossings and culverts in relation to stream conditions is currently being inventoried and evaluated in association with the geomorphic assessment of the First Branch and some of its tributaries. Of the 47 structures inventoried to date, one – on Dickerman Road (Dickerman Brook) – has been rated as "fully incompatible" meaning that it is structurally incompatible with the stream channel, and therefore at high risk of structural failure. As such it warrants consideration for immediate replacement. Another ten have been identified as "mostly incompatible" – at a moderate to high risk of structural failure. Planning for their redesign and future replacement is recommended (VT DEC).

Public Safety. Tunbridge is served by the Tunbridge Volunteer Fire Department (TVFD), a locally supported nonprofit organization. The fire department responds to fires, auto accidents, downed power lines, floods and other emergencies in Tunbridge, and in neighboring towns under mutual aid agreements. Neighboring communities' departments are called in on large fires requiring outside resources. Over the past 16 years, the department has responded to an average of 28 calls per year. It also helps maintain town bridges and cleans out clogged road culverts.

Volunteer training is provided through the department and the Vermont Fire Training Council. The fire department has an active and dedicated core group of volunteer firefighters – an average of nine members respond per call – but it is getting harder to recruit volunteers, given the time commitments required for training and emergency response. The fact that that many local residents work out of town has also affected volunteer numbers and daytime coverage.

The Tunbridge Fire Department building is located at the junction of Monarch Hill Rd. and VT 110, and was repaired following flood damage in the 1990s. The building is undersized for the fire and rescue equipment

it currently houses, including two engines, a tanker and a first response vehicle.

Medical emergencies are handled currently by the First Branch Rescue Squad located in Chelsea for emergencies north of Potash Road, and by Royalton Rescue for emergencies from Potash Road south. The town is currently reviewing the status of existing rescue services, and the option of forming a local rescue squad. This would require the purchase of equipment and additional training. The closest hospital is Gifford Medical Center, located in Randolph. Medevac services are provided by the Dartmouth-Hitchcock Advanced Response Team (DHART) helicopter.

Appointed town constables provide limited security and traffic control services as needed. All other police functions are performed by the Orange County Sheriff or the Vermont State Police (Troop D) based out of the Royalton Barracks, located off Route 107 just east of the Bethel/Royalton Town Line in Royalton.

Utilities. Tunbridge is located within the service areas of the Green Mountain Power Corporation (GMP) and the Washington Electric Co-op (WEC), which supply electrical power to all sections of town. Two transmission lines cross the northern part of town; distribution lines generally follow and are accessed from local highway rights-of-way. Lines are cleared and maintained by the utilities. There are seven homes in town that have net-metered (grid-connected) solar photovoltaic systems, and two that have solar thermal systems. Several homes are independently-powered. Some residents and the Tunbridge Central School, the town's emergency shelter, also have backup generators for use during power outages. There is only one gas station in town, at the North Tunbridge Store, and no other fuel providers other than wood suppliers.

3. Planning Process

Public Process

Tunbridge served as a volunteer town, in this demonstration project, to develop and polish public outreach tools for hazard mitigation plans. A "Vulnerability Audit" or survey of understanding of individual and community preparation for hazards was developed and honed over the fall of 2012. A "Hazards Checklist" was also developed from national templates, to also include potential manmade hazards. The earliest version of the survey was handed out at a fall community "Chicken Pie Supper," promoted at the town offices during the week property taxes were due, and posted on the town website. Only three surveys were filled out and returned by those means.

A public meeting was then held on November 29, 2012, with public notice provided on the surveys and town website, in the "Tunbridge Quarterly" and *Randolph Herald*, through posters around town and public announcements at local meetings and events. More than a dozen people attended the meeting, including the survey respondents. The meeting used the two documents to facilitate group discussion and gain feedback on their content and format. This also worked very well in gaining input on hazards history and locally vulnerable locations. It also sparked thoughtful discussion about individual and community prepared-ness. All agreed the exercise had triggered thoughts on how to become better prepared.

ARE YOU PREPARED?

Do you think Tunbridge is well-prepared?

Please provide your input into the
TUNBRIDGE HAZARD MITIGATION PLAN
UPDATE
by joining the Planning Commission
at a
Public Meeting
on
Thursday, November 29 at 6:30 pm
at the Town Hall

In the meantime, please pick up the Hazards History Checklist and the Vulnerability Audit at the Town Clerk's Office or the Library to fill out with family and friends. Please return to the boxes at the Town Clerk's Office and Library.

The Tunbridge Planning Commission then held a meeting in January 2013 with the fire chief and road foreman to further identify and discuss hazards and to locate vulnerable infrastructure and buildings on maps. A subsequent meeting was held with the selectboard and a representative of the rescue squad to gain their perspective on information and input received to date. The background, hazard history, vulnerability and risk assessment portions of the plan were then developed using this information.

A public meeting to present and discuss identified hazards and vulnerabilities, and to brainstorm potential mitigation strategies, was held on April 15, 2013. Notice was provided via the town website, public posters, and through the "Tunbridge Quarterly." Since the *Randolph Herald* mistakenly didn't run the notice of the meeting, a reporter covered the event and wrote an in depth article – a better outcome that informed more people. In response, input was also received from a local farmer with land in the floodplain, who couldn't attend the public meeting.

Additional public meetings to present the draft plan and recommended strategies were held with the planning commission and fire department members on June 25, 2013, and with the selectboard, road foreman and fire department members on July 16, 2013, after providing copies of the draft plan for public review at the Tunbridge library and town office.

A final publicly warned meeting of the selectboard was held on August 20, 2013 to consider and approve the draft plan for submission to Vermont Emergency Management and FEMA. Revisions to the plan, based on feedback from FEMA, were made to the cost benefit analysis of implementation strategies in summer 2014 and winter 2015, with representatives of the planning commission, selectboard and fire department.

Data and Information

Federal and state hazards information referenced in this plan[1] was augmented locally through interviews and research conducted by project volunteers – including most notably interviews with the town historian, Euclid Farnham – and a review of many years of town reports for information on prior disaster events. Town listers spent three successive Tuesday mornings developing the list of structures vulnerable to flooding and provided information on the value of these properties from the town's grand list. They also estimated the number of local residents who potentially may be at risk. GIS mapping assistance and technical support were provided through the Two Rivers-Ottauquechee Regional Commission.

[1] Including draft state hazard mitigation plan information provided by Vermont Emergency Management in advance of plan adoption.

Integration into Town Decision-making

The Tunbridge Planning Commission was actively involved in plan development. Their recently updated, 2013 Tunbridge Town Plan provided an excellent source of information regarding existing conditions, and current town policies regarding hazard mitigation. The town's Emergency Operations Plan (EOP), updated annually by the selectboard and fire chief, was also reviewed as part of this planning process. The road foreman and fire chief (also the emergency operations coordinator) were critical in working with both boards and planners on the project, to help inform and coordinate the information and policies contained in this plan. It is the intent of the town, once this plan is formally approved by FEMA, to incorporate and address recommended mitigation strategies in the town's future comprehensive, emergency operations and disaster response planning, the town plan and in the update of town bylaws and ordinances, as outlined in Section 6. The town also intends to continue the cross-board communication in development and implementation of updates to these plans.

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4. Hazards Identification

County-Level Data

Much of the federal information regarding past hazard events is reported and available only at the county level. Information specific to Orange County was included in this analysis.

FEMA. Most hazards affecting our region are natural hazards associated with severe weather events. There were sixteen federally-declared disasters for Orange County between 1973 and 2011 – averaging about one every two years – though not all impacted Tunbridge directly. As indicated in Table 4.1, all disaster events involved severe storms – including most recently Tropical Storm Irene in 2011.

Table 4.1. Federal Disaster Declarations: Orange County, VT (1973-2011)

No.	Date	Type	Incident
397	7/6/1973	Flood	Severe storms, flooding and landslides
518	8/5/1976	Flood	Severe storms, high winds and flooding
712	6/6/1984	Flood	Severe storms and flooding
840	8/4/1989	Flood	Severe storms and flooding
938	3/11/1992	Flood	Heavy rains, ice jams, flooding
1101	1/19/1996	Flood	Ice jams and flooding
1201	1/6/1998	Severe Storm(s)	Severe ice storm, rain, high winds, flooding
1228	6/17/1998	Severe Storm(s)	Severe storms and flooding
1307	9/16/1999	Severe Storm(s)	Tropical Storm Floyd
1336	7/14/2000	Severe Storm(s)	Severe storms, flooding
1488	7/21/2003	Severe Storm(s)	Severe storms, flooding
1698	4/15/2007	Severe Storm(s)	Severe storms, flooding
1715	7/9/2007	Severe Storm(s)	Severe storms, flooding
1790	7/21/2008	Severe Storm(s)	Severe storms, flooding
4001	7/8/2011	Severe Storm(s)	Severe storms, flooding
4022	9/1/2011	Tropical Storm	Tropical Storm Irene

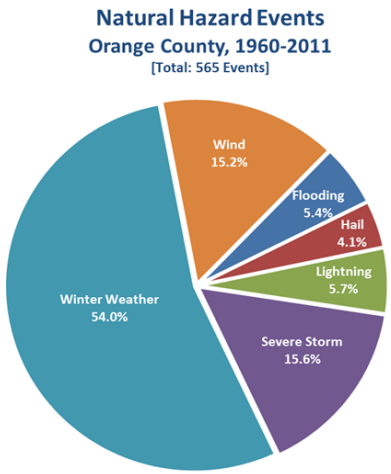
Source: FEMA National Emergency Management Information System (NEMIS).

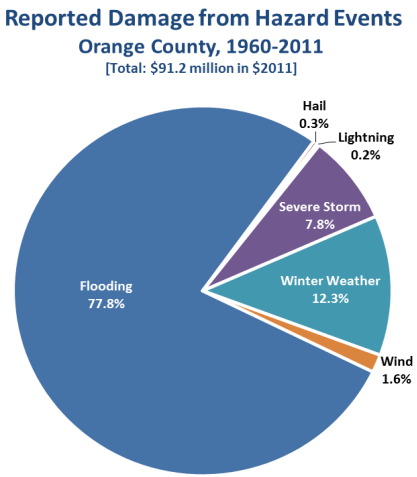
Vermont is still in the process of recovering from Irene – statewide more than 500 roads, 200 bridges, 1,000 culverts, and 3,500 homes were damaged or destroyed. Tunbridge, because of its location upstream from the White River, fared better than many of its neighbors. Irene had relatively limited impact in the watershed of the First Branch.

SHELDUS. SHELDUS, a national hazard events database, includes reported hazard events and associated property and crop damage from 1960 through 2011 (Table 4.2). Over this 51-year period, 565 hazard events were reported in Orange County (averaging 11 per year) which resulted in more than $91 million in damage. Again, not all of these events directly affected Tunbridge, but this does provide an indication of the type, frequency and relative impact of hazards that likely will affect the town. Most events (54%) were associated with winter weather, but clearly the majority of reported damage (78%) resulted from flooding.

Table 4.2. Hazard Events: Orange County (1960-2011)						
Type	Events	Damage ($2011)			% Total	
		Property	Crop	Total	Events	Damage
Flooding	30	$67,200,791	$3,511,507	$70,712,297	5.3%	77.5%
Hail	23	$209,639	$99,449	$309,089	4.1%	0.3%
Lightning	32	$207,793	$511	$208,304	5.7%	0.2%
Severe Storm	87	$5,779,224	$1,347,886	$7,127,110	15.4%	7.8%
Winter Weather	302	$10,201,661	$942,216	$11,143,877	53.5%	12.2%
Wind	85	$1,422,696	$2,140	$1,424,836	15.0%	1.6%
Tornado	3	$213,083	$26,531	$239,613	0.5%	0.3%
Hurricane	2	$22,202	$26,726	$48,928	0.4%	0.1%
Fog	1	$5,909	$0	$5,909	0.2%	0.0%
Total	565	$85,262,998	$5,956,966	$91,219,964	100.0%	100.0%

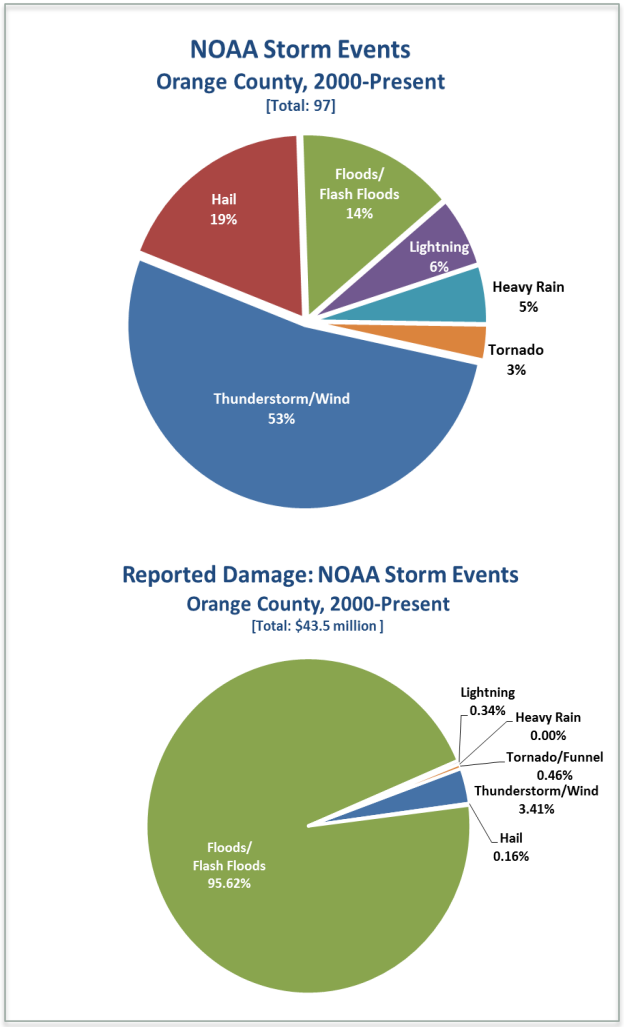
Source: Spatial Hazard Events and Losses Database for the United States, V.10.0 (2012).





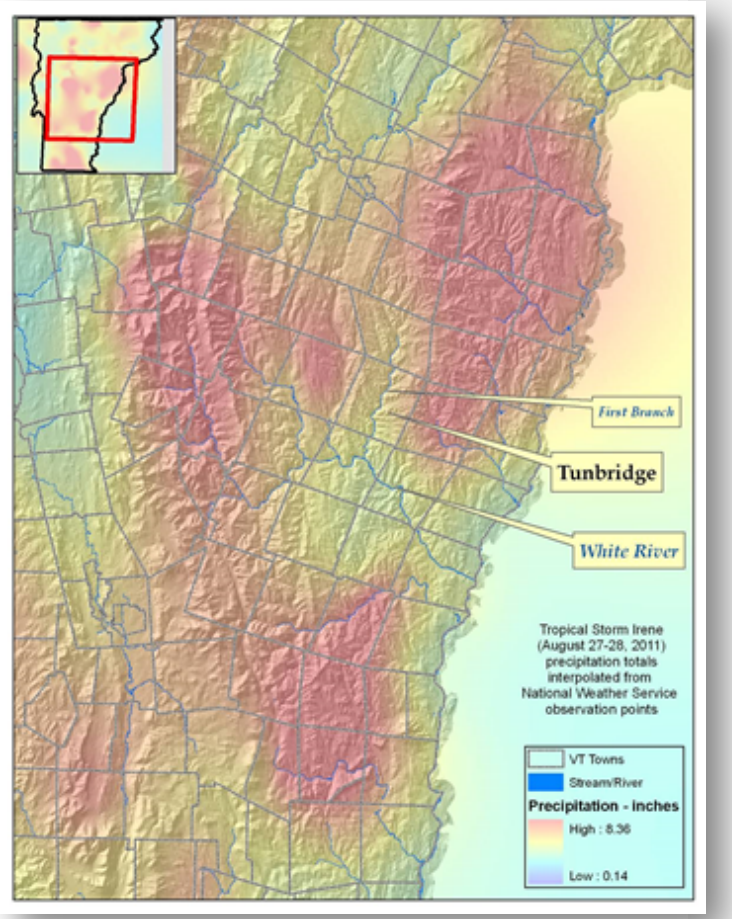
NOAA. The National Oceanic and Atmospheric Administration (NOAA) also maintains storm event databases, dating from 2000 to present. These cover "regional" events for the Orange County area (based on National Weather Service forecast zones) for periods of extreme temperature and drought, flooding, winter weather and storms, as well as more "local" (county and town level) events, including flash floods, high winds, hail and lightning. As expected, the majority of recorded regional events relate to winter storms and winter weather; while the majority of local events are associated with thunderstorms and high winds. Reported damage, however, again is largely due to flooding – including, in this context, more localized flash flooding.

Flooding is by far responsible for most reported damage from hazard events, locally and statewide. The majority of flood damage (around 60%) that occurs in Vermont, results not from floodplain inundation, but from flash flooding and fluvial (riverbank) erosion outside of mapped floodplain areas (VT DEC). Given this, flood maps issued by FEMA are not failsafe indicators of whether a given location will be safe from flooding. Tunbridge is currently in the process of mapping the First Branch river corridor, including major tributaries, to identify those areas most sensitive to flash flooding and fluvial erosion.



Local Hazards

A local history of hazard events was compiled from town documents, interviews with town and state officials, and community forum participants. These generally confirmed county-level information culled from national databases. Flooding – from severe storm events, ice jams and potential dam failures – was identified as the most prevalent hazard that has the potential to incur significant local costs. While flooding typically results in the most damage, it is not the only hazard of local concern. Hazards associated with winter weather – including icy roads, poor driving conditions, school closures and occasional power outages – are the most common and require regular attention, but typically don't have as severe an impact on property, public facilities and services.



Flooding. The November 1927 flood – Vermont's largest of record – did not directly impact Tunbridge, but did limit access in and out of town. All railroads were shut down, affecting local commerce, and only one road remained open for Tunbridge farmers to get their milk out to the Connecticut River Valley. The railroad bridge spanning the First Branch near present-day VT 110 and Welch's hardware store survived intact. The 1938 category 3 "New England Hurricane" – which hit during the week of the Tunbridge World's Fair – devastated Tunbridge and ruined the fair. Tropical Storm Floyd in 1999 was also memorable because it

closed the World's Fair (Euclid Farnham, November 2012). Tropical Storm Irene in August 2011 caused major damage to portions of the Strafford and Belknap Brook Roads. A section of Falls Hill Road was also lost to streambank collapse. The cost of road repairs totaled around $30,000.

Ice Jams. Most local flooding, and associated damage, has resulted from ice jams along the First Branch, as reported in town records and in the US Army's Cold Region Research and Engineering Laboratory (CRREL) ice jam database. The most recent, in 2010, damaged and washed away a wooden footbridge linking the Tunbridge Fairgrounds to Sherlock's Field. A 1999 ice jam of particular note destroyed the historic Tunbridge Mill Covered Bridge,

Probably the most devastating ice jam of water year 1999 occurred on the first branch of the White River in Tunbridge, VT. On March 4th and 5th, the 116-year old Tunbridge Mill Covered Bridge was destroyed by ice and the surrounding areas were flooded. No other river in Vermont was experiencing problems at the time. The problem on the White River actually began in the middle of January when ice was packed from Chelsea all the way to the Tunbridge fairgrounds. The river has a sharp bend behind the fairgrounds, and when more ice came down the river the ice was forced under the Mill Bridge. The structure was pushed off its abutments and badly smashed. Also, the old blacksmith shop, currently being used as an upholstery shop, was severely flooded. The employees in the shop as well as several Tunbridge residents nearby were forced to move out of the way in a hurry.

The Tunbridge Fairgrounds had sheep, oxen, and dairy barns knocked off their foundations by the flooding as well. Experts were called in to devise a plan to try and rescue the falling bridge but the necessary equipment was not available and could not get there in time. On the morning of Friday, March 5, the bridge was resting partially on its old abutments and partially on the ice. Attempts were still being made to save the bridge, but soon after noon the ice jam began to settle and move carrying the bridge with it. A last minute rescue was attempted, but much of the equipment had still not arrived and the bridge crashed into the frozen river. The bridge was insured for $100,000 and although the total damages have not been calculated, it is known that this amount is not enough to replace the bridge.

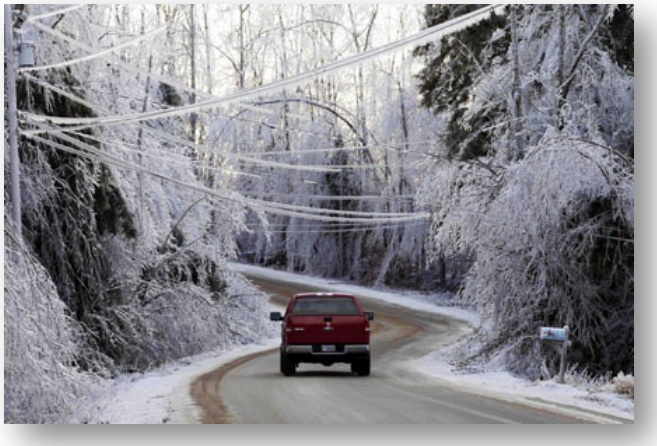
–CRREL Ice Jam Database Report.

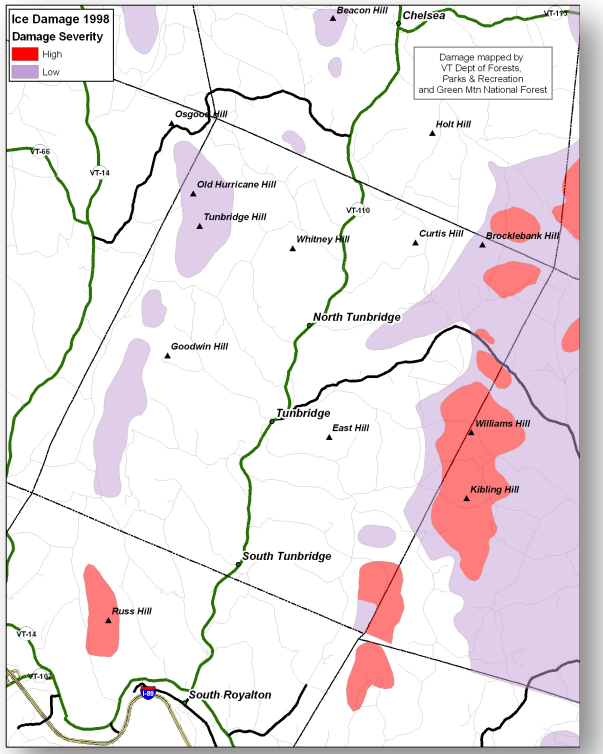
affected nearby homes and knocked barns at the Fairgrounds off their foundations. CRREL reports document other ice jams since 1964, including several in the 1990s that flooded the fairgrounds, damaged adjoining fields and temporarily closed VT 110 through town. Ice jams were also reported in eight of the eleven years between 1969 and 1980 – many occurring around the sharp bend in the First Branch, just above the fairgrounds.

Dam Failure. The Vermont Dam Inventory (VDI) maintained by the state lists seven dams on local drainages, including five on the First Branch, one on a tributary of the First Branch, and one on Bicknell Brook in Chelsea. Only the Keyser Dam, located on the Bicknell Brook upstream from the town line, is classified by the state as having a "high" hazard potential – meaning that in the event of dam failure or mis-operation, the loss of human life is probable, along with potentially significant environmental or economic losses. The Keyser Dam is a privately owned earthen dam – 225 feet long, 44 feet high with a surface area of 6 acres and maximum storage of 88 acre-feet – which was constructed in 1963 to create a recreation reservoir. Two other dams in town – the Tunbridge Trout Pond Dam, and the Hayward and Noble Mill Dam – are classified as having "low" hazard potential – in the event of dam failure, no loss of life is expected, and any economic or environmental losses would be minimal and generally limited to the property owner. Potential hazards associated with the other four dams in town have not been determined, but are likely low, given their small drainage areas.

Severe Storms and Wind. In addition to flooding, severe storms can generate high winds. High winds during the 1938 hurricane damaged barns and roofs, and blew down forests and several sugar bushes – resulting in a glut of firewood for many years thereafter (Euclid Farnham, November 2012). Storm events severe enough to generate wind shears, small cyclones and microbursts appear to be occurring with greater frequency in recent years, but associated damage tends to be highly localized. Trailing thunderstorms in June 2008 generated winds up to 65 knots (75 miles per hour) that sheared 25 to 30 trees, damaged a barn, moved a grain silo 200 feet, and brought down trees and power lines (NOAA Storm Event Database). Storms in 2009, 2012 and 2013 also downed trees on roads and power lines. A June 2013 storm damaged the Strafford, Moody, Morrill, Dodge, and Brocklebank roads. The locations hit by severe wind are random and hard to predict.

Winter Storms. The town is well-equipped to handle common hazards associated with Vermont's winter weather, though heavy snowfall and occasional power outages can create hardships for some local residents – especially older residents who live alone, and those with special care or medical equipment needs. Winter power outages are common, but typically last only a few hours – and at most no more than a day or two.





Severe winter weather is another matter. The ice storm of January1998 caused heavy tree damage at upper elevations in town. Heavy snows have been responsible for the collapse of several barn roofs over the years, and damage to a building on land recently purchased by the town to add to the Recreation Field.

Fire. Fire is a common, but generally localized hazard. Over the past sixteen years (1996–2012), the Tunbridge Fire Department responded to an average of nine fire calls per year, not including mutual aid calls. Fire calls were fairly evenly distributed between structure fires (34%), chimney fires (29%) and wild land fires (29%). Over this period, there was an average of 3 structure fires and 2.5 wild land or brush fires per year in town; 1996 was the peak year for structure fires (9) and 2004 for wild land fires (6). Over the last 30 years there have been no significant public losses due to fire. Tunbridge is fortunate to not have experienced a major fire in its village centers, given that most of the structures are older, historic wood-framed buildings. As in most rural communities, local water sources are used to fight fires.

The fire department has been installing "dry hydrants" in strategic locations around town as funding and landowners allow. The town's fire warden does not issue fire permits during dry periods when fire hazards are high.

Drought. Precipitation is generally evenly distributed throughout the year. Temporary dry spells are common – for example the first half of 2012 in Orange County was "abnormally dry" (U.S. Drought Monitor archive) – but locally these periods have not been frequent, extended or severe enough to cause drought conditions that have resulted in disaster declarations. Orange County farmers did qualify for federal assistance through the Emergency Conservation Program (ECP) in the fall of 2001, following a dry summer that resulted in moderate drought conditions in parts of the county, reduced crop yields and dried up livestock ponds. There is some concern that, given documented warming trends, periods of drought may occur more frequently in the future.

Earthquakes. Tunbridge residents occasionally feel the rumble of minor earthquakes centered out of state – the largest recorded in recent years was a 3.8 magnitude quake in 1995; other recent earthquakes included a 1.9 magnitude quake in 2007 and a 2.6 quake in 2011 (USGS Earthquake Archives). None resulted in locally reported damage. The probability of a significant earthquake (magnitude>5.0) within the next 100 years, within 50 km of Tunbridge, is less than one percent (US Geological Survey, 2009 PSHA Model).

Landslides. Locally "landslides" are associated with gradual or imminent riverbank failure – especially where the First Branch has undermined steep slopes west of VT 110 in Tunbridge Village. The town's former library was lost to gradual slope failure several years ago – it was stopped by some elm trees before going into the river. The former fire station building next to the library may be the next to go – one of the reasons the fire station was moved.

The slope west of VT 110 within the highway right-of-way (across from the General Store) is maintained by the state, and was heavily riprapped following Irene to stabilize the bank. There is concern that this hardening is increasing erosion downstream, which could increase undermining of the bank along the northern access road to the Tunbridge Fairgrounds. This area – on the wrong end of a curve in the river – receives the full brunt of water flow, and is unstable. The access road, which has been paved several times, is in disrepair. One building in the affected area has been moved, and a small office building is also at risk. The long-range Fairgrounds plan is to replace this building, in a different location, with a new building that can house the office, EMT and sheriff, but attempts to acquire the land needed to expand have been unsuccessful to date. (Euclid Farnham, April 2013).

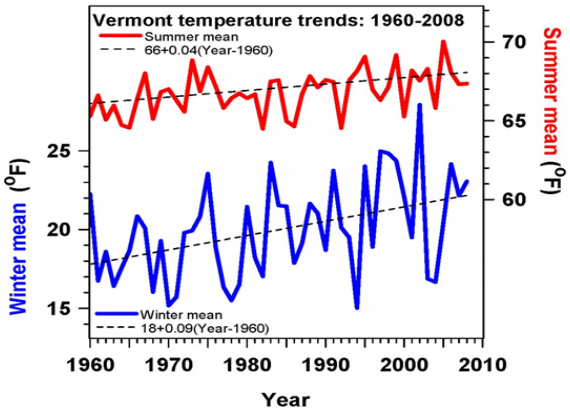
Results of bank erosion. The painting of Tunbridge Village in 1941 (left) shows land and buildings to the west of VT 110, across from the General Store, that have been lost over the years to subsidence from the river undercutting its banks far below. This stretch of VT 110 was heavily riprapped by the state after Tropical Storm Irene.

Hazardous Materials. There are no hazardous materials stored in town in any quantity, or active hazardous waste sites listed on the state's hazardous sites list. The state garage on VT 110 is listed as the only "hazardous waste generator" in town. Of the thirteen local spills logged by the VT DEC's Waste Management Division since 1996, all represented minor, isolated incidents – including overfills, an overheated transformer, and a leaking underground storage tank. Only four resulted from vehicle accidents – two involving milk truck rollovers on Howe Lane, one truck rollover on Bicknell Road and one accident VT 110. None of these resulted in significant damage or the release of more than 15 gallons of diesel fuel.

Climate Change and Emerging Hazards

The time for debate over the realities of global climate change is over. Global climate change is occurring, and every Vermonter will experience its impacts on the quality of life for which Vermont is justifiably famous." – 2007 Governor's Commission on Climate Change

Over the past few decades an increase in average annual temperatures – especially during winter months – extended growing seasons, and more severe storm events are all indicators that Vermont's climate is changing. The accompanying graph from Alan Betts, an independent atmospheric scientist and researcher living in Pittsford, Vermont, depicts the slow rise in temperature in both winter and summer seasons over the past 60 years. Since 1970 the annual average temperature in the Northeast has increased by 2°F, with winter temperatures rising nearly twice this much.



Carol Adair, Assistant Professor of Climate Change and Adaptation at the University of Vermont, has estimated that Vermont will warm 3 to 8 degrees Fahrenheit by 2050.
The Vermont Agency of Natural Resources, as part of its "Climate Change Initiative" has identified the following effects of warming on Vermont's climate – some of which are already evident:

- Shorter, warmer winters, with more wet snow, freezing rain, and icing, and less snowpack.
- Earlier spring snowmelt, ice breakups, peak river flows.
- Hotter summers – including more heat waves, droughts
- A longer growing season (with more pests).
- Stronger storms, including heavier rain events and higher stream flows.
- More invasive species, including pests and disease vectors.
- Increased hazards associated with flooding, landslides, severe storms, and threats to health, safety, infrastructure

Vermont Emergency Management has identified climate change as one of the hazards that the state, and local governments, should address in long-term hazard mitigation planning. As with other, related hazards, this highlights the need for the town to adapt to changing conditions and strengthen community resiliency to be able to better respond to emerging hazards and threats.

5. Vulnerability & Risk Assessment

Impact and Extent of Likely Hazards

Vermont Emergency Management and the Two Rivers-Ottauquechee Regional Commission have identified and ranked hazards that are likely to affect Vermont counties and towns.[2] These were considered, along with available federal, state and local information – including local responses summarized on the hazards checklist in Appendix D – in updating local priorities for hazard mitigation. All hazards considered and ranked are included in Appendix C.

Table 5.1 includes those hazards identified as the highest priorities for local hazard mitigation, as confirmed through public meetings. Those ranked highest on the list – ice jams, flash flooding and fluvial erosion – are related in their causes and effects. It's important to note that transportation-related hazards on VT 110, which ranked higher in the town's previous hazard mitigation plan, were ranked lower in this update, given that there are no high crash locations in town, and there has been only one reported accident since 1996 that resulted in a minor spill of diesel fuel.

Community Assets and Vulnerabilities

Critical Facilities and Infrastructure. The town's critical facilities, especially for emergency management, include the town office (administration, town records), the fire station, town and state highway garages, and the two schools – including the Tunbridge Central School which currently also serves as the town's only shelter. These are all located outside of the mapped

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Table 5.1 Priority Hazards

Hazard Type	Extent	Probability	Impact	Significance
Natural Hazards				
Ice Jam	Local	Highly Likely	Moderate	High
Flash Flooding	Local	Highly Likely	Moderate	High
Fluvial Erosion	Local	Highly Likely	Moderate	High
Flooding	Regional	Likely	Major	High
Hurricane/Tropical Storm	Regional	Likely	Major	High
Severe Thunderstorms	Local	Highly Likely	Minor	High
Severe Wind	Local	Highly Likely	Minor	High
Severe Winter Storms	Regional	Highly Likely	Minor	Medium
Wildfire	Local	Likely	Minor	Medium
Manmade Hazards				
Structural Fire	Local	Highly Likely	Minor	High
Transportation (Spills)	Local	Likely	Negligible	Medium

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[2] A draft list of ranked hazards, provided by VEM in advance of the draft state hazard mitigation plan, was a key reference used in Appendix C and Table 5.1

floodplain, but the fire station has experienced some flooding in the past, and is under-sized. There is concern that access to the town garage (Recreation Road) may also be cut off during flood events – during Irene, the road foreman moved road equipment up to the village. If sections of VT 110 become flooded or damaged, access to other critical facilities – including local schools and the town's only shelter – may also be cut off, at least temporarily.

VT 110 is the town's lifeline through the community – all community facilities and services are accessed from this route. The Strafford Road is also an important route in and out of town. The Fairgrounds Road is the main access to the fairgrounds – a critical connection during the World's Fair and other large public events.

Road washouts associated with flooding, ice jams and fluvial erosion are a major concern. If another storm occurs on the scale of Irene, VT 110 could easily be fragmented. There are several spots that are low and immediately adjacent to the First Branch – including the one mile stretch that runs north of the South Tunbridge Bridge to the final climb/hill that leads to Tunbridge Village. The South Tunbridge Bridge (built roughly 25-30 years ago) was controversial when built, because it required the removal of several houses. The one house remaining – clearly abandoned and decrepit – is right next to the bridge, and on the wrong end of the river's curve if the river breaches its bank.

Culverts and bridges that are vulnerable to washouts have been identified on VT 110, the Monarch/Whitney Hill Road, and the Strafford Road. Locally identified road segments at particular risk include:

- VT 110 culvert by the Fire House at the base of Monarch Hill Rd – cause for flooding about twice/yr, which has the potential to limit or eliminate access to fire and rescue services for much of the town.
- VT 110 bridge at base of Whitney Hill Rd is undersized and also could result in similar cutting off of access to services.
- VT 110 culvert just south of the village, between southern access roads to the Fairgrounds – overwhelmed during Tropical Storm Irene.
- VT110 downstream of Anichini's (former Welch farm) – possible undermining from riverbank erosion.
- VT 110 at the Wellspring School – undersized culvert.
- Strafford Road, at Drew Road – an historic stone bridge at this location has been repeatedly overwhelmed and needs to be replaced.
- Fairgrounds Road – the northern access is being undermined by riverbank erosion.
- Recreation Road – undersized culvert.
- Belknap Road – undersized bridge.

As noted earlier, a more comprehensive structural inventory, conducted as part of the geomorphic assessment of the First Branch, identified one culvert on Dickerman Road that should be replaced immediately,

and ten others that should be scheduled for future replacement.

The town's highway infrastructure also includes five historic covered bridges – the Cilley, Flint, Larkin, Howe and Mill Bridges – all listed on the National Register, and all vulnerable to flooding and fluvial erosion. The cost to replace the Mill Bridge in 1999, after it was destroyed in an ice jam, was $240,000 – paid for by the state, town, insurance and private donations (Euclid Farnham).

The only other critical infrastructure identified in town are two electric transmission lines that cross the northern end, and distribution lines that follow local roads. These are vulnerable to severe storms that generate high winds, heavy snowfall and ice. Power line corridors are cleared and maintained by the utility companies, in cooperation with the town and the state for utilities within highway rights-of-way.

The Keyser Dam, located on Bicknell Brook across the town line in Chelsea, is also a concern, given its classification as a "high hazard potential" dam in the Vermont Dam Inventory. The area below the dam, from the dam to the First Branch, consists of woods and open fields. The primary risks, in the event of dam failure, are to roads and structures below the dam.

Cultural Resources. A number of cultural resources of local and state significance have been identified that are especially vulnerable to ice jams and flooding – including, in particular, the Tunbridge Fairgrounds.

The Tunbridge Fairgrounds, as earlier described and as shown on the accompanying map, are located on the First Branch, along a bend in the river, partially within the mapped floodplain. Portions of the fairgrounds and some of the buildings have suffered fairly frequent flooding and damage from ice jams and bank erosion. As noted, the north entrance road and office – "located on wrong end of the oxbow" – are especially vulnerable to further slumping and bank failure. Emergency planning for the fairgrounds has long been a high priority for both the town and the fire department, given that thousands of people attend public events here each year. The town's emergency operations plan (EOP) is updated and adopted each year just prior to the fair, with this in mind.

The town's recreation field, created through volunteer efforts and recently expanded through the purchase of an adjoining parcel, is also near the river. This represents an appropriate use of land within the floodplain, but some recent improvements may be vulnerable to flood damage. The rec field is accessed via the Recreation Road and, like the town garage, may be cutoff during a flood event.

Other locally identified sites that are particularly vulnerable to flooding, ice jams and/or bank erosion include:

- Mill Cottage – an 1800's dwelling hit hard in the 1999 ice jam, when the Mill Bridge was lost,
- North Tunbridge buildings – including small commercial buildings housing a used furniture store and photo studio, and a former mill building (now a second home) on other side of river,
- A residence opposite the base of Dickerman Road,
- A residence just upstream of the Howe Bridge, and
- A decrepit, vacant house opposite Russell Road.

As noted, other major community buildings are located on high ground. Structural fires are a more general concern, given the town's many historic wooden buildings.

Local Residents and Businesses. Community vulnerability and resiliency traditionally have been addressed in relation to buildings and infrastructure – but people are a community's most valuable asset. Local residents, households and businesses differ in their abilities to prepare for, respond to and recover from hazard events, and especially larger, regional disasters. Assessing community vulnerability also entails identifying and accommodating the community's most vulnerable residents – including those who may need additional assistance during and after both major and minor events.

Some exposure and vulnerability to natural hazards is inherent to and an accepted part of life in a rural community. Outside of its three villages, Tunbridge's population is scattered among the hills, at a density of roughly 29 persons per square mile. Many local residents live in isolated areas, along back country roads that can be cut off and difficult to reach in emergency situations. As a result, most local households and businesses are prepared for short bouts of bad weather, storms and power outages – but larger events such as Irene may put everyone at risk. Even the smallest events can have serious consequences for the town's most vulnerable residents, including seniors, children, and residents with disabilities or limited means.

Information from the 2010 US Census and more recent 5-year estimates from the American Community Survey, also conducted by the Census Bureau, offers some limited insight into the town's more vulnerable groups. For example in 2010:

- 15% of the town's population was over the age of 65. This segment of the population is expected to grow as the local population continues to age – increasing the demand for services, including local emergency response services.
- 12% of local residents lived alone – including 25% of whom are 65 years or older.
- 14% of households were single parents with children.
- 13% of local residents lived in rented housing. Of homeowners, only half owned their homes outright.

More recent estimates released by the US Census Bureau (for 2007-2011)[3], suggest that around:

- 3% of residents speak a language other than English at home, though less than 1% cannot speak English well (and would be considered "linguistically isolated").
- 11% of individuals, 8% of families and 6% of seniors have incomes below the federal poverty level.
- 6% of local households receive some public assistance in the form of case or food assistance.
- 17% of local residents are self-employed; around 4% are unemployed.
- Most Tunbridge residents rely heavily on the local road network to get to work – 85% drive alone to work, and the average commute time is 32 minutes. Only 4% work from home. Local residents must also drive to neighboring communities for many goods and services, including medical services.
- Not surprisingly, all Tunbridge households have vehicles – an estimated 75% have two or more.
- 11% of housing units are mobile homes, which may be more susceptible to storm and flood damage.
- No households rely solely on electric heat, which would make them especially vulnerable during power outages. Most depend on fuel oil (35%), wood (32%) or propane (29%) for heat.
- All local households have telephone service.

While this type of information offers a broad view of the town's potentially vulnerable groups, it is not a substitute for the local knowledge needed for emergency response planning, and community networks that are so vital in disaster response and recovery. For example, procedures have recently been established for the road crew and fire department to work together, road by road, to check on all affected residences while clearing downed trees

after major storms. Tunbridge is especially fortunate to have strong community networks already in place, including groups such as Neighbors Helping Neighbors, which are the foundation of real, long-term community resiliency.

Flood Risk Assessment

HAZUS, the federal modeling program used in risk assessment, is available from the state only upon request, for certain rivers. HAZUS was not used in Tunbridge given its rural nature and the types of hazards the community is expected to face. Since flood risk is the only risk that is spatially predictive from available information, the number and value of properties within the mapped floodplain were determined using the most recent (1985) FEMA flood

[3] These are American Community Survey (ACS) estimates, based on surveys conducted over a five-year period. Given Tunbridge's small population base, these estimates are subject to wide margins of error. Unfortunately, information regarding mobility and other disabilities is no longer reported at the town level because of the small sample size.

maps for the town – supplied in digital form by the Two Rivers Ottauquechee Regional Commission – and from E-911 building data. The flood risk assessment was completed by two town listers who have also served on the planning commission. To identify structures, the listers also reviewed 2012 river photos taken by contractors (including one of the two listers) doing the geomorphic assessment of the First Branch. Once geomorphic assessment work is complete, the town will also have fluvial erosion hazard area (river corridor) maps for use in fluvial erosion mitigation planning.

The results of the town's risk assessment are provided in Table 5.2. Less than 4% of structures are located in an area at high risk for flooding. The total value of these structures – now estimated at $2.7 million – represents less than 3% of the town's grand list. As of November 2010 (pre-Irene) there were only four properties insured under the National Flood Insurance Program, valued at $564,500. No repetitive or severe loss properties have been identified (VT Floodplain Management).

Table 5.2 Flood Risk Assessment

	Number of Structures			Value of Structures			Population		
Structure (Type)	Total (Town)	In Flood Hazard Area (#)	In Flood Hazard Area (%)	Total Listed Value (2012$) (Grand List)	Listed Value in Flood Hazard Area (2012$)	Listed Value in Flood Hazard Area (%)	Total (Town)	In Flood Hazard Area (#)	In Flood Hazard Area (%)
Buildings	738	17	2.3%	$93,163,600	$1,909,100	2.0%	---	---	---
Outbuildings	375	8	2.1%	$7,601,700	$84,000	1.1%	---	---	---
SUBTOTAL	1113	25	2.2%	$100,765,300	$1,993,100	2.0%	---	---	---
Fairgrounds*	32	18	56.3%	$1,493,000	$746,500	50.0%	---	---	---
TOTAL	**1145**	**43**	**3.8%**	**$102,258,300**	**$2,739,600**	**2.7%**	**1,284**	**38****	**3.0%**

* Fairgrounds data are based on rough assessments of "high" and "low" value buildings in and out of the floodplain, as determined by looking at aerial photos.

**Buildings in the mapped floodplain are estimated to have around 38 occupants on a regular basis; this number is estimated to run as high as 113 during regular business hours in the summer. The Tunbridge Fairgrounds can host as many as 30,000 additional people on a single day (best annual tallies approach ~55,000 during the four days of the Fair).

Based on their knowledge of local households, the listers estimate that around 3% of the town's population resides in flood hazard areas. The Tunbridge Fairgrounds, as a large events facility located partially within the floodplain, poses significant risk during public events, including the fall World's Fair. Coordinated response planning, adequate preparation and timely warnings are needed to evacuate people and livestock in advance of a major storm event.

6. Mitigation Strategies

Goals and Policies

The 2011 Tunbridge Annex attached to the regional pre-disaster mitigation plan included several goals, supported by municipal and regional plan policies, which remain relevant for local hazard mitigation planning:

- Reduce the loss of life and injury resulting from all hazards.
- Lessen financial losses and property damage incurred by the town, businesses and private citizens due to disasters.
- The impacts of hazards should first be avoided, and then mitigated and reduced where they cannot be reasonably avoided.
- The relationships between land use and development and natural and manmade hazards

2013 Tunbridge Town Plan

Goals

- *To enhance and maintain use of flood hazard areas as open space, greenways, non-commercial recreation and/or agricultural land.*
- *To ensure no net loss of flood storage capacity in an effort to minimize potential negative impacts. These impacts include the loss of life and property, disruption of commerce, and demand for extraordinary public services and expenditures that result from flood damage.*
- *To maintain maps that reflect as accurately as possible the flood hazard areas to assist in appropriate land use decisions.*
- *To recognize that upland areas adjacent to unstable rivers and to steep streams may be at risk of erosion during floods.*

Policies

- *It is the policy of the Town that the preferred uses for flood hazard areas shall be for open space, greenbelts, and non-commercial recreational or agricultural uses.*
- *Any land use activity (filling, or removal of earth or rock) within flood hazard areas which would result in net loss of flood storage or increased or diverted flood levels or increased risk to adjacent areas shall be prohibited.*
- *Utilities or facilities serving existing development (e.g. water lines, electrical service, waste disposal systems, roads, and bridges) may be located within these areas only when offsite options are not feasible and provided that these utilities or facilities are relatively protected from flooding damage.*
- *Flood hazard regulations should be extended to areas identified as at risk to flood erosion.*

need to be identified and addressed in local policies and programs, in order to better manage and minimize associated risks.

- Local mitigation actions should complement larger, regional and statewide efforts to reduce risk to local communities and to build community resilience.

These goals also conform to recently adopted state planning goals (under 24 V.S.A. § 4302) specific to flood resilience:

- New development in identified flood hazard, fluvial erosion, and river corridor protection areas should be avoided. If new development is to be built in such areas, it should not exacerbate flooding and fluvial erosion.
- The protection and restoration of floodplains and upland forested areas that attenuate and moderate flooding and fluvial erosion should be encouraged.
- Flood emergency preparedness and response planning should be encouraged.

Tunbridge updated its town plan in April 2013 to include additional goals and policies specific to flood and fluvial erosion hazard areas (see side bar above).

Existing Programs and 2011 Hazard Mitigation Plan

The 2011 Tunbridge Annex identified eight hazard mitigation strategies to be undertaken by the town. The status of each is highlighted as follows. Local efforts since the 2011 plan was adopted are also presented in more detail.

- ***Ensure that the Basic Emergency Operations Plan is current.*** The town's BEOP is readopted annually.
- ***Encourage utilities to continue a regular schedule of tree-trimming along power lines.*** This is done by the utilities as needed, in coordination with the town and state for work within public rights-of-way.
- ***Use the regional pre-disaster mitigation plan for hazard identification and mapping.*** Hazards identified in the regional PDM plan, and the draft state hazard mitigation plan, were considered in this update.
- ***Update the existing Emergency Operations Plan.*** The EOP is updated annually, in advance of the Tunbridge World's Fair. Note: this is now considered an emergency preparedness activity.
- ***Continue planned road maintenance and culvert inventories. Upgrade culverts and ditching.*** Regular road, culvert and bridge maintenance on town highways occurs annually, with the assistance of the fire department. The culvert inventory, conducted in association with the geomorphic assessment of the First Branch, was just recently completed (in 2013).
- ***Update and revise flood hazard regulations.*** *In progress, with assistance from the state.*
- ***Develop additional dry hydrants in rural locations.*** One additional hydrant has been installed, on the Moody Road.

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- ***Pursue HAZMAT training for the fire department***. Training occurred in 2010, funded through the Fire Service Academy.

Emergency Response Planning. The selectboard takes its responsibilities for emergency operations planning – coordinated through the fire chief (who is also the town's emergency management director) – very seriously. The town's Emergency Operations Plan (EOP) is typically updated annually prior to the Tunbridge World's Fair, as needed to ensure the well-being of a much larger visiting population. Tunbridge also participates in regional emergency response and hazard mitigation planning through the Two Rivers-Ottauquechee Regional Planning Commission and the District #12 Local Emergency Planning Committee.

Flood Hazard Area Regulation. Forgoing traditional zoning regulations, the town has adopted flood hazard bylaws, and participates in the National Flood Insurance Program (NFIP). The Tunbridge Town Clerk serves as the local Flood Hazard Area Administrator, with technical assistance from the state. The town's 1985 Flood Insurance Rate Map (FIRM) includes no elevation data for use in regulating the floodplain, and is clearly out of date. A 1991 floodplain study conducted by the US Natural Resource Conservation Service (then the Soil Conservation Service), provides some additional base flood elevation and floodway information. The town's flood hazard area regulations, last updated in 1998, meet minimum NFIP requirements for program participation, but continue to allow new development within mapped flood hazard areas. They also do not address fluvial erosion hazards. The Tunbridge Planning Commission is in the process of updating the town's regulations, referencing new state models that further limit development within flood hazard areas. The commission is working from a checklist provided by state staff.

Geomorphic Assessment. As noted previously, a soon to be completed geomorphic assessment of the First Branch, conducted under state assessment protocols, will support and include the preparation of a river corridor (fluvial erosion hazard area) map of the river. Once accepted by the state, this map may be used to regulate development within those areas of the river corridor that are most at risk from riverbank erosion and collapse.

Highway Maintenance and Management. The town's road foreman administers permitting for new driveways and driveway culverts under an ordinance adopted by the selectboard in April 2011. This ordinance predates Irene, and the new (2013) state standards for road maintenance and increased culvert sizing that followed. The state has tied local adoption of these new standards (along with an EOP, flood regulations, and a local hazard mitigation plan) – to matching incentives under the Emergency Relief Assistance Fund (ERAF). This applies under new state rules governing the distribution of state matching funds for federal disaster relief, under FEMA's Public Assistance Program. The state funding default rate – currently 50% of the

local match requirement – will drop to 30% in the near future, unless the town adopts new road standards and an updated hazard mitigation plan.

The road crew, with the assistance of the fire department, regularly cleans out bridges and culverts on the town highway system. There is concern, however, that many private driveway culverts are not being properly maintained.

Fire Prevention and Response. The fire department recently acquired a compressed air foam pump to coat surfaces and suppress fires more quickly; but the department continues to rely on available local water sources, including the First Branch, to fight fires. Access can be a problem – especially at the southern end of North Tunbridge. An access to the river by the Tucker farm is maintained year-round. One dry hydrant has been installed, on Moody Road, in the past three years. A second was planned for a site on Whitney Road, but the department could not get a deeded access. A Button Hill Road hydrant is also on the schedule. The dry hydrant program takes time, energy and funding – all of which are hard to come by.

The 2011 Tunbridge mitigation plan was less than 10 pages, attached as an appendix to the regional hazard mitigation plan with even less pages unique to the town and input only from the Selectboard and Fire Chief. This plan is the result of broad public input and discussion about the environment, hazards and social cohesion particular to Tunbridge. The 2011 goals were extremely general. None of the priority areas for action have been dropped between the 2011 plan and this plan. However, the strategies recommended in this plan delve more deeply into loss avoidance via updated planning, training and regulation, including new environmental and social strategies. Although, compared to neighboring towns, Tunbridge suffered only minor damage during Tropical Storm Irene, it did serve as a wake up call. The 2011 plan had strategies limited to maintaining the currency of the Emergency Operations Plan, fire department improvements and road maintenance. This plan clearly assigns broad responsibility for implementation to engage more of the community. It is the result of networking among silos of emergency responders, road crew, Selectboard, Planning Commission, Emergency Services committee, the environmental consultant doing the river corridor analysis and town residents. More detail went into researching hazard history, determining priority hazards, and deciding on the actions the town can take. The resulting strategies are more clearly aimed at hazard mitigation, and more detailed and diverse; covering integration of multiple plans, regulatory implementation, community outreach, and infrastructure.

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Recommended Strategies

Tunbridge, as a small, rural community, has limited capacity to take on new projects and programs,

however much needed or well-intended. This was taken into consideration, a rural cost-benefit analysis weighing additional volunteer capacity and funding sources to address priority needs in developing the following recommended strategies. An initial list by type of hazard was prepared from strategies included in the 2011 plan, and in reference to FEMA's new publication, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards* (January 2013). This list was then presented for community discussion and rating, the results of which are included in Appendix E. The instructions were to choose which should be included in the five year plan, based on cost (including considering the feasibility to complete or initiate in that time) versus benefit (or need).

Based on their knowledge of feasibility and cost versus overall public benefit, the planning commission and selectboard (which includes fire department members) continued to hone the strategies to the following list, which includes those strategies that ranked the highest for local consideration, efforts currently under-way, and specific strategies that are recommended or required by the state. When considering public and environmental benefit during the prioritization process, the community, planning commission and selectboard members took into account the following considerations:

- increased education on mitigation to all residents, while focusing on reaching the most vulnerable residents
- conservation strategies that would involve more townspeople, thus both building community and increasing understanding of hazard mitigation, while gaining greater river stability and storage
- gaining information for immediate infrastructure replacements while helping inform next mitigation steps
- improving communication and integration among diverse committees, plans and regulations while meeting state requirements for hazard mitigation and flood resilience.

The choices of strategies were further refined in meetings with the Fire Chief and Road Foreman, based on immediate needs and broad public benefit versus overall cost and funding availability.

Community Outreach

- Develop an education and outreach program for local residents, e.g., to include winter or storm survival tips and evacuation information (town website, Tunbridge Quarterly, tax bills).
- Sponsor an annual river clean-up, to include private driveway culvert cleanouts.
- Identify and assist town residents who are vulnerable to severe winter hazards (e.g., freezing temperatures, power outages).

Land, Infrastructure Projects

- Develop a digital town bridge and culvert inventory database, coordinated with state databases.

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- Identify and schedule bridge and culvert upgrades, giving priority to those that are most vulnerable to washouts.
- Identify and secure locations for dry hydrants, with broadened community participation, and install as resources and funding allow.
- Identify and protect strategic land parcels that provide flood storage (e.g., through the acquisition of river corridor easements).
- Establish a committee made up of fire department, planning commission, selectboard and Neighbors Helping Neighbors members to establish a second community shelter within or near Tunbridge village.

Planning

- Amend the 2013 Tunbridge Town Plan to incorporate the adopted hazard mitigation plan under (or as) the newly required flood resiliency plan element.
- Complete fluvial geomorphic assessments of the First Branch and its major tributaries.
- Develop a river corridor management plan for the First Branch.
- Strengthen inter-board communication, planning and collaboration by holding an "all-boards" meeting – to include celebration, food.
- Strengthen supportive partnerships with adjoining municipalities through the White River Partnership (WRP), the Two-Rivers Ottauquechee Regional Commission (TROC) and Local Emergency Planning Committee (LEPC), and state officials; and participate in related regional hazard mitigation and emergency response planning.
- Develop separate rescue coverage for Tunbridge while continuing mutual aid agreements with neighboring communities and state.
- Monitor progress on adopted hazard mitigation strategies and tasks, to include brief updates in annual town reports.
- Update and amend the town's hazard mitigation plan before or in conjunction with the next town plan update.

Local Regulations

- Complete the update of the town's flood hazard area regulations to further limit development in mapped flood hazard areas, for example to include the following:
  - Further restricting fill and new development within mapped flood hazard areas,
  - Specifically prohibiting outdoor storage of materials within the floodplain,
  - Increasing freeboard requirements for flood-proofing and the elevation of structures above the base flood elevation.
- Develop and adopt river corridor (fluvial erosion hazard area) regulations and/or river setback and buffer requirements.
- Update town highway and culvert standards to incorporate 2013 recommended state standards for road maintenance and culvert sizing.

7. Mitigation Program: The Plan for the Next Five Years!

An implementation schedule that identifies mitigation actions, responsible parties, a recommended timeframe, and potential sources of funding or assistance is included in Table 7.1. It will be the responsibility of the planning commission, in association with the selectboard, road foreman and fire chief, to monitor and report annually on the progress of local implementation efforts. They will hold at least one cross-board public meeting each year, in the evening when more people can attend, with public notice to encourage public input. The Emergency Operations Plan will be reviewed at the same time, to complete both annual updates. Timing of the meeting will be between Town Meeting, to include newly elected officials, and May 1.

This plan will also be reviewed and updated by the planning commission in association with the update and re-adoption of the town's 5-year comprehensive plan during 2017, or in association with the selectboard and Emergency Management Director after a major disaster.

Vermont Emergency Management emphasizes a collaborative approach to achieving mitigation on the local level. As such, the town will continue to partner with state agencies (VEM, ANR, VTrans, ACCD), the Two Rivers Ottauquechee Regional Commission, our Local Emergency Planning Committee (#12), FEMA Region 1 and other agencies to obtain needed assistance and resources to pursue identified mitigation projects and planning initiatives. It is understood that, in order to apply for FEMA funding for mitigation projects, the town must have a FEMA-approved hazard mitigation plan, and a project must meet FEMA benefit cost criteria.

Table 7.1 Tunbridge Hazard Mitigation Schedule: 2014-2019

Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding, Resources, Cost to Town)	Implementation (via Existing Programs)
Planning				
Amend the 2013 Tunbridge Town Plan to incorporate the hazard mitigation plan under (or as) the newly required resiliency element	Planning Commission	Next town plan update due by 2017	Selectboard, TRORC, Grants Cost to Town: Low	Incorporate in regular 5-yr update of the plan. Public Hearings, Adoption
Complete fluvial geomorphic assessments and river corridor planning for the First Branch and major tributaries	VT DEC River Management, Planning Commission	Assessment and plan draft completed fall 2014	WRP, Ecosystem Restoration Grants, Community Watershed Grants Cost to Town: Low	Planning Commission, public notice, review as background to corridor management plan
Develop a river corridor management plan and incorporate recommendations into town plan update and next update of this plan (First Branch)	WRP, Planning Commission	Corridor Mgt Plan finalized fall 2014, plans begin updates 2016	Same as above	Incorporate recommendations into hazard mitigation, and town plan updates
Hold "all boards" meeting – to include celebration, food, to include update of EOP, to cross-reference the two plans	Selectboard	Annually , between Town Mtg and May 1, or after major event	Municipal, Nonprofit Boards EMD, Road Foreman Cost to Town: Low	Meet to coordinate planning, emergency response efforts
Strengthen supportive partnerships with adjoining municipalities, the WRP, TRORC and LEPC, and state officials; participate in regional hazard mitigation and emergency response planning	Selectboard, via appointed representatives	Town representatives attending regular meetings	VT Emergency Mgt TRORC LEPC Cost to Town: Low	Selectboard appointments, program/ project reports to Selectboard, Planning Commission

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Develop separate First Responder coverage for Tunbridge while continuing mutual aid with neighboring communities and state	Selectboard, Emergency Response Committee	Reporting quarterly to Selectboard Resolve medical component by spring 2015	Municipal (develop and adopt in Town Budget 2015), recruit new volunteers and train as First Responders Cost to Town: Medium	Acquire equipment & training for new members, Mutual Aid Agreements
Update 1975 School Emergency Plan	Selectboard, Emergency Response Committee, School Board and Principal	Initiated 2014, completed by 2015	Model plans have been acquired, are being reviewed Cost to Town: Low	Taxpayer pressure to meet state statute and local EOP
Monitor progress on adopted hazard mitigation strategies and tasks	Planning Commission	Annually	EMD, Selectboard, Fire Department, Road Foreman Cost to Town: Low	Provide updates in annual town reports or Tunbridge Quarterly
Update, amend hazard mitigation plan	Planning Commission	Begin in 2017, to finish by 2019	TRORC, Grants Cost to Town: Low	Public notice, hearing Selectboard adoption
Local Regulations				
Complete the update of the town's flood hazard area regulations, to further limit development in mapped flood hazard areas	Planning Commission	Draft is out for review, plan adoption July 2014	Municipal budget TRORC VT DEC Cost to Town: Low	Public notice, hearings Selectboard adoption
Develop and adopt river corridor (fluvial erosion hazard area) regulations and/or river setback and buffer requirements	Planning Commission	Review over winter 2014-15	Municipal budget TRORC VT DEC Cost to Town: Low	Public notice, hearings Selectboard adoption
	Selectboard	Completed while	VLCT, TRORC	Selectboard adoption

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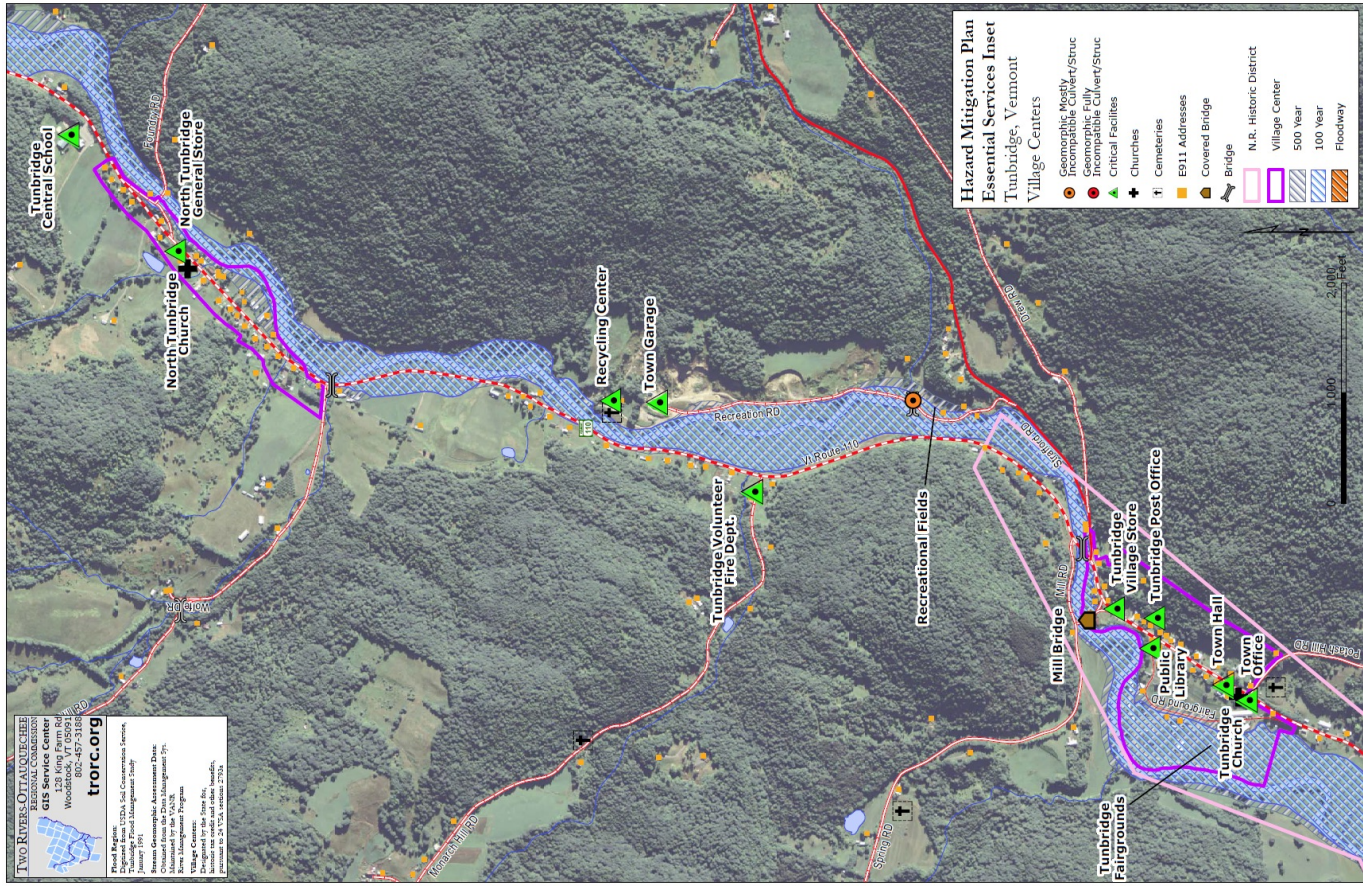
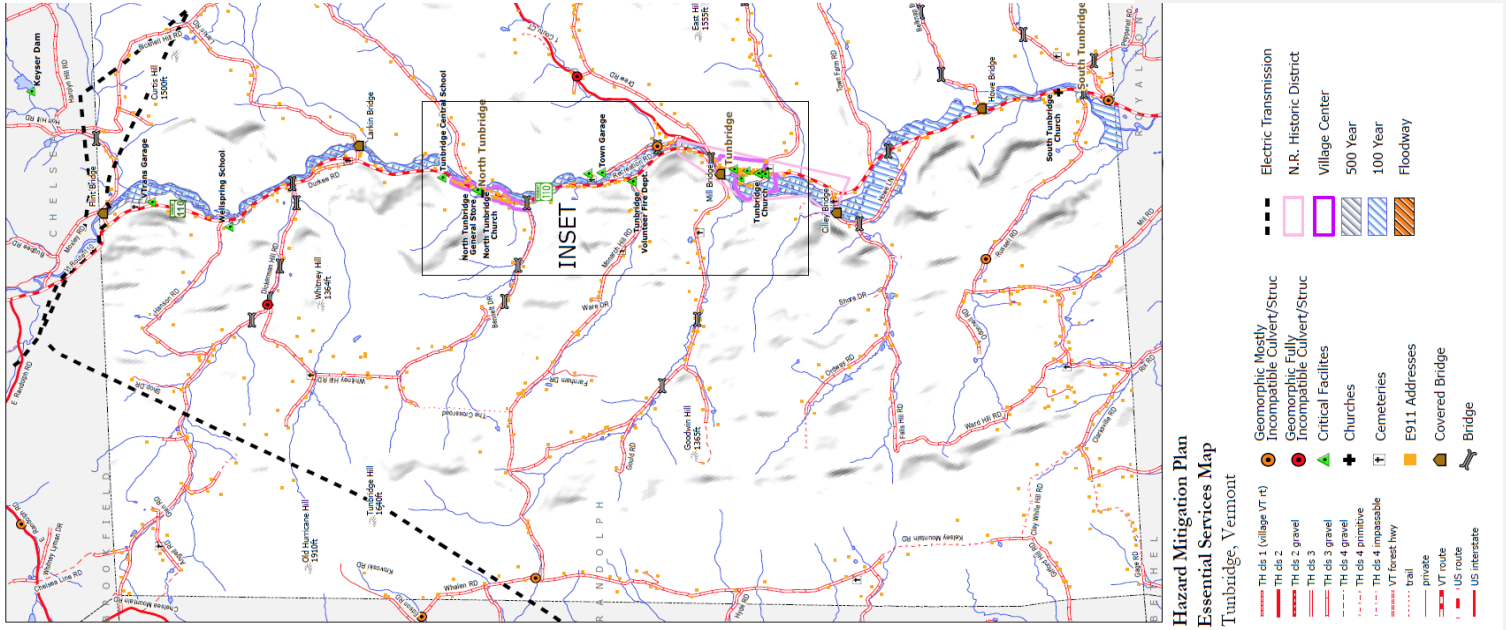
Update town highway and culvert standards to incorporate 2013 recommended state standards		this plan was under review	VTrans Cost to Town: Low	
Land, Infrastructure Projects				
Develop digital town bridge and culvert inventory, database	Selectboard, Road Foreman	Begin summer 2014, continue each summer season as funding allows	TRORC, VTrans DEC Cost to Town: Low	Town/State Inventory updates
Identify and schedule bridge and culvert upgrades, giving priority to those most vulnerable to washout and having largest impacts when access is cut off, including critical sites on VT 110 noted on p 26	Selectboard, Road Foreman	As funding allows, 10-12 replaced/yr	TRORC, VTrans Cost to Town: High!	Annual (1-yr) Highway Budget, 5-yr Improvement Program
Identify and secure locations for new dry hydrants, with broadened community participation, and install as resources and funding allow	Fire Department	As cooperative landowners and funding allows – at least one by 2019	Work Group, Available Grants Cost to Town: High	Form work group to help apply for grants, identify locations, work with property owners
Identify and protect strategic land parcels that provide flood storage (e.g., through the acquisition of river corridor easements)	Planning Commission, White River Partnership	Part of River Corridor Plan by Fall 2014, some action will occur over 5 yr period	Selectboard, TRORC, Ecosystem Restoration Grants Cost to Town: Medium	Municipal support to access state, federal funding through the WRP, Upper Valley Land Trust
Establish a mixed-board committee to discuss feasibility for a second community shelter closer to or in Tunbridge Village.	Planning Commission	Committee set up by June 2015	Neighbors Helping Neighbors, EMD, Selectboard	Red Cross training; identify location, secure use, second

			Grants	generator, staffing
Community Outreach				
Develop education and outreach program for local residents, e.g., to include winter or storm survival tips and evacuation information (town website, Tunbridge Quarterly, tax bills)	EMD/ Fire Department	VT Alert in place by 2015, have sign up at town events, beginning Memorial Day 2014	Town Office, Volunteers Cost to Town: Low	Maintain/update critical information on town website, send out info and collect email addresses with tax bills, starting Fall 2014
Sponsor annual river clean-up, to include private driveway culvert cleanouts, education and training in conjunction with Green Up Day – promote in Tunbridge Quarterly	Town Office, Selectboard, Planning Commission	one day/year beginning Fall 2015	Fire Department, Tunbridge Womens' Group Cost to Town: Low	Coordinate town clean up– roads, waterways; sponsor fun day floating down the river
Develop a process to identify and assist town residents who are vulnerable to severe winter hazards (e.g., freezing temperatures, power outages).	Fire Chief/EMD, Planning Commission	by summer 2015	Town Listers, Utility Companies, Neighbors Helping Neighbors Cost to Town: Low	Consider setting up "road captains"


Hazard Mitigation Plan
Essential Services Inset
Tunbridge, Vermont
Village Centers
Geomorphic Mostly Incompatible Culvert/Struc
Geomorphic Fully Incompatible Culvert/Struc
Critical Facilites
Churches
Cemeteries
E911 Addresses
Covered Bridge
Bridge
N.R. Historic District
Village Center
500 Year
100 Year
Floodway
0
1,000
2,000
Feet
Tunbridge Central School
North Tunbridge Church
North Tunbridge General Store
Recycling Center
Town Garage
Tunbridge Volunteer Fire Dept.
Recreational Fields
Mill Bridge
Tunbridge Village Store
Tunbridge Post Office
Public Library
Town Hall
Town Office
Tunbridge Church
Tunbridge Fairgrounds
Runnin RD
Wolcott RD
Monsen Hill RD
Spring RD
Recreation RD
Vt Route 110
Olsen RD
Mill RD
CH Pure Rd
CH III Rd
TWO RIVERS-OTTAUQUECHEE
REGIONAL COMMISSION
GIS Service Center
2 Pleasant Valley Road
Woodstock, VT 05091
802-457-3188
trorc.org


Hazard Mitigation Plan
Essential Services Map
Tunbridge, Vermont
Th ds 1 (village VT rt)
Th ds 2
Th ds 2 gravel
Th ds 3
Th ds 3 gravel
Th ds 4 gravel
Th ds 4 primitive
Th ds 4 impassable
VT forest hwy
trail
private
VT route
US route
US interstate
Geomorphic Mostly Incompatible Culvert/Struc
Geomorphic Fully Incompatible Culvert/Struc
Critical Facilites
Churches
Cemeteries
E911 Addresses
Covered Bridge
Bridge
Electric Transmission
N.R. Historic District
Village Center
500 Year
100 Year
Floodway
INSET
Keyser Dam
Vrans Garage
Fire Bridge
Wellspring School
Curtis Hill 1508ft
Whitney Hill 1364ft
Old Hurricane Hill 1910ft
Tunbridge Hill 1540ft
Larkin Bridge
Tunbridge Central School
North Tunbridge Reformed Church
North Tunbridge Church
Town Garage
Tunbridge Volunteer Fire Dept.
Mill Bridge
Tunbridge
Tunbridge Church
East Hill 1555ft
Goodsen Hill 1365ft
Chase Bridge
Twin Farm RD
Hope Bridge
South Tunbridge Church
South Tunbridge
CHELSEA
BROOKFIELD
RANDOLPH
ROYALTON
BETHEL

APPENDICES

A. Tunbridge Capability Assessment Worksheet

B. Community Assets Worksheet

C. Hazards Rating Worksheet

D. Tunbridge Hazards Summary

E. Possible Mitigation Strategies: Tunbridge Community Meeting Results

Appendix A. Tunbridge Capability Assessment

	Yes/No	Notes
Plans		
Comprehensive Municipal Plan	Yes	Updated, readopted March 2013 (updated every five years); includes flood hazard area goals, policies
Capital Improvement Plan	No	
Hazard Mitigation Plan	Yes	2011 Annex to TRORC PDM; updating for adoption by Selectboard
Emergency Operations Plan	Yes	2013; updated annually by the Selectboard and Fire Chief
River Corridor Management Plan	No	Fieldwork In progress (geomorphic assessment First Branch)
Regulations		
Zoning Regulations	No	Rely on Act 250; conformance with town plan, for larger development
Subdivision Regulations	No	Rely on Act 250; conformance with town plan, for larger subdivisions
Flood Hazard Area Regulations	Yes	As required for NFIP to regulate development within SHFAs; updating
Fluvial Erosion Hazard Area Regulations	No	Fieldwork/mapping in progress–may consider w/update of flood regs
Stormwater Management Regulations	No	State regulations may apply
Highway Ordinance/Standards	Yes	Not yet updated to reference 2013 recommended state standards
Fire Permits	Yes	Issued by Fire Officer
Public Works Ordinance/Standards	N/A	No public facilities (water, wastewater infrastructure)
Building Code	No	No administration, enforcement capacity
Programs		
Open Space/Conservation Fund	No	Addressed on case by case basis (e.g., Recreation Field)
Right-of-way maintenance	Yes	Roads maintained by road crew w/assistance from fire department
Administration		
Fire Department	Yes	Volunteer Fire Department; having difficulty finding volunteers
Rescue Services	Yes	In transition: ambulance from Chelsea or Royalton; Tunbridge initiating rescue equipment purchase and training in summer 2013
Policing Services	*	Local constables (traffic); mainly rely on state police, county sheriff
Emergency Management Services	*	Fire Department; member Local Emergency Planning Committee #12
Mutual Aid Agreements	Yes	Neighboring communities

Planning Commission	Yes	Appointed by the Selectboard
Zoning/Development Review Board	Yes	Appointed by the Selectboard
Mitigation Planning Committee	No	Currently addressed through Selectboard, Planning Commission
Staff		
Emergency Manager	Yes	Fire Chief
Floodplain Administrator (FPA)	No	Town Clerk administers flood regs w/VANR technical support
Zoning/Code Administrator	No	Town Clerk acting ZA/FPA for flood hazard area regulation
Community Planner	No	Planning services through TRORC
GIS Services	No	GIS Services through TRORC, local volunteers
Road Foreman/Commissioner	Yes	Appointed by Selectboard
Health Officer	Yes	As required to administer state health regulations
Fire Officer	Yes	Issues fire permits
Public Works Manager	N/A	No public facilities, infrastructure
Technical Resources		
E-911	Yes	Local ordinance
Warning Systems		NWS (radio, television)
Data, Information	Limited	E-911 point data, atlas; local knowledge
Grant Writing	Limited	Volunteer services
Hazus Analyses	No	Available through state only for certain rivers
Financial Resources		
Property Tax	No	Special appropriations approved by voters (e.g., for required match); no regular allocation of funds for hazard mitigation
Reserve Fund	No	No reserve funds for capital improvements specific to hazard mitigation
Other	Limited	Options include bonding, grants for specified projects

Appendix B. Community Assets Worksheet

	Location	Type	Description/Notes
Critical Facilities			
Tunbridge Fire Station	Corner VT110, Monarch Hill	Public Safety	Fire-fighting vehicles; flooded in 1990s
Tunbridge Town Office	Tunbridge Village, Market School	Administration	Town Clerk, Listers, Town Records
Tunbridge Central School	North Tunbridge, VT110	School; Public Safety	Public School, Emergency Shelter
Wellspring Waldorf School	VT110 and Hanson Rd	School	Private school
Transfer/Recycling Station		Waste Management	
Town Garage	Recreation Rd, north of Tunbridge Village	Highway Management	Town road equipment; adequate
Transmission Lines (VELCO)	Northeast Tunbridge	Utility	Corridor crosses northeast corner
Cultural Facilities			
Tunbridge Town Hall	Tunbridge Village, VT110	Public/Historic Bldg	Public meeting space
Town Public Library	Tunbridge Village/Gibbs Building, VT110	Public/Historic Bldg	Public library, meeting space
Tunbridge Recreation Field	Tunbridge Village	Public Recreation	Pool, ball fields, playground; flooding
Tunbridge Post Office	Tunbridge Village, VT110	Public/Historic Bldg	US Post Office
Tunbridge Fairgrounds	Tunbridge Village, Fairgrounds La.	Public/Historic Facility	Events facility; flooding, ice damage
Tunbridge Historic District	Tunbridge Village, VT110	NR Historic District	Village Historic District
Cilley Covered Bridge	Off Howe Lane from VT110	NR Historic Structure	Covered Bridge
Flint Covered Bridge	Bicknell Hill Rd, North Tunbridge	NR Historic Structure	Covered Bridge
Larkin Covered Bridge	Larkin Rd, North Tunbridge	NR Historic Structure	Covered Bridge
Howe Covered Bridge	Belknap Rd, South Tunbridge	NR Historic Structure	Covered Bridge
Hayward /Noble Covered Bridge	Spring Rd, Tunbridge Village	NR Historic Structure	Covered Bridge
Hayward and Kibbe Mill	Spring Rd, Tunbridge Village	NR Historic Structure	Historic mill site
South Tunbridge Church	South Tunbridge	NR Historic Structure	Historic church buildings, still in use
Cemeteries-Public	Various	Cemetery	17 public (town maintained)
Cemeteries-Private	Various	Cemetery	3 privately maintained

Appendix C. Hazards Rating Worksheet

Hazard	Rating			Scoring					
Natural Hazard	**Extent**	**Probability**	**Impact**	**Extent**	**Frequency**	**Impact**	**Total**	**Significance**	**Data/Source**
Dam Failure	Local	Unlikely	Moderate	2	1	3	6	Medium	VANR (pp. 20, 26)
Drought	Regional	Likely	Minor	1	3	2	6	Medium	NOAA, USDA (pp.15-17,22)
Earthquake	Regional	Likely	Negligible	1	3	1	5	Low	USGS, VANR (pp.15-17, 22)
Extreme Cold	Regional	Likely	Negligible	1	3	1	5	Low	NOAA, SHELDUS (pp. 15-17)
Extreme Heat	Regional	Likely	Negligible	1	3	1	5	Low	NOAA, SHELDUS (pp.15-17)
Flash Flooding	Local	Highly Likely	Moderate	2	4	3	9	High	NOAA, FEMA, VANR (pp.15-17, 26)
Fluvial Erosion	Local	Highly Likely	Moderate	2	4	3	9	High	VANR (p.26)
Flooding	Regional	Likely	Major	1	3	4	8	High	NOAA, SHELDUS, FEMA, VANR (pp. 15-20, 27)
Hail	Local	Highly Likely	Negligible	2	4	1	7	Medium	NOAA, SHELDUS (pp.15-17)
Ice Jam	Local	Highly Likely	Moderate	2	4	3	9	High	NOAA, CRREL (pp.15-17, 19, 26-27)
Hurricane/ Tropical Storm	Regional	Likely	Major	1	3	4	8	High	NOAA, SHELDUS, FEMA (pp. 15-18)
Landslide	Local	Likely	Negligible	2	3	1	6	Medium	VANR, VEM (pp. 22,27)
Lightning	Local	Highly Likely	Negligible	2	4	1	7	Medium	NOAA, SHELDUS (pp.15-17)
Severe Thunderstorms	Local	Highly Likely	Minor	2	4	2	8	High	NOAA, SHELDUS (pp.15-17,20)
Severe Wind	Local	Highly Likely	Minor	2	4	2	8	High	NOAA, SHELDUS (pp.15-17, 20)
Severe Winter Storms	Regional	Highly Likely	Minor	1	4	2	7	Medium	NOAA, SHELDUS (pp. 15-17, 20)
Tornado	Local	Occasionally	Minor	2	2	2	6	Medium	NOAA, SHELDUS (pp. 15-17)
Wildfire	Local	Likely	Minor	2	2	3	7	Medium	Fire Department, VEM (pp.21-22)
Manmade Hazard									
Structural Fire	Local	Highly Likely	Minor	2	4	2	8	High	Fire Department (pp.21-22, 28)
Transportation (Spills)	Local	Likely	Negligible	2	3	1	6	Medium	VANR, VTrans (p.22)
Hazardous Materials	Local	Unlikely	Minor	2	1	2	5	Low	VANR, VEM (p.23)
Terrorism	Regional	Unlikely	Moderate	1	1	3	5	Low	VEM

Hazard Ratings: Scoring		
Extent (Geographic) *		
Regional	1	Regional coordination/planning required
Local	2	Primarily local response (rated higher for local mitigation planning)
Probability:		
Unlikely	1	<1% per year (less than one occurrence in one hundred years)
Occasionally	2	1-10% per year (one to ten occurrences in one hundred years)
Likely	3	10-90% per year (10 to 90 occurrences in one hundred years)
Highly Likely	4	90-100% per year (annual occurrence(s))
Impact:		
Negligible	1	Isolated occurrences of minor property damage, minor disruption of critical facilities and infrastructure, potential for minor injuries
Minor	2	Isolated occurrences of moderate to severe property damage, brief disruption of critical facilities and infrastructure, potential for injuries
Moderate	3	Severe property damage on a neighborhood scale, temporary shutdown of critical facilities, potential for injuries and/or fatalities
Major	4	Severe property damage on a regional scale, shutdown of critical facilities, potential for multiple injuries and/or fatalities
Significance:		
High	Total score 8-9 points	
Medium	Total score 6-7 points	
Low	Total score 4-5 points	

*Geographic extent, defined in conformance with hazard rating system included in the Vermont Hazard Mitigation Plan. Extent with regard to magnitude of an event (per FEMA definition) could not be determined at the town level.

Appendix D: Tunbridge Hazards Checklist

Summary from Public Meetings (November 27, 2012, January 8, 2013, January 27, 2013 and May 1, 2014)

(Instructions given) In the following columns, if you have memories of damage in Tunbridge from historic events, please provide notes on that. If you're willing to be contacted for photos or other documentation, please give your name and contact information, and the kind of information you have (photo, newspaper article…) For "risk level" use "1" for "possible but not all that likely to occur or cause widespread loss" and use "2" if "there is likely risk to occur and cause widespread or major losses.

Natural Hazards	Where, when, level of loss (extent)	Source	Risk
Dam Failure	Brocklebank, Trout pond above Howe covered bridge, Keyser Pond in Chelsea, no events yet	Public mtg ANR map	1
Drought	Occasional in summer; cow ponds can dry up, sending farmers to collect water from town sources. Public water supply in former firehouse at risk over long term due to slope failure	Public mtg	1
Earthquake	One about 2003 caused some cracks in walls in old homes	Ingrid Van Steamburg	1
Flood	'27,'73,'11 First Branch and tributaries; Fairgrounds has largest potential for losses, Rte 110 gets cut off and a few homes are vulnerable. Highest water occurred during Irene, with 8-10" of rain, Rte 110 was closed for 24 hrs with 1-2' over it in places and back roads needed repair from gouging washouts. Fairgrounds was a lake.	Public mtg	2
Hailstorm	occasional	Public mtg	1

Hurricane	'38, '99(Floyd) had to close fair, open shelter, evacuate livestock to higher ground, '11 flooding/no wind	Public mtg	2
Ice Jam	Regular spring occurrence, usually flooding fields, sometimes roads temporarily, but can damage or destroy covered bridges, Mill Bridge was lost in 1999 jam	Army Corps records	2
Ice Storm	'98; most affected are those above 1500 ft elevation, long power outages likely. "Cut your way in, Cut your way out…Pretty darn scary", says road foreman Rodney Hoyt	Public mtg	2
Landslide	Falls Hill Rd a quirk that is still a potential issue but deemed "not important enough by state" to address; Strafford Rd due to slope and heavy rains; Rte 110 in village opposite General Store (see front cover) has lost buildings over 100 yrs time, was heavily riprapped by state (no communication with town – need better communication) in 2011 after Irene and again in 2013. That riprapping's pushing erosive force of river onto the Fairgrounds access road - could eventually affect the library	Public mtg, Rodney Hoyt	1
Severe Winter Storm	Blizzards '78, '83,'98 barn roofs collapsed two towns north. Blizzard of '78 was deepest at ~40": "pushed snow over the top of my hood, coming out of the garage with the truck," says Rodney Hoyt	Public mtg	2
Tornado, Windshear, Severe Wind, Thunderstorm	Becoming common ~ 2x/summer, hitting 1-2 properties at random. Brocklebank, Strafford Rd looked like tornado came thru about 4 yrs ago, Shane Young's roof needed repair, many down trees, prolonged power outage. Blew Rodney Hoyt's barn roof across Rte 110.	Brenda Field Public mtg	2
Wildfire	30-35 yrs ago had 3-4 acre burn on John Howe's side hill, another on Town Farm Rd. 1960's had "a corker" up on Brocklebank Hill, affecting about 10 acres. About 50 acres involved on Russell Hill Rd in 1988 destroyed a barn. But, the biggest fires last only 3-4 hrs, with help from surrounding towns.	Public mtg, John Durkee, Fire Chief	1

Manmade Hazards			
Nuclear, Chemical, Gas	unlikely	Public mtg	1
Large transport accident	Sporadic – over many years an overloaded truck went off Rte 110 once, and a tourist bus another time	Public mtg	1

Appendix E. Possible Mitigation Strategies – Tunbridge Community Meeting Results (6/25/13)

(+ yes vote, - nay vote, bullet= no vote, yay or nay) Instructions were to balance feasibility (resources possible to complete in next five years) with the priority needs, or to think of the following in terms of public cost vs public benefit.

All Hazards

++++ Distribute emergency preparedness, response and evacuation information to all residents.
++ Enlist local radio stations to provide updates on local emergencies and possible evacuation plans.
++ Secure grants or donations to create and distribute emergency kits to those who need assistance.
- Build a CERT: Community Emergency Response Team

Flooding, Fluvial Erosion

++++++ID and protect strategic land parcels that provide substantial flood storage through river corridor easements
++++ Prohibit new buildings in mapped fluvial erosion hazard areas or within setback areas/buffers from streams
+++ Develop and institute an annual river clean-up weekend, including driveway culvert clean-outs
+++ Maintain supporting partnerships with adjoining municipalities, WRP, TRORC, LEPC and state officials
++ Specifically identify culverts and other town infrastructure needing replacement/improvement for inclusion in a capital improvement program
++ Update the Tunbridge Town Plan to reference hazard mitigation plan policies and strategies
++ Update, administer and enforce the town's flood hazard bylaws
++ Require standard tie-downs of all propane tanks and structures within and near floodplains and ice jam areas
++ Prohibit outdoor storage near rivers (e.g., hay bales, junk cars)
+ Promote participation in the National Flood Insurance Program by property owners
+ Seek meander easements for the historic river corridor
++- Add or increase "freeboard" requirements (building, floodproofing above the base flood elevation)
- Provide property owners information on "wetproofing" existing nonresidential buildings (e.g., Fairgrounds)
- Add vegetated stream buffer requirements in updated flood hazard area bylaws
- Update town bridge and culvert standards to meet new (2013) state recommended standards
-- Adopt stormwater management requirement (storage on-site) for development over a certain size of disturbance or impermeable surface.
---- Create a schedule to elevate roads and bridges above the base flood elevation as they are improved.
- Raise any utilities or other mechanical devices above expected flood levels
- Add a "no net rise" standard, as well as a "compensatory storage" standard to the flood by-law

Wind, Snow and Ice

+++ Distributing information about family and traveler emergency preparedness, winter driving safety types, installation of carbon monoxide monitors and alarms, and the safe use of heaters

++ Identify town residents who are vulnerable to severe winter hazards (e.g., freezing temperatures, power outages)

++ Offer property maintenance assistance to vulnerable residents

++ Offer assistance on building retrofits to withstand severe wind and snow weight

++ Add generator capacity when and where possible (including potential use of electric vehicles)

++ Provide an additional community shelter(s)

- Protect public buildings, town roads and power lines from damage through regular tree pruning and maintenance.
- Retrofit public buildings and critical facilities to reduce damage.

Fire

++ Continue to support the volunteer fire department, maintain mutual aid agreements with neighboring communities

++ Continue to install and maintain dry hydrants in strategic locations around town

+ Continue to require fire permits to limit fire hazards, particularly during dry periods

+ Increase public awareness of fire hazards, and the need to obtain local fire permits

+ Assess and map the community's overall vulnerability to wildfires

- Promote fire prevention in structures (e.g., smoke detectors, fire extinguishers)
- Clear out dead trees and shrubs near structures