

***Town of Thetford, Vermont***  
***2017 Local Hazard Mitigation Plan***

***Prepared by the Two Rivers-Ottawaquechee Regional Commission and  
the Town of Thetford***

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***Date of Town Adoption: July 31, 2017***

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***Date of Final Approval by FEMA: August 9, 2017***



U.S. Department of Homeland Security  
FEMA Region I  
99 High Street, Sixth Floor  
Boston, MA 02110-2132

**FEMA**

AUG 11 2017

Lauren Oates  
State Hazard Mitigation Officer  
Vermont Department of Public Safety  
45 State Drive  
Waterbury, Vermont 05671-1300

Dear Ms. Oates:

We would like to acknowledge the Town of Thetford and the State of Vermont for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the Town of Thetford, Vermont 2017 Local Hazard Mitigation Plan and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the Town of Thetford is eligible to apply to the Vermont Division of Emergency Management & Homeland Security for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

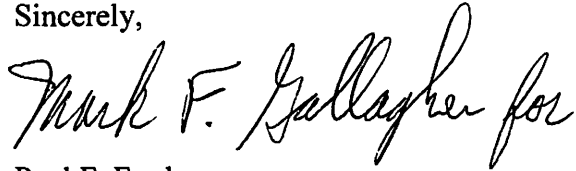
Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at <http://www.fema.gov/national-flood-insurance-program-community-rating-system>, or through your local floodplain administrator.

The Town of Thetford, Vermont 2017 Local Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of August 9, 2017** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Lauren Oates  
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Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,

A handwritten signature in black ink that reads "Paul F. Ford". The signature is written in a cursive, flowing style.

Paul F. Ford  
Acting Regional Administrator

PFF: ms

cc: Ben Rose, Recovery and Mitigation Section Chief, VT DEMHS  
Stephanie Smith, Hazard Mitigation Planner, VT DEMHS

Enclosure



Town of Thetford

• PO Box 126

• Thetford Center, VT 05075

• (802) 785-2922

## CERTIFICATE OF ADOPTION

JULY 31, 2017

### TOWN OF THETFORD, VERMONT SELECTBOARD

#### A Resolution Adopting The Thetford, Vermont 2017 Local Hazard Mitigation Plan

WHEREAS, the Town of Thetford has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of the hazards profiled in the **Thetford, Vermont 2017 Local Hazard Mitigation Plan**, which result in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Town of Thetford has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its **Thetford, Vermont 2017 Local Hazard Mitigation Plan (Plan)** under the requirements of 44 CFR 201.6; and

WHEREAS, the **Plan** specifically addresses hazard mitigation strategies, and Plan maintenance procedures for the Town of Thetford; and

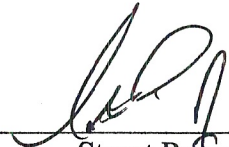
WHEREAS, the **Plan** recommends several hazard mitigation actions (projects) that will provide mitigation for specific natural hazards that impact the Town of Thetford with the effect of protecting people and property from loss associated with those hazards; and

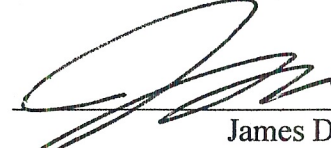
WHEREAS, adoption of this **Plan** will make the Town of Thetford eligible for funding to alleviate the impacts of future hazards; now therefore be it


#### **RESOLVED by Town of Thetford Selectboard:**


1. The **Thetford, Vermont 2017 Local Hazard Mitigation Plan** is hereby adopted as an official plan of the Town of Thetford;
2. The respective officials identified in the mitigation action plan of the **Plan** are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and **Plan** maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as part of this resolution for a period of five (5) years from the date of this resolution; and
4. An annual report on the process of the implementation elements of the Plan will be presented to the Selectboard by the Emergency Management Director or Coordinator.

IN WITNESS WHEREOF, the undersigned have affixed their signature and the corporate seal of the Town of Thetford this 31st day of July 2017.

  
Stuart Rogers - Chair

  
James Dixon

  
Jessica Eaton

  
Li Shen

  
Douglas Stone

ATTEST:

  
Tracy Borst - Town Clerk



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## I. Introduction

Natural and human-caused hazards may affect a community at any time. Natural hazard events cannot be stopped; however, their impact on human life and property can be reduced through community planning. Accordingly, this Plan seeks to provide an all-hazards mitigation strategy that will make the community of Thetford more disaster resistant.

“Mitigation” is defined as any sustained action that reduces or eliminates long-term risk to people and property from natural and human-caused hazards and their effects. Previous Federal Emergency Management Agency (FEMA), State and Regional Project Impact efforts have demonstrated that it is less expensive to anticipate disasters than to repeatedly ignore a threat until the damage has already been done. While hazards cannot be eliminated entirely, it is possible to identify prospective hazards, anticipate which might be the most severe, and recognize local actions that can be taken ahead-of-time to reduce the damage. These actions, also known as ‘hazard mitigations strategies’ can (1) avert the hazard by redirecting its impact by means of a structure, land treatment, or land use pattern change (2) adapt to the hazard by modifying structures or standards or, (3) avoid the hazard through improved public education, relocating/removing buildings in the flood zone, or ensuring development is disaster resistant.



## II. Purpose of the Plan

The purpose of this Local Hazard Mitigation Plan is to assist Thetford in identifying all hazards facing the town, to rank them according to local vulnerabilities, and to identify strategies to begin reducing risks from vulnerabilities of highest concern. Implementation of this Plan will make our community more resistant to harm and damages in the future. And reduce public costs.

The Town of Thetford's Plan seeks to be in accordance with the strategies, goals, and objectives of the State Hazard Mitigation Plan.

The 2017 Thetford Local Hazard Mitigation Plan is the first single jurisdiction mitigation plan drafted for the Town. Previously, the Town had a town-specific 2011 Annex in the Regional (multi-jurisdiction) Pre-Disaster Mitigation Plan. This new Plan has been reorganized and new sections have been added:

- Program eligibility subsequent to plan approval
- Authority for plan development
- Participating jurisdictions
- Funding for plan development
- Brief information about community

Old assumptions have been challenged throughout and new information has been added to make the plan stronger and more useful for those Thetford town officials and residents who will implement the hazard mitigation strategies in the future.



### III. Community Profile

The Town of Thetford is located along the western bank of the Connecticut River and consists of 44.2 square miles. It borders the towns of Fairlee and West Fairlee to the North, Norwich to the South, and Strafford to the west. To the east, Thetford borders the Connecticut River and Lyme, New Hampshire. The Town is situated just north of the confluence of the Ompompanoosuc and Connecticut Rivers. Its boundaries cut a swath of land, which rises from fertile river bottom through a markedly varied terrain: a physiographic mix of steep slopes, swampy lowlands, small ponds and upland terraces. The Town contains a large portion of the Main Stem and the West Branch of the Ompompanoosuc River.

According to the U.S. Census Bureau, Thetford's 2010 population was 2,588 compared to 2,617 in 2000, representing a 1.1% decrease in the Town's population. Between the years of 1990 and 2000, Thetford had a growth rate of 7.3%, and between 1990 and 1980 Thetford experienced a population increase of 11.43%. From 1970 to 1980 Thetford's population rapidly grew by 53.9% from 1,422 to 2,188 people. In 1990 there were 1,136 housing units in Thetford; by 2000, there were 1,193, an increase of 5%. As of 2010, there were a total of 1,288 housing units, which was an overall increase of 7.96% over the 2000 census. This growth is lower than Orange County or the State of Vermont (10.9% and 9.6% respectively) for the decade from 2000 to 2010. In 2010, 191 of the housing units were vacant, either because they were for sale or rent, or were second homes.

The Town lies within the service area of Green Mountain Power, which supplies electrical power to all sections of Town.

Structural fire protection within the Town is provided by the Thetford Volunteer Fire Department, Inc. (TVFD). The Town is assisted by mutual aid from 19 neighboring towns. Forest fire protection is provided by the Town Forest Fire Warden, assisted by members of the Volunteer Fire Department. Fire dispatch services are provided by the Hanover Regional Emergency Communications Center.

Thetford has two fire stations – Thetford Hill Station and the Post Mills Station. The Thetford Hill Station is located on a half-acre site on Route 113 near the elementary school. The one-story structure was built in 1967 and expanded and remodeled in 1995. It consists of five bays, a large training/meeting room, kitchen, office and furnace room. The Thetford Volunteer Fire Department, Inc maintains the following apparatus: 1 Tanker, 3 Engines, 1 Rescue Truck, 1 Forestry Truck, 1 Rescue Trailer, and 2 6 Wheeler ATVs. The Post Mills Station is located on a two-acre site on Route 244. The one-story concrete block structure contains a total of 1,296 square feet. It has two bays and an attic.

A major hindrance to effective fire protection within the town is the lack of an adequate means of water supply in some areas. The majority of properties in Thetford are within 3,000 feet of an existing water supply, however, many supplies are inadequate in summer, inaccessible in winter and/or do not have a dry hydrant installed. At the present time, Thetford is the only town on the west bank of the Connecticut River from Wells River to Hartford, which does not provide underground water mains for fire protection anywhere in town.

Medical emergencies are handled by the Thetford Volunteer Fire Department, Inc and patients are transported to the hospital by non-profit Upper Valley Ambulance, Inc. located in Fairlee. The closest hospital is Dartmouth-Hitchcock, located in Lebanon, NH. Medivac services are available by the DHART helicopter.

The Town of Thetford has a full-time Police Chief and full-time officers. Dispatching is being handled through the Vermont State Police dispatching center. Additional police protection and response to emergency situations are handled by the Vermont State Police, Troop "B" who operate out of the barracks in St. Johnsbury, and the Orange County Sheriff's Department who are dispatched from Chelsea, and police in neighboring communities.

## IV. The Planning Process

### A. Plan Developers

Michael Storace, a Land Use Planner at the Two Rivers-Ottawaquechee Regional Commission (TRORC), assisted the Town of Thetford and its LHMP Committee with updating and developing its Local Hazard Mitigation Plan.

This section of the Plan satisfies 44 CFR 201.6(b)(1) and 201.6(c)(1) (or, A3.a and A3.b of FEMA's Local Mitigation Plan Review Guide, 2011).

Committee members who assisted with the revisions include:

Name	Role/Organization	How Participation Was Solicited
Stuart Rogers	Selectboard Chair	On January 13, 2016, TRORC staff sent an introductory letter and e-mail to Selectboard members (Stuart Rogers, John Bacon, Jim Lancot, and Jessica Eaton), and TRORC Board Member (Mark McElroy). In this letter, TRORC's staff requested names and contact information for potential committee members to revise Thetford's HMP. Thetford representatives responded in January with a list of individuals they wanted to participate. An introductory meeting was scheduled on February 22, 2016. TRORC staff continued to meet with the update committee until the Local Hazard Mitigation Plan was adopted by the Selectboard. See below section for meeting details.
Bruce Hyde	Former Director Thetford Academy Buildings and Grounds	
John Brown	Current Director Thetford Academy Buildings and Grounds	
Michael Evans	Police Chief	
Mariah Whitcomb	Emergency Management Director	
Mary Ellen Parkman	911 Coordinator	
Chad Martin	Thetford Department of Public Works Foreman	
Kevin Petrone	Thetford Elementary School Principal	
Shannon Darrah	Schoolboard Chair	
Chad Whitcomb	Fire Chief	
Robin Pettingell	Assistant Emergency Management Director	

## B. Plan Development Process

The 2011 Thetford Annex was originally part of the 2008 multijurisdictional Regional Hazard Mitigation Plan drafted by Two Rivers-Ottawaquechee Regional Commission, and approved by FEMA on September 30, 2008. The Thetford Annex received FEMA approval on April 18, 2011. While this 2017 Plan is an update of the 2011 Annex, it has been reconstructed as a single jurisdiction, standalone Thetford Local Hazard Mitigation Plan that will be submitted for individual approval to FEMA. As such, several sections have been added or updated to include all necessary information.

This section of the Plan satisfies the Element A: Planning Process requirements set out in 44 CFR 201.6.

The changes to this plan include:

- **General**
  - New sections: Plan Development Process, 2011 Mitigation Strategies Status Update chart, Existing Hazard Mitigation Programs, Projects & Activities, Plan Maintenance;
  - Data updates: New hazard incidents, emergency declarations, census data;
  - Hazards have been reevaluated with the hazard ranking system used by the Vermont Division of Emergency Management and Homeland Security.
- **Hazards Analysis**
  - Severe Weather and Extreme Cold/Snow/Ice Storm are now on the list of “top threats” which reflect the Town’s intention/priority to expand their analysis of hazards that the Town is or may be vulnerable to in the next five years;
  - Severe Weather events are now depicted in a chart that shows the multiple hazards involved during each event;
  - For each hazard, a location/vulnerability/extent/impact/likelihood table has been added to summarize the hazard description.
- **Maps**
  - Added map of the Town of Thetford depicting critical facilities, town infrastructure, the NFIP special flood hazard area, mapped river corridor area, and stream buffers.

The following represent the avenues taken to draft the Thetford Local Hazard Mitigation Plan:

- **Activities and Public Participation and Involvement**

**\*\*Note:** The meetings listed below were public sessions.

- 10/05/2015: TRORC sent an introductory letter and email indicating that the town’s LHMP would soon expire and explaining the process for revising and readopting. TRORC requested names and contact information for potential committee members to revise the LHMP. Sent to Selectboard members (Stuart Rogers, John Bacon, Jim Lanctot, and Jessica Eaton). No public comments were received.
- 01/13/2016: TRORC sent a second introductory letter and email indicating that the town’s LHMP would soon expire and explaining the process for revising and readopting. TRORC requested names and contact information for potential committee members to revise the LHMP. Sent to Selectboard members (Stuart Rogers, John Bacon, Jim Lanctot,

- and Jessica Eaton) and Thetford's Emergency Director (Mariah Whitcomb). Received contact information for Hazard Mitigation Committee Members from Stuart Rodgers
- 02/22/2016: TRORC met with members of Thetford's emergency services personnel and Selectboard members and introduced the Local Hazard Mitigation Plan update process. TRORC and the Thetford Mitigation Committee ranked hazards that Thetford was most vulnerable to in terms of loss of life or property, and decided which hazards to address in the 2017 Plan. This meeting was open to the public, and followed the protocol established by Vermont's Open Meeting Law.
  - February 2016: TRORC posted a notice in four local papers alerting the public to the hazard mitigation planning process that was taking place. Contact information was provided in the notice to allow those interested in Thetford's efforts to receive more information and how to find out about upcoming meetings.
    - Valley News—ran 02/08/2016
    - The Herald of Randolph— ran 02/08/2016
    - Journal Opinion— ran 02/08/2016
    - Vermont Standard—ran 02/08/2016
  - December 2016: A notice was placed in the Two Rivers-Ottawaquechee Regional Commission Newsletter alerting recipients that Thetford was engaging in hazard mitigation planning and updating their Local Hazard Mitigation Plan. Contact information was provided in the notice to allow those interested in Thetford's efforts to receive more information and how to find out about upcoming meetings. No public comments were received.
  - 02/21/2017: TRORC staff met with town officials, the Emergency Coordinator and residents to discuss and review list of Thetford's existing hazard mitigation activities/programs/projects. TRORC staff explained to the committee what the next steps in the process are (draft plan, and then schedule a meeting to review and discuss it). The agenda for this meeting was posted in three places in Town. No public comments were received.
  - 04/27/2017: The Local Hazard Mitigation Plan Committee reviewed and discussed the first draft in detail. Their input was recorded and incorporated into this document. Meeting was warned according to Open Meeting Law. Comments received were integrated into the Plan.
  - **Governmental participation and involvement (44 CFR 201.6(b)(2))**
    - TRORC sent the revised draft to Planning Commission Chair, Kevin O'Hara, and provided contact information for receiving comments via hard copy/email—4/10/2016
    - TRORC sent the revised draft to Selectboard Chair, Stuart Rodgers, and provided contact information for receiving comments via hard copy/email—4/10/2016
    - TRORC sent the revised draft to Vermont Division of Emergency Management and Homeland Security —7/6/2017
    - Note: Town officials were given the opportunity to review, provide feedback and approve the changes that were made through the initial Plan drafting process, and during Plan revision and FEMA review process, if applicable.

- **Neighboring community participation and involvement (44 CFR 201.6(b)(2))**
  - TRORC posted a notice in four local papers alerting the public to the hazard mitigation planning process that was taking place. Contact information was provided in the notice to allow those interested in Thetford's efforts to receive more information and how to find out about upcoming meetings.
    - Valley News—ran 02/08/2016
    - The Herald of Randolph— ran 02/08/2016
    - Journal Opinion— ran 02/08/2016
    - Vermont Standard—ran 02/08/2016
  - December 2016: A notice was placed in the Two Rivers-Ottawaquechee Regional Commission Newsletter alerting recipients that Thetford was engaging in hazard mitigation planning and updating their Local Hazard Mitigation Plan. Contact information was provided in the notice to allow those interested in Thetford's efforts to receive more information and how to find out about upcoming meetings. No public comments were received.
  - TRORC sent the revised draft to neighboring Selectboards for comment and provided contact information for receiving comments via email/hard copy— 4/11/2017
    - Towns of: Norwich, Strafford, Fairlee, and West Fairlee
    - Comments were received and integrated into the Plan.
- **Review of existing plans, studies, reports, and technical information (44 CFR 201.6(b)(3))**
  - State of Vermont Hazard Mitigation Plan, 2013
  - Thetford Hazard Mitigation Plan (Adopted April 18, 2011)
    - This Plan was referenced extensively during the update process, especially in regard to the worst threats and mitigation action strategies identified in 2011.
  - Thetford Zoning Bylaw (Adopted October 17, 2011)
    - This bylaw was referenced when completing the Flood/Flash Flood/Fluvial Erosion section of this Local Hazard Mitigation Plan.
  - Thetford Town Plan (Adopted May 14, 2012)
    - This Plan provided TRORC's staff with background information on the community, as well as more detail on their emergency services.
  - Thetford Subdivision Regulations (Last amended March 7, 1995)
    - The Subdivision Regulations were referenced when completing the Flood/Flash Flood/Fluvial Erosion section of this Local Hazard Mitigation Plan.
  - Thetford Flood Hazard Area Bylaws (Adopted July 14, 2008)
    - The Bylaws were referenced when completing the Flood/Flash Flood/Fluvial Erosion section of this Local Hazard Mitigation Plan.
  - Thetford's Local Emergency Operations Plan (LEOP) (Last Adopted April 24, 2017)
    - This Plan provided TRORC's staff with general information about Thetford's emergency operations.

This section of the Plan satisfies 44 CFR 201.6(b)(3) (or, A4.a and A4.b of FEMA's Local Mitigation Plan Review Guide, 2011).

## C. Status Update on Mitigation Actions Identified in 2011

The following table outlines the mitigation actions that were proposed in the 2011 All-Hazard Pre-Disaster Mitigation Plan for the Town of Thetford (adopted on April 18, 2011 as an appendix to the Two Rivers-Ottawaquechee Regional Commission's multi-jurisdictional Pre-Disaster Mitigation Plan). Participants in the Plan update process reviewed those actions and reported on the status of each (in order of 2011 priority). Actions related to long-term mitigation of natural hazards are so noted:

This section of the Plan satisfies the requirements of 44 CFR 201.6(d)(3).

2011 Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding/ Support)	2017 – Status of Mitigation Actions
<u>ALL HAZARDS</u> 1. Ensure that BEOP is current.	Selectboard	Yearly	With TRORC assistance	Complete. The new iteration of BEOP is the Local Emergency Operations Plan (LEOP). Thetford updates this document annually. Their most recent LEOP was updated and then adopted on 04/24/2017 by the Thetford Selectboard.
2. Encourage utilities to continue a regular schedule of tree trimming along power lines.	Emergency Management Director	Yearly	Local resources	The town communicates with Green Mountain Power, which routinely maintains right-of-ways (ROW) in Thetford. This action has been carried over into the 2017 Plan.
3. Use PDM plan for Hazard Identification and Mapping.	Selectboard	Ongoing	With TRORC Assistance.	The previous iteration of this plan, the PDM plan, was referenced extensively the development of the 2017 Plan.
<u>FLOOD</u> 4. Continue the planned road maintenance program and update existing culvert inventory. Upgrade culverts and ditching. (Mitigation)	Planning Commission and Selectboard	2009	Local resources, TRORC assistance	The last comprehensive culvert inventory completed for Thetford was in 2008. This action has been carried over into the 2017 Plan.



2011 Mitigation Action	Who (Leadership)	When (Timeframe)	How (Funding/ Support)	2017 – Status of Mitigation Actions
5. Revise flood hazard regulation maps.	Selectboard	2008	Local resources.	Complete. Thetford's Flood Hazard Area Zoning Bylaw was adopted July 14, 2008.
<u>FIRE</u> 6. Develop additional dry hydrant sites in rural locations. <b>Which Locations?</b>	Fire Department	Ongoing	Local resources.	Since the 2011 Plan, Dry hydrants have been installed on Robinson Hill Road and Childs Pond in East Thetford. However, additional hydrant locations are needed. This action has been carried over into the 2017 Plan.
<u>HAZMAT</u> 7. Pursue HAZMAT training for Fire Department.	Fire Department	2010	Funded by Fire Service Training Academy (now funded by the Fire Department)	Yes, everyone at the Thetford Fire Department receives HAZMAT Awareness Training. A large portion of the Fire Department receives additional HAZMAT operations training. Renewal of this training occurs yearly. This ongoing strategy has been carried over into the 2017 Plan.
8. Develop emergency access points to the I-91 corridor in locations where access is presently difficult in the event of a derailment.	Emergency Management Director	2010	With state transportation agency assistance	Exit 14 in Thetford provides sufficient emergency access to interstate-91. This mitigation action is not necessary and has not been carried over to the 2017 Plan.

This 2017 Thetford Hazard Mitigation Plan reflects several changes in priority from the 2011 Plan. This 2017 Plan and the 2011 Plan both recognize and detail Flash Flooding and Hazardous Material Spills as the hazards that pose the greatest risk to health and property in the Town of Thetford. However, this 2017 Plan also addresses Severe Weather/Tropical Storms/Hurricanes and Extreme Cold/Snow/Ice Storms as hazards that present risk to health and property in the Town. In the 2017 Plan, the Flash Flood hazard was expanded to include Fluvial erosion The 2011 Plan did not detail this hazards.

This 2017 Plan identifies more detailed hazard mitigation strategies to reduce the risk to health and property as a result of the hazards that post the greatest risk to the Town of Thetford. However, mitigation actions identified in the 2011 Plan and the previous chart that were not specifically completed were carried over into this 2017 Plan.

The Town of Thetford is located in the Upper Connecticut River Valley of Vermont. Interstate 91 runs through the eastern portion of town, as does U.S. Route 5. Other important roads include Vermont Route 113, which stems off of Route 5 and continues northwest to West Fairlee, and Vermont Route 132, which cuts across the southwest corner of the town connecting to Norwich and Strafford. Due to its location along these roadways, hazardous material spills remain a potential hazard to the Town of Thetford.

Overall there are not large-scale development plans in the Town of Thetford. In 2014, 7 building permits were issued. Since the last annex was adopted in 2011, 17 total building permits were issued. Thetford's Flood Hazard Area Zoning Bylaw, which was adopted in 2008 prohibits all new development, including all non-residential and residential structures, in the special flood hazard area. In accordance with this bylaw, no new development has occurred within the special flood hazard area in Thetford since 2011, and the vulnerability of Thetford to inundation and flooding has not increased since Tropical Storm Irene. Specific locations that have experienced development include Snowflake Lane off of Latham Road and Sugarhouse Lane off of Cadwell Road. The Snowflake Lane development is in close proximity to a wetland area and requires a bridged stream crossing for access, so it may be vulnerable to future flooding. Both developments, along with most development in the Town of Thetford, are vulnerable to loss of power during severe storms.

Structures located outside the SFHA, especially those located in the mapped River Corridor, may be vulnerable to fluvial erosion if they are located near a steep, upland stream. Structures in these areas are vulnerable more specifically to fluvial erosion than inundation hazards. There are no current plans for commercial or industrial development within the Town of Thetford.

## D. Town Capabilities for Implementing Mitigation Strategies

The Town of Thetford is currently engaged in the following ongoing hazard mitigation programs, projects and activities:

	Type of Existing Authority / Policy / Program / Action	Resources: Staffing & Funding	Ability to Expand/Improve on
<b>Community Preparedness Activities</b>	Program—Annual update of Thetford's Local Emergency Operations Plan (LEOP).  Last updated and approved on 04/24/2017.	Updated by the Emergency Management Director with support from Emergency Management Planning committee and Selectboard, with assistance from TRORC and funding from Vermont DEMHS.	This document is reviewed and updated each year to ensure that the contact information of emergency response personnel is up-to-date. This information is then sent to Vermont Emergency Management and Homeland Security (DEMHS) for their records. The current program works well, no need to expand or improve on.
	Completed Action— Designated Red Cross Shelter— located at the Thetford Elementary School. The secondary Red Cross shelter includes the North Thetford Church.	Volunteer time from other emergency management personnel as well as town volunteers trained in shelter operations. Funding from American Red Cross.	This is a one-time action. However, several community members have voiced interest in designating Thetford Academy a shelter as a backup shelter.
	Completed Action— Town officers certified in ICS-100 level Training (Introductory)	Volunteer time from town officials. Funding from FEMA.	There is a need for constant renewed training as elected officials change.
	Program— Participation/attendance in the Local Emergency Planning Committee District 12 (LEPC 12)	Volunteer time from the Thetford Emergency Management Director; meetings convened by TRORC. Funding from Vermont DEMHS.	No need to expand or improve on attendance, as it is satisfactory.
<b>Insurance Programs</b>	Authority/ Program—participation in National Flood Insurance Program (NFIP)  The Town participates and complies with the NFIP through their enforcement of the Flood Hazard Area Bylaw, which was last adopted on 07/14/2008. The Town of Thetford first enrolled in NFIP on 6/3/1991  [Note: This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii).]	The Town of Thetford's Zoning Administrator, Mary Ellen Parkman, enforces the Flood Hazard Area Zoning bylaw and serves as the NFIP administrator. Assistance from TRORC and Vermont ANR. Funding from local resources— annual budget.	Thetford's initial Flood Insurance Rate Map was identified on 04/22/1977 and their current Flood Insurance Rate Map (FIRM) is dated 12/20/1999. The Town's FIRM and Flood Insurance Study (FIS) has been updated, and the current effective date for both is 12/20/1999.  The Flood Hazard Area Zoning Bylaw is kept up-to-date and regulates new development in the Special Flood Hazard Area (SFHA).

	<b>Type of Existing Authority / Policy / Program / Action</b>	<b>Resources: Staffing &amp; Funding</b>	<b>Ability to Expand/Improve on</b>
<b>Land Use Planning</b>	Policy/Program— Thetford Town Plan  Adopted on 05/14/2012.	Volunteer time from the Planning Commission, and assistance from TRORC and other state agencies on specific subject matter. Funding from Municipal Planning Grants.	The Town Plan is reviewed/updated every five years, as required by statute. When the plan is updated in 2017, the Planning Commission will include a flood resilience element.
	Completed Authority – Thetford Zoning Bylaw  Adopted September 26, 2011	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont Agency of Natural Resources. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Thetford Zoning Bylaw is also reviewed and updated if needed. Currently, there is no need to expand or improve on these regulations.
	Completed Authority—Thetford Flood Hazard Area Bylaws  Last adopted on 07/14/2008.	Volunteer time from the Planning Commission, and assistance from TRORC and Vermont Agency of Natural Resources. Funding from Municipal Planning Grants.	During the Town Plan review/update period, the Flood Hazard Area Bylaws are also reviewed and updated if needed. Currently, there is no need to expand or improve on these regulations.
	Authority— Thetford Subdivision Regulations  Last amended on 03/07/1995.	Volunteer time from the Planning Commission. Funding from Municipal Planning Grants.	The Subdivision Regulations may be updated when deemed appropriate by the Selectboard. Currently, there is no need to expand or improve on these regulations.
<b>Hazard Control &amp; Protection of Critical Infrastructure &amp; Facilities</b>	Policy/Program— Thetford Hazard Mitigation Plan  Adopted on 04/18/2011.	Updated with volunteer time from local officials and assistance from TRORC and Vermont DEMHS. Funding from DEMHS/FEMA.	The 2017 Thetford Local Hazard Mitigation Plan will replace the 2011 Plan. This 2017 LHMP has evolved from the 2011 Plan and has greatly expanded and improved upon it. Future iterations of the Town's LHMP will be updated by the Town at least every five years.
	Authority— 2013 Town Road and Bridge Standards  Adopted 02/13/2013	Adopted by the Selectboard, implemented by the Department of Public Works Foreman, and assistance from TRORC. Funding from VTrans and the local budget to implement.	The Town Road and Bridge standards Specify minimum construction standards for roadway, ditches, culverts and bridges and guardrails. VTrans updates the Town Road and Bridge Standards on a fairly regular basis. The Town has the authority to require above-and-beyond what is written in the policy.
	Program—Culvert inventory completed in May 2008 for the Town of Thetford  This inventory includes georeferenced locations and attributes for all culverts/drop inlets in Thetford. The Town received targeted assistance in the culvert inventory and specific priority projects were identified.	Staff time from the Thetford Department of Public Works Foreman; assistance from TRORC. Funding from Better Roads grant; local personnel time.	The Town utilizes the culvert inventory to further its culvert mitigation improvement program, and seeking funding through various sources for implementation projects. Routine in-house updates occur on an on-going basis.

	<b>Type of Existing Authority / Policy / Program / Action</b>	<b>Resources: Staffing &amp; Funding</b>	<b>Ability to Expand/Improve on</b>
<b>Education/ Public Outreach</b>	Ongoing Action— The Town places emergency-related information, on the Emergency Management website, on the Fire Department website and facebook page.	Volunteer time from the Emergency Management Director and Fire Department personnel. Funding from local budgets.	This is an ongoing action, and there is no need to expand or improve on the use at this time.
	Ongoing action — The fire department conducts annual fire prevention and safety training for the elementary school grades Kindergarten to Grade 2. This training takes place during the annual Fire Prevention Week in October.	Volunteer time from Fire Department personnel. Funding through Fire Department budget.	This is an ongoing action. There is no need to expand or improve on it at this time.

## E. Plan Maintenance

This Plan (the Thetford Local Hazard Mitigation Plan) will be updated and evaluated by discussing its effectiveness and making note to incorporate any necessary revisions in the update process. This update and evaluation will occur annually at an April Selectboard meeting along with the annual review of the Local Emergency Operations Plan (LEOP). At this meeting, the Selectboard will monitor the implementation of the hazard mitigation and preparedness strategies outlined in this Plan by noting those that have been completed, and identifying the next steps required to implement the Plan's remaining strategies. Comments from local officials and the public will be incorporated when relevant. This meeting will constitute an opportunity for the public and other town officials to hear about the Town's progress in implementing mitigation strategies and to give input on future activities and Plan revisions. The public will be given the opportunity to comment at this meeting. Evaluation of the Local Hazard Mitigation Plan will consist of a thorough analysis of the status of mitigation and preparedness strategies and whether they are being implemented according to the time frames included in tables in this Plan. The Town of Thetford will evaluate the status of mitigation strategies to assess that goals of the Local Hazard Mitigation Plan are being met. Adherence to the mitigation, preparedness, and ongoing strategy implementation tables included in this Plan will constitute the degree of effectiveness of the Plan. The Town will also evaluate the status of vulnerabilities detailed in this Plan to evaluate their validity. The update of the Plan will bring up to date materials that have become outdated due to the passage of time. Thetford's Emergency Management Director will be the principal point of contact and will take primary responsibility for the monitoring, evaluation, and update process described here. He or she will bring the Plan's maintenance activities to the Selectboard's agenda and discussions.

Updates and evaluation of this Plan by the Selectboard and the local Emergency Management Director will also occur within three months after every federal disaster declaration directly impacting the Town of Thetford. The Town will monitor, evaluate and update this Local Hazard Mitigation Plan at an April Selectboard meeting and after every federally declared disaster directly impacting the Town according to the graphic in Appendix C. The Town shall reference the Local Hazard Mitigation Plan when working on Town Plan amendments or changes to the Town's bylaws.

This section of the Plan satisfies 44 CFR and 201.6(c)(4)(i), 201.6(c)(4)(ii), and 201.6(c)(4)(iii).

At least one year before the Plan expires, the update process will begin (through annual updates, monitoring of progress and evaluation that will occur at the April Selectboard meeting). For this next Plan update, the Two Rivers-Ottawquechee Regional Commission (TRORC) will help with Plan updates if assistance is requested by the Town of Thetford and if funding is available. If TRORC is unable to assist the Town, the Emergency Management Director will update the Plan. Ultimately, it will be the Town's responsibility to update their Local Hazard Mitigation Plan.

The process of evaluating and updating the plan will include continued public participation through public notices posted on the municipal website, notice within the municipal building, notice in The Journal Opinion, and notice on the TRORC newsletter, inviting the public to the scheduled Selectboard

(or specially scheduled) meeting. The public will be given the opportunity to comment during this process. Additional stakeholders should be invited to the meeting; these include: area businesses and non-profit organizations, Thetford Volunteer Fire Department, INC., representatives from The Thetford Academy (middle and high school) and elementary school, and the Vermont Agency of Natural Resources (VT ANR). VT ANR will be invited because they can provide assistance with NFIP outreach activities in the community, models for stricter floodplain zoning regulations, delineation of river corridor areas, and other applicable initiatives. These efforts will be coordinated by the Emergency Management Director.

Updates will address changes in community mitigation strategies; new town bylaws, zoning and planning strategies if appropriate; progress on the implementation of initiatives and projects; effectiveness of implemented projects or initiatives; and evaluation of challenges and opportunities effectiveness in reducing town's vulnerabilities and meeting plan goals. If new actions are identified in the interim period, the plan can be amended without formal re-adoption during regularly scheduled Selectboard meetings.

Thetford shall also incorporate mitigation planning into their long-term land use and development planning documents. The Thetford Municipal Plan was being updated during the development of this 2017 Local Hazard Mitigation Plan. The 2011 Thetford Annex, the previous version of this Local Hazard Mitigation Plan for the Town of Thetford, provided guidance and development of the Thetford Municipal Plan, including directing goals, policies, and recommendations towards mitigating the effects of future hazards on health and property in the Town. The 2013 Vermont Legislature passed a law requiring all towns to incorporate flood resiliency elements into their town plans as of July 2014. To do so, flood hazard and river corridor areas will be identified, and strategies and recommendations will be provided to mitigate risks to public safety, critical infrastructure, historic structures and public investments. This Local Hazard Mitigation Plan will help the town to comply with the new community flood resiliency requirement for town plans adopted after July 2014.

The Town should review and incorporate elements of the Local Hazard Mitigation Plan into updates for the municipal plan, zoning regulations, and River Corridor bylaws. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas. During the Municipal Plan update process, the planning commission will review and consider incorporating mitigation actions and priorities described in this Local Hazard Mitigation Plan into Thetford's Municipal Plan. Mitigation strategies will directly influence goals, policies, and recommendations in future updates to the Thetford Town Plan. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations, flood hazard bylaws, and River Corridor bylaws will also be considered after declared or local disasters.



## V. Community Vulnerability by Hazard

### A. Hazard Identification

Mitigation efforts must be grounded in the rational evaluation of hazards to the area and the risks these hazards pose. This is done through a process, which in essence asks and answers three basic questions:

- What bad things can happen, given the Town’s vulnerabilities?
- How likely are they to occur?
- How bad could they be?

This process, which is laid out in the table below, is an attempt to inventory the known hazards, establish the likelihood of them occurring in the future, and then assess the community’s potential vulnerability to each. By performing this analysis, we are then able to prioritize actions that are designed to mitigate the effects of each of these disaster types and ultimately make Thetford a safer place.

It is important that we learn from the past in order to avoid the same disasters and their outcomes. Disasters that have occurred within the Town of Thetford, the larger region, and the State of Vermont can give us good information about what types of disasters we can expect in the future and what kinds of damage they might cause. However, while this historical data can inform our perspective of what might happen in the future, it is by no means a prophecy. While Thetford might not have been impacted by a specific hazard in the past, this does not necessarily mean it will never be affected in the future. Indeed, the advance of climate change means that old weather patterns may not hold. For instance, in recent years, Vermonters have seen an increase in the number and severity of storms, especially rainfall events. Armed with historical data and a healthy respect for climate change and the unknown, we have tried our best to identify hazards and prepare for the future.

The following table reflects the hazards that we believe can be expected, or are at least possible, in the central Vermont area. We have considered factors such as frequency of occurrence, warning time and potential community impact to rank each and determine which hazards pose the greatest threats to life and property in Thetford.<sup>1</sup> The top threats (bolded in the table below) are then followed with a

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<sup>1</sup> The ranking methodology used in this Plan (see Appendix A) is closely modeled on that which is used by the Vermont Division of Emergency Management & Homeland Security (VDEMHS). The only changes made were intended to reflect the more limited geographical scope of this analysis, which is focused on a small, rural town rather than the entire State of Vermont (which is the focus of VDEMHS). Those hazards which were not found to pose the greatest threats to Thetford – including wildfire, tornado, earthquake, dam failure, landslides/mudslides, water supply contamination, ice jams, invasive species infestation, extreme heat, drought, avalanche, and radon – were not addressed in this Plan due to low probability of impact and scarce community resources (time and money). For these hazards, please review the Vermont State Hazard Mitigation Plan. The changes made were intended to reflect the more limited geographical scope of this analysis, which is focused on a small, rural town rather than the entire State of Vermont (which is the focus of VDEMHS).

discussion and mitigation strategies throughout the rest of this Plan.<sup>2</sup> It should be noted that hazards assigned with the same “Hazard Score” are not in order and their placement in the table should not be assumed to reflect their potential to create hazards for the town.

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<sup>2</sup> It’s important to note that those hazards which were not found to pose the greatest threats may still occur in Thetford’s future; however, they are not the focus of this Plan.

Hazard	Frequency of Occurrence	Warning Time	Potential Impact	Hazard Score
<b>Severe Weather (Thunderstorm, Lightning, High Winds, Hail, and Flooding)</b>  <b>Note: We have defined ‘Severe Weather’ to include two or more of the above hazards. The Hazard Mitigation Committee decided to combine this hazard with Hurricane/Tropical Storm and Hail Storm.</b>	Highly Likely	None/Minimal	Moderate	11
Flash Flood/Flood/Fluvial Erosion	Highly Likely	3-6 hours	Major	11
Extreme Cold/Snow/Ice Storm	Highly Likely	6-12 hours	Moderate/Major	9.5
Hazardous Material Spill	Likely	None	Minor/Moderate	9.5
Hurricanes/Tropical Storms	Likely	6-12 hours	Major	9
Hail Storm	Likely	None	Minor	9
Structure Fire	Occasionally	None	Minor	8
Wildfire	Occasionally	None	Minor	8
Tornado	Occasionally	None	Minor	8
Earthquake	Likely	None	Negligible	8
Dam Failure	Unlikely	None	Minor	7.5
Landslides/Mudslides	Occasionally	None	Negligible	7
Water Supply Contamination	Unlikely/Occasionally	None	Negligible	6.5
Ice Jams	Occasionally	6-12 hours	Minor	6
Invasive Species Infestation	Highly Likely	12+ hours	Negligible	6
Extreme Heat	Occasionally	12+ hours	Minor	5
Drought	Unlikely/Occasionally	12+ hours	Negligible	3.5
Avalanche (Thetford determined they do not receive enough snow build-up, nor do they have the exposures that create the possibility of avalanches).	N/A	N/A	N/A	N/A

The Thetford LHMP discussed the result of the hazard ranking activity and decided to focus on hazards that had the potential to impact the Town on a town-wide scale (having a **Minor**, **Moderate**, or **Major** potential impact) and/or is **Likely** or **Highly Likely** to occur in the future. In addition to the highest ranking natural hazards, the LHMP committee decided to address *Hazardous Material Spill* in this Plan due to the potential for serious bodily injury and environmental impact. For the purposes of this Plan, *Severe Weather Hurricanes/Tropical Storms/Hail Storms* will be combined into one hazard profile area for analysis due to their overlapping events and potential impacts to the Town. The Severe Weather section also details high winds and hail storms, due to the overlapping impacts, extents, and hazard histories in Thetford.

The Town originally deemed structural fire as a hazard of high concern due to the high likelihood of its occurrence in the future; however the Town decided to remove the hazard from the list of those addressed in the Plan due to the minimal potential impact that would only affect singular residences and would not have the capabilities of affecting Thetford on a Town-wide scale. The Town also has very strong capabilities for addressing structural fire when it does occur. Due to low probability of impact, small potential impact, and scarce community resources (time and money), the mitigation committee chose not to detail the following hazards in this LHMP: wildfire, tornado, earthquake, dam failure, landslides/mudslides, water supply contamination, ice jams, invasive species infestation, extreme heat, drought, avalanche, and radon. Refer to Appendix A for definitions of the hazard ranking terms used in the above chart.

After engaging in discussions using their best available knowledge, the Town of Thetford identified the following “top hazards” which they believe their community is most vulnerable to (based on frequency of occurrence and potential impact):

- Severe Weather (Thunderstorm, Lightning, High Winds, Hail, Flooding, Tropical Storms, and Hurricanes)
- Flash Flood/Flood/Fluvial Erosion
- Extreme Cold/Snow/Ice Storm
- Hazardous Material Spill

Each of these top hazards will be discussed in the following sections. Within each section, previous occurrences of each hazard will be listed, including the County-wide FEMA Disaster Declarations (DR-#) when applicable. Hazards information was gathered from local sources (ex. town history book or local record), the National Climatic Data Center’s (NCDC’s) Storm Events Database (1950-2015), the Spatial Hazard Events and Losses Database for the United States (SHELDUS) 1960-2015, and Special Reports produced by the National Weather Service in Burlington, Vermont. Each section also includes a description of each top hazard and a hazard matrix that will also include the following information (please see each hazard profile for a hazard-specific matrix):

<b>Hazard</b>	<b>Location</b>	<b>Vulnerability</b>	<b>Extent</b>	<b>Impact</b>	<b>Likelihood/ Probability</b>
Type of hazard.	General areas in community that may be vulnerable to the hazard.	Community structures, systems, populations, or other assets as defined by the community that are susceptible to damage and loss from hazard events	The strength or magnitude and details of the most notable event(s).	Financial impact from an event and/or the number of structures that are impacted.	<u>Occasionally</u> : 1–10% probability of occurrence per year, or at least one chance in next 100 years <u>Likely</u> : >10% but <100% probability per year, at least 1 chance in next 10 years <u>Highly Likely</u> : 100% probable in a year

## B. Hazard Profiles for Hazards Posing Highest Vulnerabilities

### 1. Severe Weather (Thunderstorm, Lightning, High Winds, Hail, Flooding), Tropical Storms, and Hurricanes)

Severe weather consists of thunderstorms, lightning, hail, and intense winds. Often it consists of multiple events that combine to create hazardous conditions that pose a threat to communities in the State of Vermont and the Town of Thetford. Severe weather can be incredibly unpredictable. More common than hurricanes or tropical storms are severe thunderstorms (usually in the summer), which can cause flooding as noted below, and are associated with lightning, high winds, hail and tornadoes. Hailstorms have occurred in Vermont, usually during the summer months. While local in nature, these storms are especially significant to area farmers, who can lose entire fields of crops in a single hailstorm. Large hail is also capable of property damage. Between 1950 and 2013, there were 698 hail events recorded in the state of Vermont, making hail an annual occurrence in some part of the state. Most of these events had hail measuring .75 inches, but many had hail at least 1.5 inches in size. The largest hail during the period was 3-inch hail that fell in Chittenden County in 1968. Tennis ball-sized hail was reported in the town of Chittenden during a storm in the summer of 2001. Thunderstorms can also generate high winds, such as hit the region on July 6, 1999, downing hundreds of large trees in a few minutes.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Severe Weather (Thunderstorm, Lightning, High Winds, Hail, Flooding)**.

In Thetford, severe weather is quite common, typically in the late spring and summer months when the region experiences high temperatures. Severe thunderstorms tend to bring other hazards such as high winds, hail, and lightning, and flooding. These hazards are often experienced in combinations which create many unique weather and emergency management situations. Over the years, Thetford has been hit with high winds that have downed and uprooted numerous trees, and knocked out electricity to residents in the Town. Town-specific wind data could not be easily found, but the “Remarks” section of National Climatic Data Center Database helps to illuminate the impact strong winds can have on Thetford.

The following list indicates the history of occurrence with regard to this hazard in Orange County. Given the relatively small population of Thetford, town-specific data is limited. Federal disaster numbers are listed when appropriate. Damage estimates will only be provided when the weather event is only listed for the Town of Thetford, and if that data is available. In an attempt to capture the individual hazards that may arise, and the different circumstances caused by the hazards in concert, the separate hazards are documented in the table below.

Severe weather events are highly likely to occur in the future in Thetford. Precipitation trend analysis suggests that intense, local storms are occurring more frequently and will continue to do so in the future. More localized severe weather events will occur in the Town of Thetford, which will be high intensity and will likely result in high flooding events, as well.

## Beaufort Wind Chart – Estimating Winds Speeds

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



**Webpage:** <http://www.weather.gov/iwx>

**Twitter:** @nwsiwx

**Facebook:** NWSNorthernIndiana





### History of Occurrences:

Severe Weather Date	Event					Location	Extent
	Thunderstorm / severe storm	Flooding	Hail	High Winds	Lightning		
7/23/2016-7/27/2016	✓			✓		Thetford	A high wind storm that lasted approximately 30 minutes and caused power outages in ¾ of the Town of Thetford. The storm caused extensive damage to power and phone lines that blocked many roads in Town, including Route 113 and Route 132. On 7/23 417 GMP customers were affected for 14.37 hours, 545 customers were affected for 9.6 hours, 59 customers were affected for 12 hours, and 564 customers were affected for nearly 24 hours. Power outages continued into 7/25 and 7/26. Wind speed was estimated at 69 mph, which registers as a violent storm on the Beaufort Wind Chart.
7/18/2016	✓	✓	✓	✓		Thetford; County-wide	Several rounds of thunderstorm developed ahead of a cold front and intensified when they reached Vermont. There were reports of wind damage to trees and utility lines. 1.5 inch in diameter hailstones were exhibited. Rainfall accumulation was not severe. 66 GMP customers were affected for 3 hours. Wind speed was estimated at 57 mph, which registers as a storm on the Beaufort Wind Chart.
6/2/2013 – 6/3/2013*	✓		✓	✓		Thetford; County-wide	A very warm and humid air mass was located across Vermont. A strong mid-atmospheric disturbance, ahead of a cold front, moved across portions of Vermont and triggered widespread thunderstorms with pockets of damaging winds and large hail. Event caused tree damage and widespread power outage. At its peak, roughly 20k customers lost power. Thetford received .61 inches of rain in 24 hours. 148 total GMP lost power on 6/2. 85 customers lost power for 3 hours, 40 customers lost power for 5.6 hours, 12 lost power for 7.4 hours, and 11 lost power for 16.4 hours. Wind speed was estimated at 57 mph, which registers

							as a Storm on the Beaufort Wind Scale.
6/25/2013-7/11/2013* (DR-4140 VT)	✓	✓	✓	✓		County-wide	Severe storms over a nearly one month period. Rains caused flooding in the region, winds downed trees, power outages were reported. On 7/5 80 GMP customers lost power for 3.18 hours, on 7/7 4 GMP lost power for 1 hour, on 7/8 14 GMP customers lost power for 1.4, and on 7/11 13 GMP customers lost power for 1.7 hours. Overall during the disaster period, Thetford received approximately 8 inches of rain. Wind extent data was unavailable for this event.
9/11/2013*	✓			✓	✓	Thetford, County-wide	A weak area of low pressure embedded in an unseasonably warm and unstable air mass resulted in thunderstorms that moved across Vermont. Thunderstorms and high winds caused downed trees and utility lines. Thetford received 1.86 inches of rain in 96 hours. Widespread power outages occurred in Thetford, affecting 636 total customers on 9/11. 169 GMP customers lost power for 5.9 hours, 82 lost power for 8.5 hours, 111 lost power for 11.4 hours, 8 lost power for 21.4 hours, 62 lost power for 15.9 hours, 17 lost power for 22.4 hours, 14 lost power for 19 hours, 158 GMP customers lost power for 13.4 hours, and 13 GMP customers lost power 25 hours. Wind speed was estimated at 57 mph for this event, which registers as a Storm on the Beaufort Wind Scale.
7/4/2012*	✓			✓	✓	Thetford, County-wide	A moderately strong upper level disturbance ahead of a surface cold front moved through Vermont on July 4. Storm caused widespread wind damage and frequent lighting. Several trees were downed along Route 5. Hailstones estimated at 1.5 inches in diameter fell. Thetford received .3 inches of rain in 24 hours. On 7/1 442 GMP power customers were affected for 1.5 hours. Wind extent was unavailable for this event.
7/17/2012	✓		✓	✓		Thetford, County-wide	A west-east oriented cold front caused a series of weak areas of low pressure which resulted in numerous thunderstorms, damaging winds, and large hail. Number roads in Thetford

							became impassible due to trees down. Thetford experienced 1.22 inches of rain in 24 hours. Thetford experienced widespread outages. 452 GMP customers lost power 9.72 hours, 132 GMP customers lost power for 12 hours, 272 GMP customers lost power for 6.5 hours , and 89 GMP customers lost power for 3 hours.
8/28/2011 (DR-4022 VT)	✓	✓		✓		County-wide	Tropical Storm Irene prompted widespread, devastating flooding throughout the region. Frequent wind gusts of 35 to 50 mph, especially in higher terrains, along with saturated soils caused widespread downed and uprooted trees. Thetford received 6.79 inches of rain in 48 hours. Thetford had \$22,799.26. in damages. Only minimal power outages occurred in Thetford with isolated incidents affecting singular GMP customers for short durations.
06/09/2011	✓		✓	✓		County-wide	Scattered thunderstorms and a few isolated reports of damaging winds and large hail were reported. Power outage data was unavailable for this event.
05/26/2011- 05/27/2011 (DR-4001 VT)	✓	✓		✓		County-wide	Region struck by severe storms and flooding. Minimal damage occurred in Thetford. Thetford received .3 inches of rain in 24 hours. Power outage data was unavailable for this event.
07/21/2010	✓		✓	✓		Thetford, County-wide	Thunderstorms hit the area along with high winds, developing into supercells that caused widespread damage to trees, power poles and structures. Golf ball-sized hail fell in Thetford. Thunderstorm winds damaged trees and utility poles. No significant precipitation and power outages occurred in Thetford.
5/31/2009	✓		✓	✓		County-wide	40-55mph wind gusts and hail caused fallen trees and power outages in the region. Winds caused fallen trees, downed power lines, and property damage Power outage data was unavailable for this event. Thetford received 21.21 inches of rain in 24 hours.
7/21/2008- 8/12/2008 (DR-1790 VT)*	✓		✓	✓		County-wide	Thunderstorms with heavy rainfall in a moist atmosphere moved through central and southern Vermont during

							the afternoon and evening hours. A few thunderstorms produced hail that ranged from .5 to .25 inches in diameter. Thetford received 2.6 inches of rain in 24 hours with an additional 1.22 inches of rain in the previous 24 hours. No significant power outages occurred.
9/12/2008	✓	✓					Thetford reported \$15,808.21 in damages. Detailed storm history was unavailable.
07/09/2007- 07/11/2007 (DR-1715 VT)	✓		✓	✓	✓	Thetford; County- wide	An area of low pressure moved across Canada and south to Vermont causing thunderstorms, hail, winds, and lighting. Thetford experienced 1.65 inches of rain in 24 hours, but significant power outages did not occur.
8/30/2007	✓		✓	✓		Thetford; County- wide	A cold front moved through a warm and unstable airmass across southern and eastern Vermont. A few widely scattered thunderstorms moved across the region with nickel sized hail in neighboring Town of Newbury.
6/7/2007	✓		✓	✓		Thetford; County- wide	A backdoor cold front and mid-level disturbance moved into a moderately unstable airmass during the afternoon, which moved into Vermont. Some severe thunderstorms produced damaging winds. Winds in Thetford caused the total collapse of a tin bar and downed trees on many roads. Some severe storms produced large hail .75 inches in diameter. Thetford received .9 inches of precipitation. Outage data was unavailable for this event.
04/15/2007- 04/21/2007 (DR-1698 VT)	✓	✓		✓		County- wide	Severe storms and flooding impacted Orange and surrounding counties. 7.5 inches of wet heavy snow mixed with warming temperatures led to flooding. Power outage data was unavailable for this event.
7/18/2006	✓			✓		County- wide	A strong mid-level atmospheric disturbance moved into a marginally unstable airmass across Vermont to cause severe thunderstorms. The thunderstorm knocked down trees along Interstate 91 in neighboring Newbury. Power outage data was unavailable for this event. Specific

							precipitation data and wind speed was unavailable for this event.
8/2/2006	✓			✓	✓	County-wide	A mid-atmospheric disturbance moved into a very warm, humid and unstable airmass across Vermont during the afternoon of the 2nd, which lead to the development of scattered thunderstorms. Some of these thunderstorms were locally severe and produced damaging winds that knocked down trees, powerlines and a tree on a mobile home along Route 5 in neighboring Newbury. Power outage data was unavailable for this event. Wind extent was unavailable for this event.
07/21/2003-08/18/2003 (DR-1488 VT)	✓	✓		✓		County-wide	Severe storms and flooding impacted Orange and surrounding counties. Specific precipitation and outage data was unavailable for this event. Thetford reported \$5,710.12 in damages. Wind extent was unavailable for this event.
07/14/2000-07/18/2000 (DR-1336 VT)	✓	✓		✓		County-wide	Severe storms and flooding impacted Orange and surrounding counties. Specific precipitation, wind speed, and outage data was unavailable for this event.
9/16/1999-9/21/1999 (DR-1307 VT)	✓	✓		✓		County-wide	Tropical Storm Floyd's rains and winds caused road and culvert washouts. Specific precipitation, wind speed, and outage data was unavailable for this event.
7/6/1973 (DR-397 VT)		✓		✓		County-wide	One of the largest flood events of the 20 <sup>th</sup> century in VT. Landslides reported in the region.
11/3/1927	✓	✓				County-wide	"Great Flood of 1927." Worst recorded flood in VT. The White River crested at a record of 29.30 feet.

The Town of Thetford has received high wind events in the past. Thankfully, the damage caused by high winds has been relatively minimal. Often power outages occur as a result of trees and tree limbs falling on power lines. The Town of Thetford does not follow a regular tree-trimming schedule; however, Green Mountain Power provides this service as part of the utility company's Reliability Project. This will help improve Green Mountain Power's response time during a power outage and decrease the amount of time some residents are without power.

The main hazard caused by severe weather throughout the Town is flooding. Prior to the flooding from Tropical Storm Irene, spring of 2011 was particularly wet and a pre-Memorial Day storm caused

widespread flooding throughout Orange County. There are a number of roads in Town that are subject to erosional flooding when heavy rain events drop large amounts of rain in a short period of time. The Town plans to update future culverts with at least 18 inch replacements. The Town last updated its comprehensive culvert inventory in fall 2008, however the Department of Public Works foreman actively updates his culvert data on personal databases and on VTCulverts.org. The Town will continue to periodically update culvert data. The work to upgrade culverts remains ongoing.

In Thetford, there are 1,666 acres of mapped floodplain and 58 acres of mapped floodway, which consists of 6% of the Town's land area. Rivers, brooks, and streams in Thetford that have mapped Special Flood Hazard Areas include the Ompompanoosuc River, the West Branch of the Ompompanoosuc River, the Connecticut River, Abbot Brook, Lake Fairlee, Lake Abenaki, Mud Pond, Zebedee Brook, and Gunn Brook. Other significant streams that flood frequently include Blood Brook, Jackson Brook, and Fulton Brook. In Thetford there are 80 structures in the Special Flood Hazard Area, or 100 year floodplain. These areas are at risk to flooding and inundation. These structures consist of 65 residential (48 single family residential structures, 11 camps, 2 mobile homes, 1 other residential building, and 3 accessory units), 10 commercial/industrial/government, and 5 properties classified as other. If all of these properties were destroyed in a flood, the resulting damage would be approximately \$21,765,260. Specific commercial and government structures that are vulnerable to flooding include, the North Thetford Post Office, Caldwell Logging, the United Church of Thetford, A Cook Associates, Long Wind Farm, and Simple Energy Services.

Hazard	Location	Vulnerability	Extent	Impact	Likelihood/Probability
Severe Weather	Town wide for wind, hail, high winds, lightning and thunderstorm impacts; for flooding (damaged during Tropical Storm Irene): Route 132, Route 113, East Thetford, Colby Road South, New Boston Road, Barker Road, Tefft Road, Hauger Road, and Burnham Road. Many other roads may be subject to erosional flooding, especially in steep areas.	Town and private buildings, and utilities; culverts, bridges, road infrastructure. There are 80 structures located in the SPHA. These consist of 65 residential (48 single family residential structures, 11 camps, 2 mobile homes, 1 other residential building, and 3 accessory units), 10 commercial/industrial/government, and 5 properties classified as other. If all of these properties were destroyed in a flood, the resulting damage would be approximately \$21,765,260. Specific vulnerable structures include the Post Office, Caldwell Logging, Long Wind Farm, Simple Energy, and A Cook Associates.	Most recent severe flooding event: Tropical Storm Irene- 5-7" of rain across county (6-7" in Thetford). ** The maximum potential wind speed for thunderstorms is 63 mph. The maximum potential wind speed of a tropical storm is 74 mph. The maximum potential wind speed for a hurricane is 157 mph.	From 2003 Severe Storm, Thetford experienced \$45,954.93 in damages. Irene also caused substantial damage in Thetford.**	Highly likely

**\*\*Note:** The main hazard caused by severe weather is typically flooding (though not always). In addition, flooding is often the most expensive hazard caused by severe weather. Therefore, the Extent and Impact categories for Severe Weather will reflect the data reported in the Flash Flood/Flood/Fluvial Erosion, as it represents the higher limits of damage caused by severe weather.

## 2. Flash Flood/Flood/Fluvial Erosion

The most frequent form of flooding in the State of Vermont and the Town of Thetford is riverine flooding, or overbank flooding, which occurs to rivers when they receive more rain or snowmelt from their watershed than they typically experience. Flooding causes the inundation of land that is normally dry. Overbank flooding is experienced more frequently in mountainous and hilly areas where water moves with higher velocities. Flash floods occur when severe storms drop high amounts of rainfall in short periods of time. Flash floods occur more frequently in areas with steep slopes and narrow stream valleys. Riverine erosion is the gradual wearing away of land masses by rivers and streams. River channels are constantly changing. As rivers flow and water moves downstream, water exerts energy upon riverbanks and causes erosion.

Flooding is one of the worst threats to Thetford's residents and infrastructure. Past instances of flooding in Thetford have included rain and/or snowmelt events that cause flooding in the major rivers' floodplains and intense rainstorms over a small area that cause localized flash flooding. Both kinds of events can be worsened by the build-up of ice or debris which can contribute to the failure of important infrastructure, such as culverts, bridges, and dams.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Flash Flood/Flood/Fluvial Erosion**.

Perhaps the worst flood disaster to hit the Town of Thetford, as well as the overarching region and the State of Vermont, occurred on November 3, 1927. This event was caused by nearly 10 inches of heavy rain from the remnants of a tropical storm that fell on frozen ground. Eighty-four Vermonters, including the Lieutenant Governor, were killed. The flooding in the White River Valley was particularly violent, with the river flowing at an estimated 900,000 gallons per second on the morning of the 4th (Vermont Weatherbook). Like many towns in the region, the Town of Thetford received heavy precipitation.

A more recent flood that devastated the region and the state was the result of Tropical Storm Irene, which occurred on August 28, 2011. Record flooding was reported across the state and was responsible for several deaths, and millions of dollars of home, road and infrastructure damage. Due to the strong winds, 50,000 Vermont residents were initially without power, and many did not have electricity restored to their homes and businesses for over one week. Putting such an event into context, the flooding that occurred as a result of Tropical Storm Irene is considered to be greater than a 100-year flood event, and likely closer to a 500-year flood. Despite the damage wrought, the flooding caused by Tropical Storm Irene is considered to be the second greatest natural disaster in 20<sup>th</sup> and 21<sup>st</sup> century Vermont; second only to the Flood of 1927.

The Town of Thetford suffered some damage to property and infrastructure during Tropical Storm Irene, although no lives were lost. It is estimated that Tropical Storm Irene dropped 4-5 inches in the Town of Thetford in a very short span of time (24-48 hours), and 5-7 inches across the county. Many of Thetford's roads and culverts were damaged by the storm, including Route 132. The county-wide damage totaled \$5 million, and Town-wide damage was over \$22,799.26 for this flooding event.

Flooding is common across the region, with many events impacting the Town of Thetford specifically. The following list indicates the history of occurrence with regard to this hazard in Orange County and



given the relatively small population of Thetford, town-specific data is somewhat limited. Federal disaster numbers are listed when appropriate. No detailed data was available for fluvial erosion damage in Thetford in terms of numbers of acre lost during each event.

#### History of Occurrences:

Date	Event	Location	Extent and Impacts
4/15/2014	Flash Flooding	Thetford; County-wide	Snowmelt from a late season snowpack combined with heavy rain, nearly 1 inch in 24 hours, to produce widespread flooding across central Vermont and Orange County. 4-6 inches of water was released from the snowpack over several days due to temperatures 60s to 70s. Rivers were brought to near bankfull width due to snowmelt, and additional rain forced rivers out of their banks. Route 5 in Thetford was flooded by the Connecticut River. 160 Green Mountain Power customers lost power for 1.7 hours. Overall, \$46,013.07 in damage occurred in Thetford according to FEMA's Public Assistance Database (which captures at least 70% of damage).
Period from 06/25/2013—07/11/2013 (DR-4140)*	Severe Storms, Flooding, and Fluvial erosion	County-; region-wide	Severe storms caused flooding and fluvial erosion throughout the region, causing damage to some infrastructure and facilities. During this period, the neighboring Town of Corinth received 7.96 inches of precipitation. There were several outages that occurred in Thetford during the disaster period. On 7/19 281 Green Mountain Power customers lost power for 7-10 hours. In Thetford, \$43,887.82 in damages occurred according to FEMA's Public Assistance Database (which captures at least 70% of damage).
08/28/2011 (DR-4022, TS Irene)*	Tropical Storm, Flooding, and Fluvial Erosion	Thetford, County-wide	Widespread rainfall amounts of 3-5 inches occurred across Vermont with 5 to 7+ inches across much of southern, central Vermont. Devastating flash flooding occurred across much of central and southern Vermont mountain valleys with substantial and some record breaking flood stages on larger rivers. This flood event will likely rank second to the November 1927 flood in the scope of meteorological and hydrological conditions/impacts as well as loss of life (84 in 1927), but likely first in monetary damage [approx. \$500 million statewide vs \$350 million (1927 in 2010 dollars)]. There were nearly 2,400 roads, 800 homes/businesses, 300 bridges and a half dozen railroad tracks destroyed or damaged from the flooding caused by Irene. According to spotter's reports, Thetford received 4-5 inches of rain. In Thetford, \$22,799.26 in damages occurred according to FEMA's Public Assistance Database (which captures at least 70% of damage).
3/7/2011*	Ice Jam, Flooding, and Fluvial Erosion	Thetford; County-wide	Heavy rainfall preceded a cold front that swept through Vermont that caused temperatures to drop and changed rain to heavy sleet and wet snow. Rainfall totaled about 2 inches in the morning before changing to ice/sleet. Snow accumulations added another 6-7 inches of precipitation. Rapid snowmelt and heavy rainfall caused ice-covered rivers to melt. Outage data was unavailable for this event.
9/30/2010-10/1/2010	Flooding and Fluvial Erosion	County-wide	An area of low pressure and a pocket of tropical moisture associated with the remnants of Tropical Storm Nicole caused heavy rain in Vermont on September 30 and October 1, 2010. Thetford experienced 3.75 inches of rain in 24 hours, and experienced 5 inches in 48 hours. Outage data was unavailable for this event.
07/21/2010*	Severe Weather and Flash Flooding	Thetford; County-wide	Several storms strengthened into super cells that produced widespread wind damage to trees, power poles and structures as well as large hail in excess of golf ball size in diameter. Very heavy localized rains caused some temporary problems in many communities. 2.43 inches of precipitation was experienced in Thetford. Outage data was unavailable for this event.

Date	Event	Location	Extent and Impacts
08/21/2009	Flash Flooding and Fluvial Erosion	Thetford; County-wide	Thunderstorms produced torrential downpours in nearby Chelsea, who experienced significant damage on several roads due to flash flooding and fluvial erosion. Thetford received 1.26 inches in precipitation. Outage data was unavailable for this event.
08/07/2008* (Part of DR-1790 VT)	Flooding and Fluvial Erosion	Thetford; County-wide	Thunderstorms with heavy rainfall in a moist atmosphere moved through central and southern Vermont during the afternoon and evening hours. Thetford received 2.6 inches of rain in 24 hours with an additional 1.22 inches of rain in the previous 24 hours. No significant power outages occurred.
07/11/2007 (DR 1715 VT)	Flash Flooding and Fluvial Erosion	County-wide	Localized heavy rainfall exceeded 3 inches within a two hour time frame. Some localized storm totals approached 6 inches across very hilly or mountainous terrain, which resulted in flash flooding and fluvial erosion of several communities in Orange County. Outage data was unavailable for this event.
1/18/2006	Flash Flooding and Fluvial Erosion	County-wide	A powerful storm moved across Ontario and Quebec that brought rising temperatures and caused snow melt. Widespread rainfall of 1.5 to 2.5 inches combined with increased runoff caused flooding and ponding of roadways across Orange county. Outage data was unavailable for this event.
9/12/2003*	Severe Storm, Flooding, and Fluvial Erosion	Thetford; County-wide	Thetford experienced \$45,954.93 in damages. A small area of Town received 4 inches of rain in an hour, which created flooding and significant damage to roads including Tucker Hill Road, Whipporwill Road, and Poor Farm Road.
06/28/1973— 06/30/1973 (DR-397)	Flooding	County-wide	As much as 6 inches of rain fell in 24 hours in some locations. 3 deaths occurred and \$64 million in damage occurred in Vermont.
11/02/1927— 11/04/1927 ("Flood of 1927")	Flooding	County-wide	Considered to be on of VT's most devastating events, the flood took our 1285 bridges, miles of roads and railways, and countless homes and buildings. 84 people were killed, including Lt. Gov. S. Hollister Jackson. Rainfall totaled 4-9" statewide, following a month with 150% the normal amount of rain.

The Town of Thetford has a standalone Flood Hazard Area Zoning Bylaw that prohibits new residential and non-residential structures in the Special Flood Hazard Area (also considered the 100-year floodplain). Permitted uses in the special flood hazard areas include open space uses, such as agricultural uses, recreational uses, and residential uses that consist of lawns, gardens, and parking areas.

In Thetford, there are 1,666 acres of mapped floodplain and 58 acres of mapped floodway, which consists of 6% of the Town's land area. Rivers, brooks, and streams in Thetford that have mapped Special Flood Hazard Areas include the Ompompanoosuc River, the West Branch of the Ompompanoosuc River, the Connecticut River, Abbot Brook, Lake Fairlee, Lake Abenaki, Mud Pond, Zebedee Brook, and Gunn Brook. In Thetford there are 80 structures in the Special Flood Hazard Area, or 100 year floodplain. These areas are at risk to flooding and inundation These structures consist of 65 residential (48 single family residential structures, 11 camps, 2 mobile homes, 1 other residential building, and 3 accessory units), 10 commercial/industrial/government, and 5 properties classified as

other. If all of these properties were destroyed in a flood, the resulting damage would be approximately \$21,765,260. Specific commercial and government structures that are vulnerable to flooding include the North Thetford Post Office, Caldwell Logging, the United Church of Thetford, A Cook Associates, Long Wind Farm, and Simple Energy.

Across Vermont, most child and elder care facilities are not registered with the State. There are also six licensed childcare facility in Thetford: Caring Communities, Mapleleaf Daycare, Tammie's Daycare, Little Feet Children's Center, Visual Eye's Creativity Center, and County Bear Child Care. None of these facilities are located within the FEMA designated Special Flood Hazard Area. There are no elder care facilities in the Town of Thetford. Finally, low income housing is not registered with the State, and there are currently no mobile home parks located in Thetford that are registered with the State.

Recent studies have shown that the majority of flooding in Vermont occurs along upland streams, as well as along road drainage systems that fail to convey the amount of water they are receiving. These areas are often not recognized as being flood prone, and property owners in these areas are not typically required to have flood insurance. It should be noted that, while small, mountainous streams may not be mapped by FEMA in NFIP FIRMs (Flood Insurance Rate Maps), flooding along these streams is possible, and should be expected and planned for. Flash flooding in these reaches can be extremely erosive, causing damage to road infrastructure and to topographic features including stream beds and the sides of hills and mountains. The presence of undersized or blocked culverts can lead to further erosion and stream bank/mountainside undercutting. Furthermore, precipitation trend analysis suggests that intense, local storms are occurring more frequently, which indicates that Thetford will experience high intensity rainfall, flooding, and fluvial erosion events in the future. Due to Thetford's topography of steep slopes and narrow river valleys, fluvial erosion also has a high probability of future occurrence. The State of Vermont has conducted a mapping initiative to identify areas along rivers, brooks, and streams in Vermont that are vulnerable to fluvial erosion, and has deemed these the River Corridor areas.

Rivers, streams, and brooks, in Thetford that have mapped River Corridor Areas include, the Ompompanoosuc River, the West Branch of the Ompompanoosuc River, Zebedee Brook, Avery Brook Lord Brook, Abbot Brook, and Barker Brook. Other streams that frequently flood include Blood Brook, Jackson Brook, and Fulton Brook. In Thetford, there are 51 structures in the mapped River Corridor Areas. These structures are at risk to fluvial erosion. These consist of 47 residential properties and 4 structures classified as other. If all of these structures were destroyed in a flood, the resulting damage would be \$11,221,632.

The last official culvert inventory for the town of Thetford was completed in 2008. The process of upgrading culverts is ongoing.

No development projects are planned in Thetford in areas that would be vulnerable to flooding. There are no repetitive loss properties in Thetford on FEMA's NFIP list.

<b>Hazard</b>	<b>Location</b>	<b>Vulnerability</b>	<b>Extent</b>	<b>Impact</b>	<b>Likelihood/ Probability</b>
Flooding	Many of Thetford's roads are vulnerable to erosional flooding due to steep terrain. Some of the most vulnerable for fluvial erosion or flooding include: Route 132, Route 113, Colby Road South, New Boston Road, Barker Road, Tefft Road, Robinson Road, Poor Far Road, Houghton Hill Road, Picknell Road, Hauger Road, and Burnham Road. Many other roads may be subject to erosional flooding, especially in steep areas.	Town and private buildings, and utilities; culverts, bridges, road infrastructure. There are 80 structures located in the SPHA. These consist of 65 residential (48 single family residential structures, 11 camps, 2 mobile homes, 1 other residential building, and 3 accessory units), 10 commercial/industrial/government, and 5 properties classified as other. If all of these properties were destroyed in a flood, the resulting damage would be approximately \$21,765,260. Specific vulnerable structures include the North Thetford Post Office, Caldwell Logging, Long Wind Farm, Roger Carpentry Services, and Simple Energy.	Most recent severe flooding event, Tropical Storm Irene- 5-7" across county (4-5" in Thetford). No detailed data are available for fluvial erosion damage in Thetford in terms of numbers of acre lost during each event.	June 2014 flooding caused \$46,013 in damages.	Highly likely

### 3. Extreme Cold/Snow/Ice Storm

Winter storms are a regular occurrence in Vermont. Severe winter storms can cause serious damage, including collapse of buildings due to overloading with snow or ice, brutal wind chills, downed trees, downed power lines, and stranded vehicles. People can be at risk of freezing in extended power outages if they lack wood heat or backup power, and individuals shoveling large accumulations of snow can also be at risk from frostbite, hypothermia and heart attacks due to cold and overexertion. While snow removal from the

transportation system is standard fare in Vermont winters, extreme snow or ice can close rail and road systems, further jeopardizing any stranded persons that are in danger of freezing or needing medical assistance. Extreme cold in the Town of Thetford is defined as below zero degrees Fahrenheit for two or more consecutive days.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Extreme Cold/Snow/Ice Storm**.

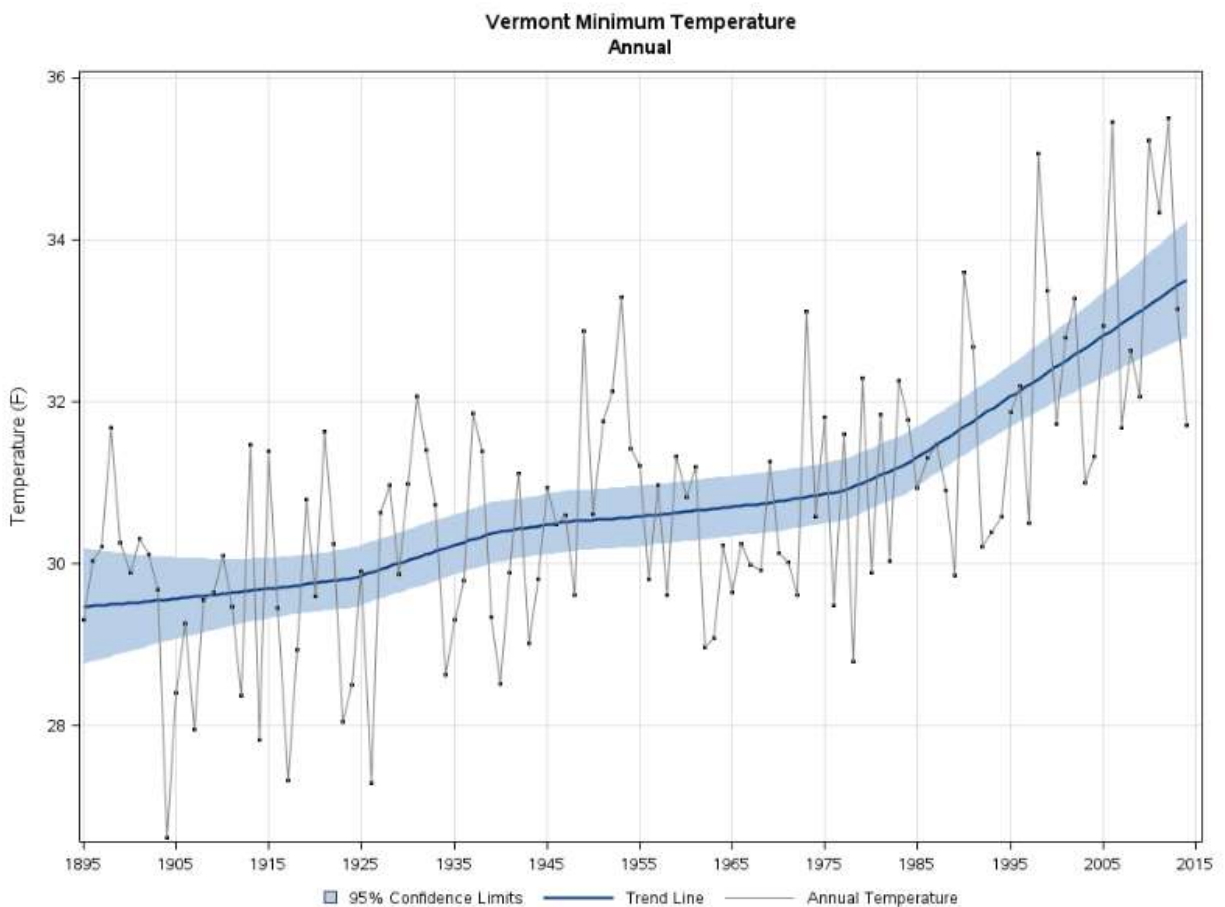
Severe winter storms included a blizzard on February 15-17 in 1958 that dumped over 30 inches and resulted in 26 deaths in New England. On December 26-27 in 1969, another blizzard left 18-36 inches of snow in northwestern Vermont and a whopping 45 inches in Waitsfield. A string of storms in March 2001 hit the state, beginning with 15-30 inches on March 5-6 (later declared a federal disaster), 10-30 inches on the 22nd and 10-20 inches on the 30th. Recent years have seen wet snow storms that have leveled trees and caused widespread power outages.

The worst winter storm in terms of damage to hit the state recently was not a snow storm, but an ice storm. In January of 1998, just the right combination of precipitation and temperature led to more than three inches of ice in spots, closing roads, downing power lines, and snapping thousands of trees. This storm was estimated as a 200-500 year event. Power was out up to 10 days in some areas and 700,000 acres of forest land were damaged in Vermont. Amazingly, there were no fatalities in Vermont, unlike Quebec where 3 million people lost power and 28 were killed.

Over the past few winters, Thetford has received numerous snow storms that have dropped significant amounts of snow over a day or two. However, the details of these events and the damage they caused are overshadowed by winter weather events of the past. This is not to say such extreme events will not repeat themselves. It should be assumed that extreme winter weather events will occur at some point in the future. The following table documents the occurrence of extreme cold/snow/ice storms in the Town of Thetford and Orange County.

ICE DAMAGE INDEX	DAMAGE AND IMPACT DESCRIPTIONS
<b>0</b>	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
<b>1</b>	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
<b>2</b>	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
<b>3</b>	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
<b>4</b>	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
<b>5</b>	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.

(Sperry-Piltz Ice Accumulation Index (SPIA), 2009).



### History of Occurrences:

Date	Event	Location	Extent and Impacts
1/7/2015-1/8/2015	Extreme Cold	County Wide; State-wide	An arctic cold front pushed across Vermont with plummeting temperatures and brisk strong winds of 15-30 mph caused dangerously cold wind chills of 25-40 degrees below zero during the evening of January 7 and morning of January 8. Temperatures in the morning of January 8 were 15-25 degrees below zero on the morning of January 8 in Orange County.
02/01/2015-02/28/2015	Cold/wind chill	County-; region-wide	Vermont communities experienced the coldest month on record for over 20 years. Many communities recorded 15 to 20+ days below zero and on several days, dangerously cold wind chills of 30 below zero or colder occurred. 1 Green Mountain Power Customer (GMP) lost power for 3.3 hours, and 4 GMP customers lost power for 1.7 hours.
Period from 12/09/2014—12/12/2014 (DR-4207 VT)	Snow/Winter Storm	County-; region-wide	A powerful prolonged heavy, wet snow event from December 9th through December 11 <sup>th</sup> . Snowfall totals ranged from a few inches to almost 2' near Warren, VT. The snow to liquid ratios ranged from 5-7" of snow to 1" of rain, which lead to the snow sticking to trees and power lines. A widespread 10 to 15 inches of snow fell across Orange County. 175 GMP customers in Thetford lost power for 2 hours.
Period from 03/12/2014—03/13/2014	Snow Storm	County-; region-wide	A major snowstorm with near blizzard conditions at times impacted Vermont towns. Numerous motor vehicle accidents, school and business closures resulted due to the storm on both March 12th and 13th. Snowfall totals across Orange county were generally 15 to 20+ inches. 132 GMP customers in Thetford lost power for 7 hours.
Period from 02/13/2014—02/14/2014	Winter Storm	County-; region-wide	A winter storm, responsible for record ice and snow across the southeast United States on February 12th, moved and redeveloped off the southeast United states coastline on February 13th. Snowfall across Orange county was 12 to 18 inches. 62 GMP customers lost power for 2 hours.
02/05/2014	Snow Storm	County-; region-wide	Snowfall was at its peak during both the morning and afternoon/evening commutes causing hazardous travel. Eight to twelve inches of snow fell across Orange county. 19 GMP customers lost power for 1 hour.
11/23/2011	Winter Storm	Thetford, County-wide	Heavy snowfall accounted for numerous vehicle accidents and scattered power outages from tree limbs falling on power lines. Thetford recorded 7 inches of snow accumulation. Specific GMP outage data was unavailable for this event.
02/02/2012	Winter Storm	County-; region-wide	An intense winter storm brought snowfall at rates of up to 2 inches per hour, and dropped 10-15 inches across Orange County. Specific GMP outage data was unavailable for this event.
Period from 12/26/2010-12/27/2010	Winter Storm	Thetford, County-wide	Heavy snowfall combined with strong winds (15-25mph with gusts up to 40mph) caused blowing and drifting snow that led to accidents and power outages. Thetford recorded 9 inches of snow accumulation. Specific GMP outage data was unavailable for this event.
Period from 02/23/2010-02/25/2010	Winter Storm	County-; region-wide	Heavy wet snow led to accumulations of 6-30 inches across central and southern Vermont, leading to power outages of 50,000 or more residents.
Period from 02/22/2009-02/23/2009	Winter Storm	County-; region-wide	Heavy snow and high winds with gusts as high as 30mph it the region, impacting travel. Around a foot of snow or more fell in towns neighboring Thetford. Specific GMP outage data was unavailable for this event.
Period from 12/19/2008-12/21/2008	Winter Storms	County-; region-wide	Two heavy storms moved through the region over a 2-3 day period, leading to combined snowfall totals in excess of 2 feet. High snowfall totals led to blocked ventilation pipes and some carbon monoxide injuries as well as a few collapsed small farm structures due to the weight of the snow in Orange County. Specific GMP outage data was unavailable for this event.

Date	Event	Location	Extent and Impacts
Period from 02/06/2008—02/07/2008	Winter Storm	County-wide; statewide	Heavy snowfall of 10 to 16 inches fell across Orange County, prompting many school closures and vehicle accidents. Specific GMP outage data was unavailable for this event.
02/01/2008	“Mixed” Winter Storm	County-wide; statewide	Snowfall reports were generally 2 to 5 inches with localized amounts up to 7 inches. In addition, one quarter to one half of ice accumulation (accretion) occurred as well. Finally, strong south to southeast winds around 3000 feet and above transferred to a few hilltops along the western slopes and produced wind gusts in excess of 50 mph. Specific GMP outage data was unavailable for this event.
02/14/2007	Snow Storm	Thetford; County-wide; statewide	Snow fell at 2-4 inches per hour at times amidst brisk 15-25mph winds and wind chills of -10F, making many roads virtually impassible. A total of 19 inches was reported in Thetford. Specific GMP outage data was unavailable for this event.
Period from 12/06/2003-12/07/2003	Winter Storm	County-; region-wide	Steady snow fell throughout a two day period, producing snow totals around 12-20 inches in Orange County. Specific GMP outage data was unavailable for this event.
Period from 01/06/1998-01/16/1998 (DR-1201 VT)	Ice Storm	County-; state-wide	Ice accumulations of around 3/4 of an inch or less hit the region, causing damage to tens of thousands of trees, downed power lines, road closures due to ice coatings, vehicle accidents, and temporary cessation of milking operations at farms. Indirect injury impacts included carbon monoxide poisoning from improper generator use and hazards from tree limb/other debris.

The Town of Thetford is no stranger to winter weather and the hazards it brings. Depending on the event, particularly with heavy, wet snow or ice, electricity may be knocked out for a few hours or days. The utility companies currently serving the Town of Thetford, including Green Mountain Power, have followed a regular tree-trimming schedule. Thetford town officials believe this is satisfactory to mitigate damage and the power outages caused by downed trees and tree limbs during a heavy, wet snow or ice event. In the event of an extended power outage, the Town would open emergency shelters at the North Thetford Church and Thetford Elementary School.

Heavy, wet snow or large quantities of snow may also leave structures vulnerable to roof collapse. Roof collapse occurs when the structural components of a roof can no longer hold the weight of the snow. Flat roofs are most vulnerable to collapse because they do not drain well, and the snow on the roof soaks up water like a sponge, increasing the weight the roof must bear. More common it seems is the collapse of barns commonly used for livestock sheltering and other agricultural purposes. Unfortunately, livestock in the barn are often killed and equipment stored in the barn may be damaged or ruined. It is difficult to determine whether a residential structure or a barn would be rebuilt after a roof collapse, because the decision to rebuild would likely depend on the extent of damage and the property owner’s finances. The collapse of a barn roof is likely to be a total loss, and the collapse of a house roof may be a 50% loss. While roof collapse has not occurred in Thetford recently, very heavy snow in the region on February 14, 2007 resulted in the partial or total collapse of 20 or more barn roofs, and led to the deaths of more than 100 cattle.

In general, winter weather is most hazardous to travelers. Icy and snow-covered roads present multiple examples of dangerous driving conditions and situations. In Thetford, the mountainous terrain, steep slopes, and remoteness of some roads further complicate travel. The Town relies on Travel Advisories



issued by the State of Vermont Department of Emergency Management Homeland Security and the National Weather Service to alert residents of dangerous travel weather. However, it is difficult, if impossible, to prohibit people from driving during winter weather events. As a result, emergency services personnel must always be prepared to provide assistance to stranded drivers or to those who have been in an accident. To increase awareness in the event of hazardous weather, the Town also encourages residents to utilize 211, social media outlets, and the Town listserv.

<b>Hazard</b>	<b>Location</b>	<b>Vulnerability</b>	<b>Extent</b>	<b>Impact</b>	<b>Likelihood/ Probability</b>
Extreme Cold/ Snow/Ice Storm	Town wide	The entire Town is vulnerable, including road infrastructure, town and privately owned buildings, utility infrastructure. In particular, power transmission lines and power-critical customers.	Snow fall has varied, from a few inches to over a foot or more. Heavy snow and wind downed trees and power lines. Snow/ice contributed to hazardous driving conditions.	For car crashes due to poor driving conditions: minimal damage to vehicle to totaled vehicle.	Highly likely

#### 4. Hazardous Materials Spill

Hazardous materials include any biological, chemical, or physical substances that can harm human beings, property, or the environment.<sup>3</sup> These materials can be released in a variety of different ways to varying degrees of severity. When hazardous materials are released, response is required in order to minimize the extent of contamination and to reduce the impact on human health and property.

Based on available VT Tier II data, there are seven sites in town that have sufficient types and/or quantities of hazardous materials to require reporting.

Thetford Center is located along Route 113, which is used by many as the principal access point for the neighboring towns of West Fairlee and Vershire. East Thetford lies along Route 5, another major state highway. Interstate-

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(2)(i), 201.6(c)(2)(ii), and 201.6(c)(2)(iii) for **Hazardous Materials Spill**.

91 traverses the town, and Thetford is located along exit 13. There are 752 residential and 58 commercial, industrial or public buildings within 1,000 feet of a potential HAZMAT spill on 1-91, Route 113, Route 132, Route 5, Route 244, and the railroad. This includes six government/town buildings, the two fire stations, six churches, the Thetford Academy and the Thetford Elementary School. In the event that 5% of these structures were involved in a HAZMAT incident, the estimated damage would be \$9,669,155. It should also be noted that the State of Vermont currently has one fully trained HAZMAT response team, with vehicles located in Essex Junction, Brandon, Putney, and Windsor. The HAZMAT crew chief is available within minutes of a call for the team but on-scene response would be a matter of hours. In the event of a serious accident in town, there would be little time for evacuation and response would be difficult.

The following data was retrieved from the Vermont Department of Environmental Conservation's Spill List and by searching the archives of local newspapers. The online database of spills consists of those that have been reported. It is difficult to encompass the hazardous material spills that were not reported, and those are not reflected in the table. The table is used to illustrate the ease with which trucks and the day-to-day activities in the Town have the potential to create a hazardous material spill and dangerous conditions for emergency responders and town residents.

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<sup>3</sup> Tufts University. (2016). *Hazardous materials spill*. Office of Emergency Management. Retrieved from <http://emergency.tufts.edu/guide/hazardous-spill/>

### History of Occurrences:

Date	Event	Location	Extent and Impacts
5/2/2016	Hose rupture on garbage truck	3073 Route 5	Casella garbage truck malfunction resulted in the release of 10 gallons of hydraulic oil in pavement area. Although spill was close to the Connecticut River, no contamination was detected.
7/21/2016	Car struck UST	Route 113	Resulted in the release of 150 gallons of propane vapor.
8/31/2016	Truck struck another vehicle	Interstate-91	Accident resulted in the release of 15-20 gallons of diesel fuel. Excavation of contaminated soil occurred on 9/16/2016
11/21/2016	Hose burst on Thetford Town truck	Colby Road South and Sawnee Bean Road	Blown hose on Town of Thetford truck resulted in 1 gallon release of hydraulic oil.
12/29/2016	Above ground storage tank leak	713 Tucker Hill Rd	Fuel soaked into dirt floor of residence and 10 foot radius and an unknown amount of material was released.
6/19/2015	Car hit utility pole	2697 Route 5	Car accident resulted in release of less than 1 gallon of antifreeze and it also damaged utility infrastructure including downed wires.
5/28/2015	Roadside accident	3052 US Route 5	Accident during a storm resulted in 7 gallons of released mineral oil dielectric fluid.
5/11/2015	Punctured hydraulic oil tank	Juncture of Route 113 and Latham Road	The event led to the release of 35 gallons of hydraulic oil.
8/7/2014	Dump truck off road on side	240 Stevens Road	A dump truck accident led to release of hydraulic liquid in swampy wetland area off of Stevens Road. The liquid extent of release is unknown; however, 9.5 tons of impacted soil was excavated and disposed. 5 drums of sludge was removed and disposed.
6/7/2014	Vehicle accident	321 Route 113	A vehicle accident led to the partial dislodgement of gas tank and the release of 5 gallons of gasoline.
5/31/2014	Vehicle struck utility pole	Route 5	5 gallons of mineral oil dielectric fluid was released.
2/25/2013	VTrans vehicle release	Interstate-91	A VTrans vehicle lost 10 gallons of engine oil, however that material was dispersed over a large area and was therefore not recoverable.
4/23/2013	Fuel Tank discovered near Ompompanoosuc River	Tucker Hill Road	Tank was discovered on Ompompanoosuc riverbank, however contents were unknown.
4/26/2013	Thetford truck hose malfunction	Route 113- Town Garage	2 gallons of hydraulic oil were released when truck hose blew. Impacted soil was removed.
5/22/2012	Tank spill during removal	639 Route 244	2 gallons of #2 fuel oil were released when basement tanks were pumped for removal. Contamination immediately absorbed and removed.
7/2/2012	Transformer leak	568 Mud Pond Road	A transformer leaked .25 gallons of mineral oil dielectric fluid. The contamination was cleaned by GMP.

<b>Date</b>	<b>Event</b>	<b>Location</b>	<b>Extent and Impacts</b>
2/13/2012	Fuel oil leak	1082 Lathum Road	Residential fuel oil leak from above ground storage tank led to the release of 5 gallons of #2 fuel oil.
5/27/2011	Vehicle fuel tank leak	Route 113	A fuel oil spill from a vehicle led to the release of 7 gallons of gasoline.
9/18/2010	Unattended vehicle spill	7788 Route 113	An unattended vehicle spilled 20 gallons of gasoline.
4/29/2002	Fuel spill	Route 244	Vandal damaged 2 aboveground storage tanks which led to the release of 500 gallons of fuel oil. Minimal contamination occurred in Lake Fairlee.
11/2/1997	Septic Spill	Interstate 91	20 gallons of Septic material was spilled. VTrans cleaned contamination.

The Town of Thetford has experienced hazardous material spills in the past, and the potential for a major spill exists in the future. Interstate 91 runs through the town, which provides a significant hazardous material spill threat. The I-91 corridor poses a constant threat to the Town of Thetford. As one of the major highways in Vermont, I-91 is a main thoroughfare for trucks and other motor vehicles transporting a wide-range of goods, including a variety of hazardous materials. Of particular concern to the Town is the proximity of I-91 to the Thetford Elementary School, Thetford Academy and Thetford Center. A truck accident and a resulting hazardous material spill could be exceedingly disastrous for the Town and its residents

Major state highways in Thetford include Route 5, Route 113, Route 244, and Route 132. These routes witness considerable truck traffic. A truck accident and a resulting hazardous material spill could be exceedingly disastrous for the Town and its residents. These routes serve as the main thoroughfares for trucks and other motor vehicles transporting a wide-range of goods, including a wide range of hazardous materials, within the confines of Thetford. Route 5 follows the Connecticut River through Thetford, and, as a result, additional water contamination issues could be created if a hazardous material spill were to occur along either of these major routes. Additionally, Route 132 follows the West Branch of the Ompompanoosuc River, and a spill on this highway would risk contaminating this surface water resource.

In order to prepare for hazardous material spills in Thetford, the members of the Thetford Fire Department are trained to the Firefighter 1 certification level as well as to the HAZMAT Operations level. In addition, the Town plans to host Level 2 classes.

<b>Hazard</b>	<b>Location</b>	<b>Vulnerability</b>	<b>Extent</b>	<b>Impact</b>	<b>Likelihood/ Probability</b>
Hazardous Materials Spill	I-91, Route 113, Route 132, Route 5, Route 244, and the railroad running along the Connecticut River are all vulnerable to HazMat spills. HazaMat storage facilities include the Thetford Town Garage, the two fire departments, Thetford Academy, and Thetford Elementary School.	Road infrastructure, nearby structures, Thetford Center, and the Connecticut River.	Initially, local impacts only; but depending on material spilled, extent of damage may spread (ex. into groundwater).	There are 752 residential and 58 commercial, industrial or public buildings within 1,000 feet of a potential HAZMAT spill on I-91, Route 5, Route 132, Route 113, and Route 244. In the event that 5% of these structures were involved in a HAZMAT incident, the estimated damage would be \$9,669,155	Likely

### C. Vulnerability Summary

As a result of the above profiled hazards, the Town believes the following vulnerabilities to be of highest concern due to their potentially severe consequences and likelihood of occurrence:

- **Severe Summer Weather & Hurricanes/Tropical Storms:** Damage to public and private property and municipal infrastructure can be extensive during severe weather events. Prolonged power outages and downed cellular communications can greatly hamper public and business services for indeterminate periods of time. Specific vulnerable structures include the North Thetford Post Office, Caldwell Logging, Long Wind Farm, Simple Energy, and A Cook Associates.
- **Flash Flood/Flood/Fluvial Erosion:** One of the worst threats, flooding impacts roads and the village center, especially facilities for children, elders, and community emergency shelters. Under-sized bridges and culverts factor into the threat. Outdated flood hazard mapping for Orange County also compounds existing threats. Furthermore, flood hazard mapping (Special Flood Hazard Areas) does not adequately encompass all areas that could be flooded, thus potentially making some residents too complacent in regard to the threat. In addition, numerous homes, commercial entities, and public facilities, including the North Thetford Post Office, Caldwell Logging, Long Wind Farm, Simple Energy, and A Cook Associates could be vulnerable to a major flood event.
- **Extreme Cold/Snow/Ice Storms:** Lack of access to power and telecommunication services throughout the Town could severely impede response efforts, and could be especially harmful to vulnerable populations (e.g., the elderly and disabled).
- **Hazardous Material Spill:** Hazardous material spills, particularly along major roadways, such as Interstate 91, Route 132, Route 113, Route 5, and Route 244, could pose a serious harm to the Town of Thetford. A hazardous material spill along Route 132 would likely impact the West Branch of the Ompompanoosuc River and a hazardous material spill along Route 5 would likely impact the Connecticut River, as well as other local brooks and streams. Hazardous material spills can occur at any time without warning, although some accrete over a long period without anyone's knowledge (e.g., a leaking storage tank or residual waste from historic operations on Brownfield sites). Adjacent or immediate landowners (municipal, businesses, and private homeowners alike) are anticipated to be most adversely impacted by contaminants at the outset of a spill. Infrastructure could also incur impacts. In the case of Thetford, impacts are expected to affect roadways, road infrastructure, and railways. Water wells may also be at risk. Hazardous Material storage facilities include Thetford Town Garage, Thetford Fire Department and Post Mills Fire Department, Thetford Academy and Thetford Elementary School.

## **VI. Mitigation**

### **A. Mitigation Goals**

1. To reduce injury and losses from the natural hazard of severe weather.
2. To reduce injury and losses from the natural hazard of flash flooding/flooding/fluvial erosion.
3. To reduce injury and losses from the natural hazard of extreme cold/snow/ice storms.
4. To reduce injury and losses from the hazard of hazardous material spills.

### **B. Town Plan Goals & Objectives Supporting Local Hazard Mitigation**

- Create a water resources overlay to provide protection for the Town's aquifers, rivers, streams, lakes, and ponds. (page 13).
- Consider adding subdivision regulations to exclude very steep slopes and wetlands from the calculation of lot size when determining minimum lot sizes or when calculating allowable density for cluster and multi-unit development (page 13).
- Maintain a well-trained and well-equipped volunteer fire department (page 32).
- Respond quickly and aggressively to extinguish fires, minimizing demand for water (page 32).
- Develop a wet hydrant system in East Thetford village (page 32).
- The Town, TVFD, FAST, Police and Emergency Management Director should continue to work on the Emergency Plans including the Large-scale evacuation of homes (page 33).
- In collaboration with disaster relief organizations, consider development of shelters with generators, food and bedding which will be available in the event of major weather-related emergency, an earthquake or a major hazardous materials incident. Wherever possible, make use of existing Town resources such as Elementary School and other facilities (page 33).
- Schedule and budget road improvement programs such that it will save taxpayers money in the future (page 33).
- Allow development only if the development is sensitive to and considerate of Thetford's natural resources (page 46).
- Building construction should not occur in flood prone areas (page 47).
- The Planning Commission should promote the preservation of these buffers and, where possible, use the buffers to create greenways to protect these water resources, create and preserve wildlife habitat and provide recreational opportunities (page 47).
- Do not permit uses that pose potential for water contamination in flood hazard areas (page 47).
- Add specific ordinances to ensure that construction of building and roads on slopes of 15-25 percent be considered a conditional use (page 47)
- Slopes greater than 25 percent should be left undeveloped because of high erosion potential and difficulty for development. Slope considerations should be added to the Zoning Ordinance (page 47).
- Adopt ordinances which require monitoring and testing of above and below ground storage tanks for hazardous materials and which set standards for the installation of new tanks (page 47).
- Establish protection zones to preserve these resources (page 47).

- Create and adopt a water resources protection overlay zone (page 47).
- Add regulations to the Subdivision Regulations: Development in flood plain areas should not be permitted; substantial improvements to existing structures in the flood plain area should be flood proofed (page 68).

The Thetford Town Plan was adopted on May 14, 2012 and was being updated in 2017 during the development of this Local Hazard Mitigation Plan. The 2011 Thetford Annex, the previous version of this Local Hazard Mitigation Plan for the Town of Thetford, provided guidance in the development of the Thetford Municipal Plan, including directing goals, policies, and recommendations towards mitigating the effects of future hazards on health and property of the Town.



## B. Hazard Mitigation Strategies: Programs, Projects & Activities

Vermont Division of Emergency Management & Homeland Security encourages a collaborative approach to achieving mitigation at the local level through partnerships with Vermont Agency of Natural Resources, VTTrans, Vermont Agency of Commerce and Community Development, Regional Planning Commissions, FEMA Region 1 and others. That said, these agencies and organizations can work together to provide assistance and resources to towns interested in pursuing hazard mitigation projects.

This section of the Plan satisfies the requirements of 44 CFR 201.6(c)(3)(ii), 201.6(c)(3)(iii) and 201.6(c)(3)(iv).

With each mitigation strategy, general details about the following are provided: local leadership, possible resources, implementation tools, and prioritization. The prioritization category is based upon the economic impact of the action, Thetford's need to address the issue, the cost of implementing the strategy, and the availability of potential funding. The cost of the strategy was evaluated in relation to the benefit using STAPLEE-like guidelines (includes economic, political, environmental, technical, social, administrative, and legal criteria). A range of mitigation strategies was vetted by the committee, and those that were determined to be feasible are included in the table below. The committee also determined preparedness, response, and recovery strategies, which have been included in the table following mitigation actions.

Strategies given a "High" prioritization indicate that it is either critical or potential funding is readily available, and should have a timeframe of implementation of less than two years. A "Medium" prioritization indicates that a strategy is less critical or the potential funding is not readily available, and has a timeframe for implementation of more than two years but less than four. A "Low" prioritization indicates that the timeframe for implementation of the action, given the action's cost, availability of funding, and the community's need to address the issue, is more than four years.

The Town of Thetford understands that in order to apply for FEMA funding for mitigation projects that a project must meet FEMA benefit cost criteria. The Town must have a FEMA approved Local Hazard Mitigation Plan as well.

The following strategies will be incorporated into the Town of Thetford's long-term land use and development planning documents. In addition, the Town will review and incorporate elements of this Local Hazard Mitigation Plan into updates for the municipal plan, subdivision regulations, and flood hazard/ River Corridor bylaws. The Thetford Planning Commission will review and incorporate aspects of and mitigation strategies from this Hazard Mitigation Plan during the Thetford Town Plan update in 2017. The incorporation of the goals and strategies listed in the Local Hazard Mitigation Plan into the municipal plan, zoning regulations and flood hazard/river corridor bylaws will also be considered after declared or local disasters. The Town shall also consider reviewing any future TRORC planning documents for ideas on future mitigation projects and hazard areas.

<b>Hazard(s) Mitigated</b>	<b>Hazard Mitigation Actions</b>	<b>Local Leadership</b>	<b>Prioritization (Mitigation Plan Status)**</b>	<b>Possible Resources*</b>	<b>Time Frame</b>
All Hazards	<i>Install new dry hydrant at 1530 Latham Road to reduce the loss of life and infrastructure from structure fires. (Mitigation).</i>	Thetford Fire Department	High (Action #6 of 8 in 2011 Plan).	Vermont Dry Hydrant grant	Fall 2018-Fall 2019
	<i>Upgrade dry hydrant at 2829 Route 113 to reduce the loss of life and infrastructure from structure fires. (Mitigation).</i>	Thetford Fire Department	Low (Action #6 of 8 in 2011 Plan).	Vermont Dry Hydrant grant	Summer 2017-Fall 2017
	<i>Install new dry hydrant at 82 Bridge Road to reduce the loss of life and infrastructure from structure fires. (Mitigation).</i>	Thetford Fire Department	Medium (Action #6 of 8 in 2011 Plan).	Vermont Dry Hydrant grant	Summer 2019-Fall 2019
	<i>Purchase new Fire Engine to augment Fire Department's capacity to reduce the loss of life and property from structure fires. (Mitigation)</i>	Thetford Fire Department	High	Local Resources	Summer 2018
Flash Flood/Flood/ Fluvial Erosion/ Severe Summer Weather	<i>Stabilize bank and improve ditching on Robinson Hill Road. Stabilized bank will prevent sedimentation and erosion in Lake Fairlee and will protect town infrastructure from future damage from flooding and fluvial erosion. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	High (New)	Better Roads Grant Program, Local Resources	Summer 2017-Fall 2018

Hazard(s) Mitigated	Hazard Mitigation Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
	<i>Improve ditching and stabilize banks to significantly reduce stream channel erosion on New Boston Road. This bank stabilization will protect town infrastructure from future damage from flooding and fluvial erosion and will improve the water quality of Lord Brook. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	High (New)	Better Roads Grant Program, Local Resources	Summer 2017-Fall 2018
	<i>Improve ditching, stabilize erosion areas and culvert outlets, and upsize undersized culverts on Colby Road South. Improved road maintenance and culverts will reduce the impact on town infrastructure from fluvial erosion and flooding. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	Medium (New)	Better Roads Grant Program, Local Resources	Fall 2019-Fall 2020
	<i>Improve ditching and stabilize erosion areas on Barker Road. Improved road maintenance and culverts will reduce the impact on town infrastructure from fluvial erosion and flooding. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	Medium (New)	Better Roads Grant Program, Local Resources	Fall 2019-Fall 2020
	<i>Improve ditching, stabilize erosion areas, and upsize undersized culverts to improve drainage on Tefft Road. Improved road maintenance and culverts will reduce the impact on town infrastructure from erosion and flooding. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	Low (New)	Better Roads Grant Program, Local Resources	Fall 2021-Fall 2022

<b>Hazard(s) Mitigated</b>	<b>Hazard Mitigation Actions</b>	<b>Local Leadership</b>	<b>Prioritization (Mitigation Plan Status)**</b>	<b>Possible Resources*</b>	<b>Time Frame</b>
	<i>Improve ditching, stabilize erosion areas, and install new culverts to improve drainage on Hauger Road. Improved road maintenance and culverts will reduce the impact on town infrastructure from fluvial erosion and flooding. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	Low (New)	Better Roads Grant Program, Local Resources	Summer 2023-Fall 2024
	<i>Improve ditching, stabilize erosion areas, and install new culverts to improve drainage on Burnham Road. Improved road maintenance and culverts will reduce the impact on town infrastructure from fluvial erosion and flooding. (Mitigation)</i>	Selectboard, Department of Public Works Foreman	Low (New)	Better Roads Grant Program, Local Resources	Fall 2023-Fall 2024
	<i>Develop a schedule and capital budgeting program to replace undersized culverts. Upgraded culverts appropriately handle the hydraulic capacity of streams and therefore protect town infrastructure from flooding. (Mitigation)</i>	Selectboard/ Department of Public Works Foreman	High (Action #4 of 8 in 2011 Plan).	TRORC; local resources	Fall 2018- Spring 2019
	<i>Consider adopting river corridor regulations, which will incorporate VT ANR's river corridor maps, helping residents and planners know what land is necessary for riparian functions and to prevent the threat to current and future development. (Mitigation)</i>	Selectboard	Low (Action #5 of 8 in 2011 Plan).	ANR; MPG; local resources	Fall 2022-Fall 2023
	<i>Complete an up-to-date geo-referenced culvert inventory, which will identify priority upgrade projects. (Mitigation)</i>	Department of Public Works Foreman/ Selectboard	Medium (Action #4 of 8 in 2011 Plan).	Better Roads grants; TRORC; local resources	Fall 2020-Fall 2021

<b>Hazard(s) Mitigated</b>	<b>Hazard Mitigation Actions</b>	<b>Local Leadership</b>	<b>Prioritization (Mitigation Plan Status)**</b>	<b>Possible Resources*</b>	<b>Time Frame</b>
	<i>Support projects to protect or restore, including riparian planting, strategic areas of floodplain to provide areas for flood storage, which will help alleviate peak flood flows and reduce the loss of property during a flood. (Mitigation)</i>	Selectboard/ Planning Commission	Medium (new)	Upper Valley Land Trust; Upper Valley Trout Unlimited; local resources	Spring 2021- Fall 2021
	<i>Keep up-to-date with Vermont Road and Bridge Standards, which will help Thetford design structures that mitigate flood damage. (Mitigation)</i>	Department of Public Works foreman/ Selectboard	High (New)	Local resources	Spring 2018- Summer 2018 (or when they are updated by VTrans)
	<i>Request an updated flood map from FEMA, which will more accurately represent frequently flooded areas and will allow the town to properly monitor and restrict the construction of infrastructure in areas that are vulnerable to flooding and severe weather. (Mitigation)</i>	Town Zoning Administrator	Medium (Action 5 of 8 in 2011 Plan)	Local resources; FEMA	Fall 2020- Winter 2021
Extreme Cold/Snow/ Ice Storm	<i>Clear and maintain town road rights-of-way to protect town infrastructure. (Mitigation)</i>	Highway Department/Se lectboard	Medium (New).	Local resources	Summer 2020-Fall 2020
	<i>Encourage Green Mountain Power to clear and maintain utility corridors, which will protect town and utility infrastructure. (Mitigation)</i>	Emergency Management Director	High (Action #2 of 8 in 2011 Plan).	Green Mountain Power; local resources	Fall 2018-Fall 2019

Hazard(s) Mitigated	Ongoing Actions to Support Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
All Hazards	<i>Ensure that Thetford's Local Emergency Operations Plan (LEOP) is kept up-to-date and identifies vulnerable areas and references this Plan. (Preparedness)</i>	Emergency Management Director/ Selectboard	High (Action #1 of 8 in 2011 Plan).	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); TRORC; local resources	Yearly
	<i>Include a Flood Resilience Element in the 2017 Town Plan Update to identify areas of vulnerability to flooding and erosion in the Municipal Plan and to identify areas for future protection. (Preparedness).</i>	Planning Commission	High	Local resources	Fall 2018-Winter 2018
	<i>Update Thetford's flood hazard area regulations to ensure that they are compliant and consistent with state and federal guidelines and statutes. (Preparedness)</i>	Planning Commission	Low (Action #5 of 8 in 2011 Plan).	Municipal Planning Grant; TRORC; local resources	Fall 2022-Fall 2023
	<i>Alert residents to upcoming hazards, bad weather, and potentially treacherous travel conditions by posting the VTrans Live Update Road Condition webpage on the Thetford Town Website. These resources will be used to give residents important information about upcoming hazards and potentially treacherous travel conditions. This town-wide notification system will reduce the loss of life and property during a hazard. (Preparedness)</i>	Emergency Management Director / Selectboard	High (New).	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); TRORC; local resources	Fall 2017-January 2018
	<i>Develop a methodology to consistently document infrastructure damage after weather events. (Preparedness)</i>	Department of Public Works Foreman/ Town Clerk	Medium (Action #4 of 8 in 2011 Plan).	TRORC; local resources; National Weather Service; VTrans	Fall 2020

<b>Hazard(s) Mitigated</b>	<b>Ongoing Actions to Support Mitigation and Preparedness Actions</b>	<b>Local Leadership</b>	<b>Prioritization (Mitigation Plan Status)**</b>	<b>Possible Resources*</b>	<b>Time Frame</b>
	<i>Require Thetford employees to become Incident Command System (ICS) 100 certified. (Preparedness).</i>	Emergency Management Director	High (New)	Local Resources	Ongoing
	<i>Consider making Thetford Academy a designated Red Cross Shelter. (Preparedness)</i>	Emergency Management Director	Medium (New)	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); VT Alert; local resources	Ongoing
	<i>Maintain highway and fire mutual aid agreements. (Preparedness)</i>	Department of Public Works /Fire Department	High (New)	Local resources and with assistance from TRORC	Yearly
	<i>Distribute Vermont Division of Emergency Management &amp; Homeland Security: Family Emergency Preparedness booklet at Town Meeting Day. (Preparedness)</i>	Selectboard/ Emergency Management Director	High (New)	Local resources	Ongoing and yearly
	<i>Ensure Red Cross Shelter, Thetford Elementary School, are stocked with cots, blankets, and supplies. (Preparedness)</i>	Emergency Management Director	High (New)	Vermont Division of Emergency Management and Homeland Security (VT DEMHS); VT Alert; local resources	Yearly
	<i>Continuously stock gear to help contain small spills when they occur (booms, absorbent materials, etc.). (Preparedness)</i>	Thetford Fire Department	High (New)	Thetford Fire Department resources	Yearly
	<i>Maintain existing dry hydrants, by checking, servicing, flushing, and opening them annually. Proper maintenance of hydrants will reduce the loss of life and infrastructure from structure fires. (Preparedness)</i>	Fire Chief/Fire Department	High (Action #6 of 8 in 2011 Plan).	Local Resources	Ongoing and occurs yearly.

<b>Hazard(s) Mitigated</b>	<b>Ongoing Actions to Support Mitigation and Preparedness Actions</b>	<b>Local Leadership</b>	<b>Prioritization (Mitigation Plan Status)**</b>	<b>Possible Resources*</b>	<b>Time Frame</b>
	<i>Distribute fire prevention fliers at the school to protect young residents from loss of life during fires. (Preparedness)</i>	Fire Chief/Fire Department	High (New)	Local resources	Ongoing. Occurs once per year in the fall.
Hazardous Material Spill	<i>Ensure that all emergency response and management personnel continue to receive HAZMAT Awareness training at a minimum. (Preparedness)</i>	Thetford Fire Department	High (Action #7 of 11 in 2011 Plan).	Thetford Fire Department resources	Yearly
Flash Flood/ Flood/ Fluvial Erosion	<i>Plan for, budget, and maintain roads for safe winter travel. (Preparedness)</i>	Selectboard	High (Action #4 of 8 in 2011 Plan).	Local resources	Ongoing and occurs yearly.
	<i>Continue efforts throughout Town to maintain and improve ditching in rights-of-way of Town maintained roads. (Mitigation).</i>	Department of Public Works Foreman	High (New)	Local Resources; Better Roads	Ongoing
Extreme Cold/Snow/ Ice Storm	<i>Develop a periodic program to clear tree limbs and maintain town road rights-of-way, and work with local utilities to ensure that utility corridors are cleared and maintained. (Preparedness)</i>	Selectboard	Low (New)	Green Mountain Power; local resources	1 year from date of Plan Approval
	<i>Update and maintain existing list of populations that are vulnerable to extreme cold and other hazards. Call and visit vulnerable residents, if necessary, in the event that a hazard occurs. By maintaining this list, the health of vulnerable populations will be protected. (Preparedness)</i>	Selectboard, Emergency Management Director	Medium (New)	Local resources	Ongoing and occurs yearly.



Hazard(s) Mitigated	Ongoing Actions to Support Mitigation and Preparedness Actions	Local Leadership	Prioritization (Mitigation Plan Status)**	Possible Resources*	Time Frame
	<i>Distribute safe winter driving informational materials to residents by means of Thetford listserv. Safe winter driving mitigates the loss to human health. (Preparedness)</i>	Department of Public Works	Low (New)	Local Resources	Year

\*Depending on the mitigation action, local resources may include the following: personnel/staff time; volunteer time; budget line items, donations, cash from capital campaigns, among others.

## Appendices

### Appendix A: Hazard Ranking Methodology

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

## Appendix B: Critical Stream Crossings

Critical crossings in the table below includes stream crossing structures on town highways that cross third order streams or larger. Headwater streams generally include first through third order. Third order was included as these headwater streams will have larger drainage areas and may have larger structures that are more difficult to replace and have a larger impact on the road network. Most of these are bridges. Structures that have a “Y” in the “AOTSTRUCT” column are state-owned.

local_id	location	label	cul_type	cul_matl	height	width	length
B12	GODFREY RD	THETFORD					
B5	ROUTE 132	THETFORD					
B21	PICKNELL RD	THETFORD					
B18	LATHAM RD	THETFORD					
B6	NEW BOSTON RD	THETFORD					
B19	STEVENS RD	THETFORD					
B4	ROUTE 132	THETFORD					
00008	W BR. OMPOMPANOOSUC RIV.	THETFORD	200177000809112	3 SP CONT WELD GIRD			000225
00007	OMPOMPANOOSUC RIVER	THETFORD	100911000709111	GLU LAM BM/MKGPSTCB			000123
00022	LAKE FAIRLEE OUTLET	THETFORD	100911002209111	PRESTRESS CONC. TBM			000055
00023	LORD BROOK	THETFORD	100911002309111	CONCRETE SLAB			000025
00026	OMPOMPANOOSUC RIVER	THETFORD	100911002609111	WELDED PLATE GIRDER			000103
00027	OMPOMPANOOSUC RIVER	THETFORD	100911002709111	2 SPN ROLBM/HAUPT CB			000125

The critical crossings in the table below includes significantly undersized structures, usually culverts, which were identified from the ANR-DEC stream geomorphic assessment survey with openness ratios less than 50%. This measure refers to when structure’s width is less than half of the stream bank’s full width. Several of these structures may have been damaged during TS Irene or other events and may have been replaced. The town, at some point, should look at these sites and assess their status and need for repair/upgrades.

BankfullWidthPercent	CompatabilitySum	IceDebrisJam	OpennessRatio	AOPCourseScreen	RetroftPotential	StructureType	Town	Location	GisRoadName	StreamName	ChannelWidth	StructureLength	StructureHeight	StructureWidth
24.2	2	1	7% Red	LLL	Culvert	Thetford	Thetford Hill State Forest. Trail Off of Houghton Hill Rd.			Trib to Zebedee Brook	4.96667	20	1.2	1.2
59.1	5	1	9% Gray	LLL	Culvert	Thetford	East of Route 5 Culvert			Roaring Brook	11	502	7.2	6.5
28.6	5	1	11% Gray	LLL	Culvert	Thetford	CT river bends back to South, Near a PVT Drive, BM 396	ROUTE 5		Trib to CT	14	210	6	4
25.5	1	1	14% Red	LLL	Culvert	Thetford	Just North of Cream street	ROUTE 132		Trib to West Branch C	13.7	85	3.5	3.5
69.8	3	1	16% Gray	MLL	Culvert	Thetford	MM - 81.75			Trib to CT River	6.3	118	4.4	4.4
69.8	3	1	16% Red	MLL	Culvert	Thetford	100' after Orange / Windsor Town Line - MM 81.75			Trib to CT River	6.3	118	4.4	4.4
33.5	1	1	18% Gray	MLL	Culvert	Thetford	Thetford Hill State Forest. On Lower Loop			Unnamed Trib	7.16667	34	2.5	2.4
46	3	1	19% Gray	MLL	Culvert	Thetford	Above large turnout/school bus turn around Below Thetford Hill	ROUTE 113		Outlet to Lake Abenaki	8.7	106	5	4
36.8	5	1	19% Red	MLL	Culvert	Thetford	First structure after road turns to dirt	ROBINSON HILL RD		Trib to Lake Fairlee	7.6	39	2.7	2.8
49.7	1	1	20% Red	MLL	Culvert	Thetford	Thetford Hill state Forest			Unnamed Trib	4.025	20	2	2
26.5	4	1	22% Red	LLL	Culvert	Thetford	100' east of Y in road	CRANBERRY HILL RD		Trib to Zebedee Brook	11.3	40	3	3
72.7	3	1	24%	Missing Data	Bridge	Thetford	Part of the Route 5 Culvert at Newton Lane (priv)			Roaring Brook	11	100	3	8
43.4	5	1	26% Gray	MLL	Culvert	Thetford	Just below Colby and Sawnee Bean intersection	SAWNEE BEAN RD		Barker Brook	7.61	42	3.3	3.3
40.1	1	1	28% Gray	LLL	Culvert	Thetford	Median between North & South Bound Lanes			Zebedee Brook	21.2	290	9.5	8.5
68	3	1	28% Red	MLL	Culvert	Thetford	Near the Thetford/Norwich town lines	CAMPBELL FLATS RD		Trib to Ompompanoc	5	30	2.5	3.4
41.1	1	1	30% Gray	MLL	Culvert	Thetford	Second structure above junction with Tucker Hill Road	POOR FARM RD S		Trib to West Branch C	7.3	30	3	3
54.8	1	1	31% Red	LLL	Culvert	Thetford	At Jct with Clay Hill Road	ROUTE 5		Trib to CT River	7.3	77	6	4
23.4	2	1	31% Red	LLL	Culvert	Thetford	North of Turnpike Road South Jct			Trib to CT River	10.7	20	2.5	2.5
57.7	0	1	33% Red	MLL	Culvert	Thetford	North of Sanborn Road	LATHAM RD		Trib to CT River	13	114	5	7.5
56.3	5	1	34% Gray	MLL	Culvert	Thetford	By Mile Marker 81.8			Unnamed	8	60	4.5	4.5
46.3	1	1	38% Gray	MLL	Culvert	Thetford	West of Gorey Road	ROUTE 113		Zebedee Brook	10.8	68	5.1	5
46.7	4	1	38% Gray	MLL	Culvert	Thetford	Just south east of Turnpike Road			Trib to CT	15	153	8.3	7
42.7	2	1	39% Gray	LLL	Culvert	Thetford	Junction of Wippowill Road & Tucker Hill Road	TUCKER HILL RD		Trib to Ompompanoc	11.7	64	5	5
26.4	3	1	39% Gray	LLL	Culvert	Thetford	Jct Godfrey Road & Quail John Road	GODFREY RD		Trib to Zebedee Brook	16.3	33	3	4.3
38	1	1	40% Red	MLL	Culvert	Thetford	Just after passing under the I-91 Overpass.	TURNPIKE RD S		Trib to CT River	15	88	6.1	5.7
46.7	4	1	41% Gray	MLL	Culvert	Thetford	Just South of I-91 South overpass			Trib to CT River	15	141	8.3	7
40.1	1	1	43% Gray	MLL	Culvert	Thetford	Under I-91 underpass, between N/S bound lanes	QUAIL JOHN RD		Zebedee Brook	21.2	190	9.5	8.5
40	1	1	45% Red	MLL	Culvert	Thetford	Thetford Hill State Park			Unnamed	7.5	20	3	3
50	3	1	45% Gray	MLL	Culvert	Thetford	Near Junction with S - corners road	ROUTE 113		Mud Pond Outlet	11	74	6.1	5.5

## Appendix C: Five-Year Review and Maintenance Plan

### Five-Year Local Hazard Mitigation Plan Review/Maintenance



#### After Plan Adoption—Annually Implement & Evaluate

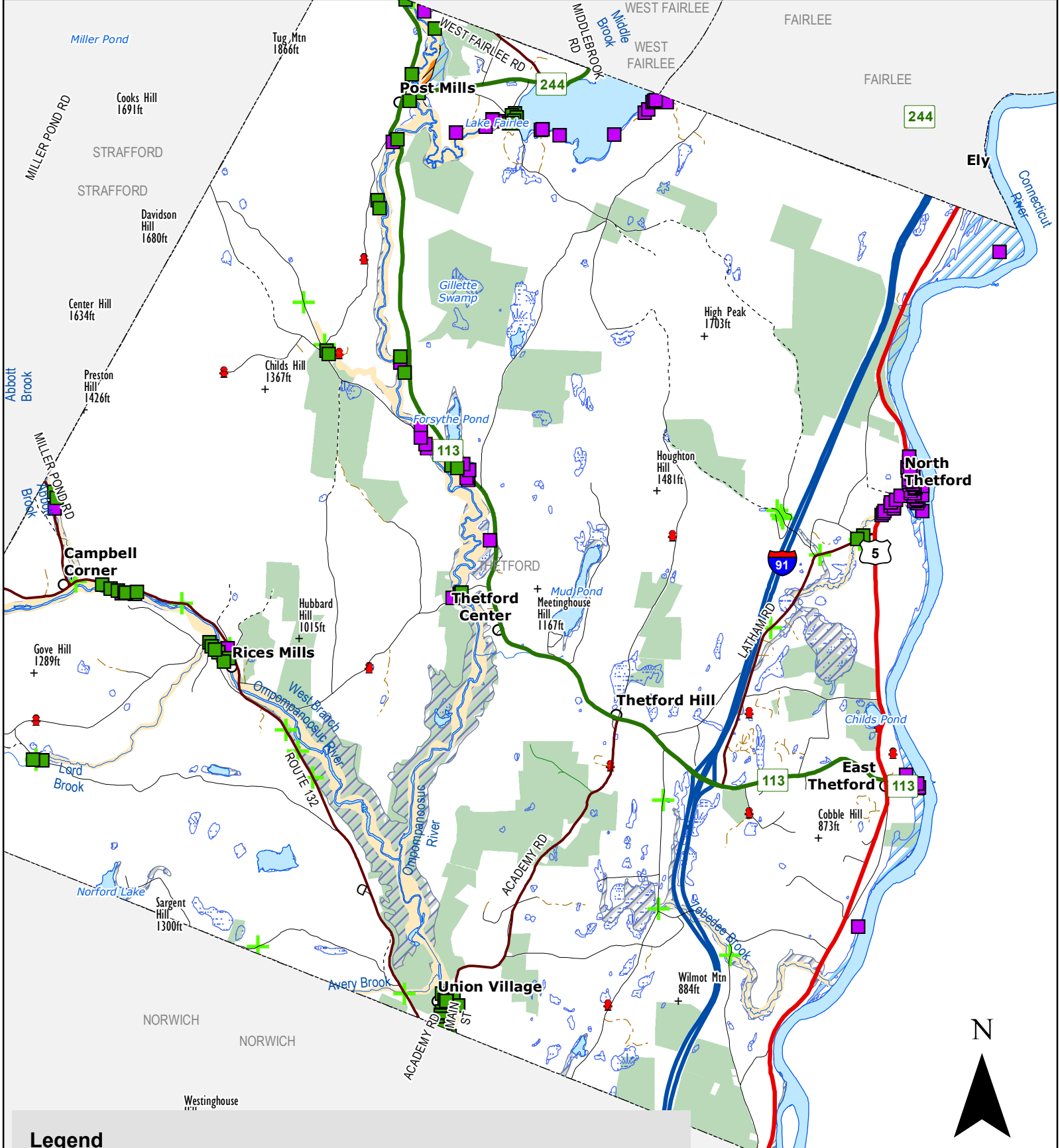


#### Fifth Year, and After a Major or Federally Declared Disaster Directly Impacting the Town Evaluate & Revise



## **Attachments**

### **Attachment A: Map of the Town of Thetford**



**Legend**

**Flood Sites**

- Sites in Flood Hazard Area
- Sites in River Corridor
- Bridges
- Stream
- Brook
- HYDRANTS
- River Corridor

**Surface Water**

- Lake or Pond
- River

**Mapped Flood Hazard Areas**

- A, Special Flood Hazard Area
- AE, SFHA with BFE
- AE, FLOODWAY
- Wetland
- Conserved