TOWN OF NEW MILFORD
HAZARD MITIGATION PLAN

ADOPTED DECEMBER 14, 2015

MMI # 3101-14

Prepared for the:

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LIST OF ACRONYMS

AEL	Annualized Earthquake Losses
ARC	American Red Cross
ASFPM	Association of State Floodplain Managers
BCA	Benefit Cost Analysis
BCR	Benefit-Cost Ratio
BFE	Base Flood Elevation
BOCA	Building Officials and Code Administrators
CLA	Candlewood Lake Authority
CLEAR	Center for Land Use Education and Research (University of Connecticut)
CM	Centimeter
CRS	Community Rating System
DEEP	Department of Energy & Environmental Protection
DEMHS	Division of Emergency Management and Homeland Security
DFA	Dam Failure Analysis
DMA	Disaster Mitigation Act
DOT	Department of Transportation
DPW	Department of Public Works
EAP	Emergency Action Plan
ECC	Emergency Communications Center
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
GIS	Geographic Information System
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HURDAT	Hurricane Database (NOAA's)
HURISK	Hurricane Center Risk Analysis Program
HVCEO	Housatonic Valley Council of Elected Officials
ICC	International Code Council
IPCC	Intergovernmental Panel on Climate Change
ISO	Insurance Services Office, Inc.
KM	Kilometer
KT	Knot
LID	Low Impact Development
LOMC	Letter of Map Change
MM	Millimeter
MMI	Milone & MacBroom, Inc.
MPH	Miles per Hour
NAI	No Adverse Impact
NCDC	National Climatic Data Center
NESIS	Northeast Snowfall Impact Scale

LIST OF ACRONYMS (Continued)

NFIA	National Flood Insurance Act
NFIP	National Flood Insurance Program
NFIRA	National Flood Insurance Reform Act
NOAA	The National Oceanic and Atmospheric Administration
OPM	Office of Policy and Management
POCD	Plan of Conservation and Development
PDM	Pre-Disaster Mitigation
RFC	Repetitive Flood Claims
RLP	Repetitive Loss Property
SFHA	Special Flood Hazard Area
SLOSH	Sea, Lake and Overland Surges from Hurricanes
SRL	Severe Repetitive Loss
SSURGO	Soil Survey Geographic
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
TAHD	Torrington Area Health District
TNC	The Nature Conservancy
USACE	The United States Army Corps of Engineers
USD	United States Dollars
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WCCOG	Western Connecticut Council of Governments

EXECUTIVE SUMMARY

The Town of New Milford has developed the subject hazard mitigation plan (HMP) along with nine other communities in western Connecticut through a grant to the Housatonic Valley Council of Elected Officials (HVCEO[1]). Although each of the ten communities developed or updated a single-jurisdiction HMP, certain components of the planning process were shared throughout the ten-town regional planning area. The primary goal of this HMP is to prevent loss of lives and reduce the damage to property, infrastructure, and important economic resources from natural disasters.

New Milford is a rural/suburban town of 28,142 (2010 US Census) that contains a densely developed mixed-use Downtown area along the Housatonic River near the intersection of Route 7, Route 67, and Route 202. The southern Route 7 corridor includes extensive commercial development and provides access to Interstate 84 in Danbury. Residential areas of moderate density are adjacent to the Downtown and commercial corridor, with generally decreasing residential densities moving towards outlying areas. The terrain is hilly and varied with rugged highlands in the northern and western portions of the town, with Candlewood Lake and the Housatonic River being the two most prominent water features in New Milford. Most of the town's total land and water area drains directly to the Housatonic River within the community, although a small portion drains east to the Shepaug River, a tributary of the Housatonic River.

The pace of development in New Milford has leveled off compared to other communities in Connecticut. The recent development trends have focused on single family homes or small subdivisions. Most of the outlying parts of the town will remain at lower residential densities, while the commercial corridor along Route 7 and in the Downtown area will continue to provide a variety of services to both New Milford residents and surrounding communities.

Like other communities in Connecticut, New Milford has been impacted by recent disasters such as the winter storms of January 2011, Tropical Storm Irene of August 2011, Winter Storm Alfred of October 2011, and Hurricane Sandy of 2012:

- The snow storms of January 2011 spurred the town to remove snow from many roofs and inspect others.
- Flooding and wind damage from Tropical Storm Irene was moderate. Surrounding communities relied on businesses in New Milford for supplies as power was not lost in the community.
- Winter Storm Alfred caused power outages of up to seven days and significant quantities of tree and tree limb debris were generated. Shelters were open for several days to accommodate overnight stays.
- Hurricane Sandy caused additional wind damage and debris generation, but the overall effects were relatively minor compared to the previous storms.

The town of New Milford remains primarily at risk to flooding. The main source of overbank flooding is the Housatonic River, with additional flooding potential occurring along the Still River and the East and West Aspetuck Rivers. The Town must regularly close sections of Route 7 due to flooding, and the Town

[1] The planning area included the City of Danbury and the Towns of Bethel, Bridgewater, Brookfield, Newtown, New Fairfield, New Milford, Redding, Ridgefield, and Sherman. Subsequent to the commencement of the planning process, HVCEO merged with the Southwestern Regional Planning Agency to form an 18-municipality regional planning organization known as Western Connecticut Council of Governments (WCCOG).

is considering performing drainage studies to mitigate backwater flooding through drainage systems that will minimize road closures. In addition, the Town's emergency operations center is located in a building that can be isolated by flooding, so the Town is looking to move the center to another facility. The Public Works Garage is also located in the floodplain and is proposed to be relocated.

New Milford is also at risk for wind damage. Several tornadoes have touched down in the community over the years, and a wind corridor exists that appears to be prone to downbursts. The Town's capabilities for dealing with wind damage are significant including a sizeable trimming budget, cleanup equipment, and regulations that require utilities to be located underground in new subdivisions. The local utility company also assists with tree and tree limb maintenance. The Town's capabilities relative to winter storms are also significant.

The Town of New Milford has identified a number of mitigation strategies to decrease risks from future floods and other hazards. The Town has identified methods of improving emergency service capabilities such as by improving emergency communications and relocating the emergency operations center. The Town also is working towards constructing a new Public Works Garage as the current facility is prone to flooding. The Town is also considering elevating certain roads in order to ensure egress is available for ambulance and wastewater personnel to their respective facilities.

A table of hazard mitigation strategies and actions is provided in Appendix A. The record of municipal adoption for this plan is provided in Appendix B. Appendix C contains a worksheet to be used by the town for annually documenting the status of potential mitigation actions. When the Town updates its hazard mitigation plan in five years[2], these mitigation strategies will be reviewed for progress and updated as needed. The remaining appendices include documentation of the planning process and other resources.

[2] HMP updates will be pursued by the Town individually or in connection with WCCOG.

1.0 INTRODUCTION

1.1 Background and Purpose

The goal of emergency management activities is to prevent loss of life and property. The four phases of emergency management include Mitigation, Preparedness, Response and Recovery. Mitigation differs from the remaining three phases in that hazard mitigation is performed with the goal to eliminate or reduce the need to respond. The term *hazard* refers to an extreme natural event that poses a risk to people, infrastructure, or resources. In the context of natural disasters, hazard mitigation is commonly defined as any sustained action that permanently reduces or eliminates long-term risk to people, property, and resources from hazards and their effects.

The primary purpose of a hazard mitigation plan (HMP) is to identify hazards and risks, existing capabilities, and activities that can be undertaken by a community or group of communities to prevent loss of life and reduce property damages associated with the identified hazards. Increased public safety and property loss reduction are the impetus behind this plan. However, careful consideration also must be given to the preservation of history, culture, and the natural environment of the region.

This HMP is prepared specifically to identify hazards in the town[3] of New Milford, Connecticut. The HMP is relevant not only in emergency management situations but also should be used within the Town's land use, environmental, and capital improvement frameworks.

The Disaster Mitigation Act of 2000 (DMA), commonly known as the 2000 Stafford Act amendments, was approved by Congress and signed into law in October 2000, creating Public Law 106-390. The purposes of the DMA are to establish a national program for pre-disaster mitigation and streamline administration of disaster relief. The DMA requires local communities to have a FEMA-approved mitigation plan in order to be eligible to apply for and receive Hazard Mitigation Assistance (HMA) grants.

The HMA "umbrella" program contains several competitive grant programs designed to mitigate the impacts of natural hazards. This HMP was developed to be consistent with the general requirements of the HMA program as well as the specific requirements of the Hazard Mitigation Grant Program (HMGP) for post-disaster mitigation activities, as well as the Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA) programs. These programs are briefly described below.

[3] In this document, the term "Town" will be used as a direct reference to the governmental institution and agencies of the Town of New Milford while the term "town" is used to denote the incorporated area within the municipal boundary.

Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster. The "5% Initiative" is a subprogram that provides the opportunity to fund mitigation actions that are consistent with the goals and objectives of the state and local mitigation plans and meet all HMGP requirements but for which it may be difficult to conduct a standard benefit-cost analysis (Section 1.5) to prove cost effectiveness. The grant to prepare the subject plan came through the HMGP program.

Pre-Disaster Mitigation (PDM) Program

The PDM Program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through PDM planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities. PDM funds should be used primarily to support mitigation activities that address natural hazards. In addition to providing a vehicle for funding, the PDM program provides an opportunity to raise risk awareness within communities.

Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to FMA:

- The definitions of repetitive loss and severe repetitive loss properties have been modified;
- Cost-share requirements have changed to allow more Federal funds for properties with repetitive flood claims and severe repetitive loss properties; and
- There is no longer a limit on in-kind contributions for the non-Federal cost share.

Effective August 15, 2013, acquisitions and elevations will be considered cost-effective if the project costs are less than $276,000 and $175,000, respectively. Structures must be located in Special Flood Hazard Areas (the area of the 1% annual chance flood). The benefit-cost analysis (BCA) will not be required.

The NFIP provides the funding for the FMA program. The PDM and FMA programs are subject to the availability of appropriation funding, as well as any program-specific directive or restriction made with respect to such funds.

One potentially important change to the PDM, HMGP, and FMA programs is that "green open space and riparian area benefits can now be included in the project benefit cost ratio (BCR) once the project BCR reaches 0.75 or greater." The inclusion of environmental benefits in the project BCR is limited to acquisition-related activities.

Table 1-1 presents potential mitigation project and planning activities allowed under each FEMA grant program described above as outlined in the most recent HMA Unified Guidance document.

Table 1-1
Eligible Mitigation Project Activities by Program

Eligible Activities	HMGP	PDM	FMA
Property Acquisition and Structure Demolition or Relocation	X	X	X
Structure Elevation	X	X	X
Mitigation Reconstruction			X
Dry Floodproofing of Historic Residential Structures	X	X	X
Dry Floodproofing of Non-residential Structures	X	X	X
Generators	X	X	
Localized Flood Reduction Projects	X	X	X
Non-Localized Flood Reduction Projects	X	X	
Structural Retrofitting of Existing Buildings	X	X	
Non-structural Retrofitting of Existing Buildings and Facilities	X	X	X
Safe Room Construction	X	X	
Wind Retrofit for One- and Two-Family Residences	X	X	
Infrastructure Retrofit	X	X	X
Soil Stabilization	X	X	X
Wildfire Mitigation	X	X	
Post-Disaster Code Enforcement	X		
Advance Assistance	X		
5% Initiative Projects	X		
Miscellaneous/Other	X	X	X

Source: Table 3 – HMA Unified Guidance document, 2015

Many of the strategies and actions developed in this plan fall within the above list of eligible activities.

1.2 Hazard Mitigation Goals

The primary goal of this HMP is to ***reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters.*** This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster.

Developing, adopting, and implementing this HMP is expected to:

- ***Increase access to and awareness of funding sources for hazard mitigation projects.*** Certain funding sources, such as the PDM, FMA, and HMGP may be available if the HMP is in place and approved.

- ***Identify mitigation initiatives to be implemented if and when funding becomes available.*** This HMP will identify a number of mitigation recommendations that can be prioritized and acted upon as funding allows.

- ***Connect hazard mitigation planning to other community planning efforts.*** This HMP can be used to provide guidance regarding development in New Milford through interdepartmental and inter-municipal coordination.

- ***Improve the mechanisms for pre- and post-disaster decision making efforts.*** This HMP emphasizes actions that can be taken now to reduce or prevent future disaster damages. If the actions identified in this HMP are implemented, damage from future hazard events can be minimized, thereby easing recovery and reducing the cost of repairs and reconstruction. Like many communities, the Town of New Milford has historically focused on hazard preparation and response rather than mitigation.

- ***Improve the ability to implement post-disaster recovery projects*** through development of a list of mitigation alternatives ready to be implemented.

Local Plan Development Process

Local governments in Connecticut are the primary decision makers for land use, utilizing land use and planning documents to make decisions along with management measures, zoning, and other regulatory tools. Development of a HMP at the community level is therefore vital if the community is to effectively address natural hazards. While communities cannot prevent disasters from occurring, they can lessen the impacts and associated damages from such disasters. Effective planning improves a community's ability to respond to natural disasters and documents local knowledge on the most efficient and effective ways to reduce losses. The benefits of effective planning include reduced social, economic, and emotional disruption; better access to funding sources for natural hazard mitigation projects; and improvement in the community's ability to implement recovery projects.

- ❑ ***Enhance and preserve natural resource systems.*** Natural resources, such as wetlands and floodplains, provide protection against disasters such as floods. Proper planning and protection of natural resources can provide hazard mitigation at substantially reduced costs.

- ❑ ***Educate residents and policy makers about hazard risk and vulnerability.*** Education is an important tool to ensure that people make informed decisions that complement the Town's ability to implement and maintain mitigation strategies.

- ❑ ***Complement future Community Rating System efforts.*** Implementation of certain mitigation measures may increase a community's rating with the NFIP and thus the benefits that it derives from FEMA. The Town of New Milford does not participate in the Community Rating System (CRS).

1.3 Identification of Hazards and Document Overview

As stated in Section 1.1, the term *hazard* refers to an extreme natural event that poses a risk to people, infrastructure, or resources. Based on a review of the *2014 Connecticut Natural Hazards Mitigation Plan* and correspondence with local officials, the following have been identified as hazards that can potentially affect the town of New Milford:

- ❑ Flooding;
- ❑ Hurricanes and Tropical Storms;
- ❑ Summer Storms (including lightning, hail, and heavy winds) and Tornadoes;
- ❑ Winter Storms;
- ❑ Earthquakes;
- ❑ Dam Failure; and
- ❑ Wildfires.

The only hazard given attention in the 2014 Connecticut Hazard Mitigation Plan Update but not addressed in the New Milford Hazard Mitigation Plan is drought. However, this is the lowest-ranked hazard of those discussed in the state's plan, with a "low" composite risk score for Litchfield County. In addition, the statewide and countywide annual estimated loss (AEL) for this hazard is $0 in the state plan. Thus, its inclusion was considered unnecessary.

This document has been prepared with the understanding that a single *hazard effect* may be caused by multiple *hazard events*. For example, flooding may occur as a result of frequent heavy rains, a hurricane, or a winter storm. Thus, Tables 1-2, 1-3, and 1-4 on the following pages provide summaries of the hazard events and hazard effects that impact the town of New Milford and include criteria for characterizing the locations impacted by the hazard, the frequency of occurrence of the hazards, and the magnitude or severity of the hazards.

Notwithstanding their causes, the effects of several hazards are persistent and demand high expenditures from the Town. In order to better identify current vulnerabilities and potential mitigation strategies, each hazard has been individually discussed in a separate chapter.

This document begins with a discussion of the planning process followed by a general discussion of New Milford's community profile, including the physical setting, demographics, development trends, governmental structure, and sheltering capacity. Next, each chapter of this HMP that is dedicated to a particular hazard type is broken down into six or seven different parts. These are *Setting*; *Hazard Assessment*; *Historic Record*; *Existing Programs, Policies, and Mitigation Measures*; *Vulnerabilities and Risk Assessment*; and *Potential Mitigation Measures, Strategies,* *and Alternatives*, and *Summary of Recommended Strategies and Actions.* These are described below.

Table 1-2
Effects of Natural Hazards

Effects	**Natural Hazard**					
	Hurricanes and Tropical Storms	**Summer Storms and Tornadoes**	**Winter Storms**	**Wildfires**	**Earthquakes**	**Dam Failure**
Flooding	X	X				X
Flooding from Poor Drainage	X	X				
Wind	X	X	X			
Falling Trees/Branches	X	X	X			
Lightning	X	X				
Hail		X				
Snow			X			
Blizzard			X			
Ice			X			
Fire/Heat				X		
Smoke				X		
Shaking					X	
Dam Failure					X	X
Power Failure	X	X	X	X	X	

Table 1-3
Hazard Event Ranking

Natural Hazards	Location 1 = small 2 = medium 3 = large	Frequency of Occurrence 0 = unlikely 1 = possible 2 = likely 3 = highly likely	Magnitude/ Severity 1 = limited 2 = significant 3 = critical 4 = catastrophic	Rank
Winter Storms	3	3	2	8
Hurricanes	3	1	3	7
Summer Storms and Tornadoes	2	3	2	7
Earthquakes	3	0	2	5
Wildfires	1	1	1	3

- ❑ Each hazard may have multiple effects; for example, a hurricane causes high winds and flooding.
- ❑ Some hazards may have similar effects; for example, hurricanes and earthquakes may cause dam failure.
- ❑ Frequency of Occurrence, Magnitude / Severity, and Potential Damages based on historical data from NOAA National Climatic Data Center.

Location
1 = small: isolated to specific area during one event
2 = medium: multiple areas during one event
3 = large: significant portion of the town during one event

Frequency of Occurrence
0 = unlikely: less than 1% probability in the next 100 years
1 = possible: between 1 and 10% probability in the next year; or at least one chance in next 100 years
2 = likely: between 10 and 100% probability in the next year; or at least one chance in next 10 years
3 = highly likely: near 100% probability in the next year

Magnitude/Severity
1 = limited: injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%
2 = significant: injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
3 = critical: injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
4 = catastrophic: multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

Table 1-4
Hazard Effect Ranking

Natural Hazard Effects	Location	Frequency of Occurrence	Magnitude/ Severity	Rank
	1 = small 2 = medium 3 = large	0 = unlikely 1 = possible 2 = likely 3 = highly likely	1 = limited 2 = significant 3 = critical 4 = catastrophic	
Snow	3	3	2	8
Blizzard	3	2	2	7
Hurricane Winds	3	1	3	7
Nor'easter Winds	3	2	2	7
Riverine & Floodplain Flooding	3	2	2	7
Falling Trees/Branches	3	2	1	6
Flooding from Dam Failure	1	1	4	6
Flooding from Poor Drainage	2	3	1	6
Ice	2	2	2	6
Thunderstorm and Tornado Winds	2	2	2	6
Lightning	1	3	1	5
Shaking	3	0	2	5
Hail	1	2	1	4
Fire/Heat	1	2	1	4
Smoke	1	2	1	4

- ❑ Some effects may have a common cause; for example, a hurricane causes high winds and flooding.
- ❑ Some effects may have similar causes; for example, hurricanes and nor'easters both cause heavy winds.
- ❑ Frequency of occurrence, magnitude / severity, and potential damages based on historical data from NOAA National Climatic Data Center.

Location
1 = small: isolated to specific area during one event
2 = medium: multiple areas during one event
3 = large: significant portion of the town during one event

Frequency of Occurrence
0 = unlikely: less than 1% probability in the next 100 years
1 = possible: between 1 and 10% probability in the next year; or at least one chance in next 100 years
2 = likely: between 10 and 100% probability in the next year; or at least one chance in next 10 years
3 = highly likely: near 100% probability in the next year

Magnitude/Severity
1 = limited: injuries and/or illnesses are treatable with first aid; minor "quality of life" loss; shutdown of critical facilities and services for 24 hours or less; property severely damaged < 10%
2 = significant: injuries and/or illnesses do not result in permanent disability; shutdown of several critical facilities for more than one week; property severely damaged <25% and >10%
3 = critical: injuries and/or illnesses result in permanent disability; complete shutdown of critical facilities for at least two weeks; property severely damaged <50% and >25%
4 = catastrophic: multiple deaths; complete shutdown of facilities for 30 days or more; property severely damaged >50%

- ***Setting*** addresses the general areas that are at risk from the hazard.

- ***Hazard Assessment*** describes the specifics of a given hazard, including general characteristics and associated effects. Also defined are associated return intervals, probability and risk, and relative magnitude.

- ***Historic Record*** is a discussion of past occurrences of the hazard and associated damages when available.

- ***Existing Capabilities*** gives an overview of the measures that the Town is currently undertaking to mitigate the given hazard.

- ***Vulnerabilities and Risk Assessment*** focuses on the specific areas of the community at risk to the hazard. Specific land uses in the given areas are identified. Critical buildings and infrastructure that would be affected by the hazard are identified.

- ***Potential Mitigation Strategies and Actions*** identifies typical mitigation alternatives, including those that may not be cost-effective or are inappropriate for New Milford.

- ***Summary of Recommended Strategies and Actions*** lists the recommended courses of action for New Milford, which are included in the STAPLEE ranking method described below.

This document concludes with a strategy for implementation of the HMP, including a schedule, a program for monitoring and updating the HMP, and a discussion of technical and financial resources.

1.4 Discussion of STAPLEE Ranking Method

To prioritize recommended mitigation measures, it is necessary to determine how effective each measure will be in reducing or preventing damage. A set of criteria commonly used by public administration officials and planners was applied to each proposed strategy. The method, called STAPLEE, is outlined in FEMA planning documents such as *Developing the Mitigation Plan* (FEMA 386-3) and *Using Benefit-Cost Review in Mitigation Planning* (FEMA 386-5). STAPLEE stands for the "Social, Technical, Administrative, Political, Legal, Economic, and Environmental" criteria for making planning decisions.

Benefit-cost review was emphasized in the prioritization process. Criteria were divided into potential benefits (pros) and potential costs (cons) for each mitigation strategy. The following questions were asked about the proposed mitigation strategies:

- **Social**:

  - Benefits: Is the proposed strategy socially acceptable to the jurisdiction?
  - Costs: Are there any equity issues involved that would mean that one segment of New Milford could be treated unfairly? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower-income people? Is the action compatible with present and future community values?

- **Technical**:

  - Benefits: Will the proposed strategy work? Will it reduce losses in the long term with minimal secondary impacts?
  - Costs: Is the action technically feasible? Will it create more problems than it will solve? Does it solve the problem or only a symptom?

- **Administrative**:

  - Benefits: Does the project make it easier for the community to administrate future mitigation or emergency response actions?
  - Costs: Does the Town of Bethel have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? Can the Town of Bethel perform the necessary maintenance? Can the project be accomplished in a timely manner?

- **Political**:

  - Benefits: Is the strategy politically beneficial? Is there public support both to implement and maintain the project? Is there a local champion willing to see the project to completion? Can the mitigation objectives be accomplished at the lowest cost to the community (grants, etc.)?
  - Costs: Have political leaders participated in the planning process? Do project stakeholders support the project enough to ensure success? Have the stakeholders been offered the opportunity to participate in the planning process?

- **Legal**:

  - Benefits: Is there a technical, scientific, or legal basis for the mitigation action? Are the proper laws, ordinances, and resolutions in place to implement the action?
  - Costs: Does the Town of Bethel have the authority to implement the proposed action? Are there any potential legal consequences? Will the community be liable for the actions or support of actions, or for lack of action? Is the action likely to be challenged by stakeholders who may be negatively affected?

- **Economic**:

  - Benefits: Are there currently sources of funds that can be used to implement the action? What benefits will the action provide? Does the action contribute to community goals, such as capital improvements or economic development?
  - Costs: Does the cost seem reasonable for the size of the problem and the likely benefits? What burden will be placed on the tax base or local economy to implement this action? What proposed actions should be considered but be tabled for implementation until outside sources of funding are available?

- **Environmental**:

  - Benefits: Will this action beneficially affect the environment (land, water, endangered species)?

- Costs: Will this action comply with local, state, and federal environmental laws and regulations? Is the action consistent with community environmental goals?

Each proposed mitigation strategy presented in this plan was evaluated and quantitatively assigned a "benefit" score and a "cost" score for each of the seven STAPLEE criteria, as outlined below:

- ❑ For potential benefits, a score of "1" was assigned if the project will have a beneficial effect for that particular criterion; a score of “0.5” was assigned if there would be a slightly beneficial effect; or a "0" was assigned if the project would have a negligible effect or if the questions were not applicable to the strategy.
- ❑ For potential costs, a score of "-1" was assigned if the project would have an unfavorable impact for that particular criterion; a score of “-0.5” was assigned if there would be a slightly unfavorable impact; or a "0" was assigned if the project would have a negligible impact or if the questions were not applicable to the strategy.
- ❑ Technical and Economic criteria were double weighted (multiplied by two) in the final sum of scores.
- ❑ The total benefit score and cost score for each mitigation strategy was summed to determine each strategy's final STAPLEE score. The highest possible score is 9.0, while the lowest possible score is -9.0.

An evaluation matrix with the total scores from each strategy can be found in Appendix A. Strategies are prioritized according to final score in Section 10. The highest scoring is determined to be of more importance economically, socially, environmentally, and politically and, hence, is prioritized over those with lower scoring.

The highest-ranking proposed structural projects were additionally evaluated through qualitative methods. The results of the qualitative assessments are included in Appendix A. See Section 10.3 for details.

1.5 Discussion of Benefit-Cost Ratio

Although a community may implement recommendations as prioritized by the STAPLEE method, an additional consideration is important for those recommendations that may be funded under the FEMA mitigation grant programs. To receive federal funding, the majority of mitigation actions must have a benefit-cost ratio (BCR) that exceeds a value of 1.0; namely, that the benefits of the project outweigh its costs. Calculation of the BCR is conducted using FEMA's Benefit Cost Analysis (BCA) toolkit. The calculation method may be complex and vary with the mitigation action of interest. Calculations are dependent on detailed information such as property value appraisals, design and construction costs for structural projects, and tabulations of previous damages or NFIP claims.

Although it is beyond the scope of this Plan to develop precise BCRs for each recommendation, the likelihood of receiving funding is estimated for each recommendation as presented in Appendix A. When pursuing grants for selected projects, this information can be used to help select the projects that have the greatest chance of successfully navigating through the application review process.

Calculation of cost estimates for recommendations is not appropriate for a HMP, as this information can be misleading or inaccurate in several years and lead to problems when municipal personnel receive cost estimates from contractors. Potential costs of each recommendation is therefore based on an order of magnitude and listed as “minimal”, “low”, “intermediate”, or “high” on the STAPLEE matrix. These identifiers are defined as follows:

- “Minimal” costs only include printing, copying, or meetings of personnel. Direct expenditures are expected to be less than $1,000 (staff time is not included).
- “Low” costs can typically be handled by existing personnel with few outside expenses. These projects typically cost less than $10,000.
- “Intermediate” costs would require less than $100,000 to implement and may include studies, investigations, or small improvement projects. Such projects often require the use of outside consultants.
- “High” costs would require greater expenditures and may require grant funding to successfully complete the project. Such projects typically include capital expenditures for construction or infrastructure along with associated permitting and engineering costs.

1.6 Documentation of the Planning Process

When the planning process commenced, the Town of New Milford was a member of the Housatonic Valley Council of Elected Officials (HVCEO), the regional planning body responsible for New Milford and nine other member municipalities: Bethel, Brookfield, Bridgewater, Danbury, New Fairfield, Newtown, Redding, Ridgefield, and Sherman. Three municipalities in the region (Danbury, New Fairfield, and Sherman) previously developed HMPs. The remaining seven municipalities, including New Milford, began the planning process in 2013 to develop single-jurisdiction plans. The Town of New Milford became part of the Western Connecticut Council of Governments (WCCOG), an 18-municipality regional planning organization in fall 2014.

Ms. Marla Scribner, Emergency Management Director and Mr. Michael Zarba, P.E., Director of Public Works coordinated the development of this HMP. The adoption of this HMP in the Town of New Milford will be coordinated by Town personnel.

Milone & MacBroom, Inc. (MMI) prepared the subject HMP. The following individuals from the Town provided information, data, studies, reports, and observations and were involved in the development of the HMP:

- Patricia Murphy, Mayor
- Marla Scribner, Emergency Management Director
- Michael Zarba, P.E., Director of Public Works
- James Rotondo, P.E., Town Engineer
- James Ferlow, Inland Wetlands Enforcement Officer & Fire Chief, Water Witch Hose Company #2
- Shawn Boyne, Chief of Police
- Mark Buckley, Deputy Chief of Police
- Laurene Beattie, Public Works

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the town, as well as to identify areas that should be prioritized for hazard mitigation. Appendix D contains copies of meeting minutes, field notes and observations, the public information meeting presentation, and other records that document the development of this HMP. The following is a list of meetings that were held as well as other efforts to develop this plan:

- ***A project kickoff meeting was held January 15, 2014.*** Necessary documentation was collected, and problem areas within the town were discussed.

- ***A public information meeting was held on May 14, 2014.*** Preliminary findings were presented and public comments solicited. A notice of the meeting was posted on the Town's website in April 2014 and in The Greater New Milford Spectrum on May 2, 2014. No members of the public attended.

- ***Outreach to neighboring communities was conducted on July 8, 2014.*** For adjacent communities that <u>are not</u> part of the former HVCEO, letters were mailed to these adjacent communities to invite them to participate in the planning process for this hazard mitigation plan. A copy of the letter is included in Appendix D. To date, none of the surrounding communities have responded or accepted the invitation to participate.

- ***The Draft HMP was reviewed by the Town between July 2014 and May 2015.*** Town staff reviewed the HMP, discussed components with appropriate departments and provided detailed comments to improve the HMP.

- ***The Plan was reviewed by the Connecticut DEMHS in July 2015.***

Residents, business owners, and other stakeholders of New Milford, neighboring communities, and local and regional entities were invited to the public information meeting via the local newspaper and via the home page of the Town's website. Copies of these announcements are included in Appendix D. To date, members of the public have not provided input to the plan, and therefore public commentary has been addressed in this document.

Opportunities for the public to review the Plan were implemented in advance of the public hearing to adopt this plan following "approval pending adoption" from FEMA. The draft HMP that was sent for FEMA review will be posted on the Town website (http://www.newmilford.org) and the WCCOG website (www.westcog.org) to provide opportunities for public review and comment. Comments will be incorporated into the final draft where applicable. The public and interested parties will be notified of the opportunity to review the HMP via the websites.

1.7 <u>Coordination with Neighboring Communities</u>

The Town of New Milford has coordinated with neighboring municipalities in the past relative to hazard mitigation and emergency preparedness and will continue to do so. New Milford is bordered by the municipalities of Kent to the north, Washington and Roxbury to the east, Bridgewater and Brookfield to the south, and New Fairfield and Sherman to the west. The municipalities of New Fairfield and Sherman have current HMPs, while the remaining neighboring communities are concurrently developing their initial HMPs.

Adjacent communities were given ample opportunity to review and comment on this HMP:

- First, staff from Bridgewater and Brookfield were invited to comment on potential shared projects and inter-community issues during the data collection meetings for each community's respective plan. Staff from New Fairfield and Sherman were also given this opportunity during their planning processes in 2011.

- Second, staff from Kent, Washington, and Roxbury were invited to comment on potential shared projects and inter-community issues during the data collection meetings for each community's respective plan. These data collection meetings were conducted by MMI under contract to the former Northwest Connecticut Council of Governments.

- Third, a letter was mailed to the hazard mitigation planning contacts for all 12 local jurisdictions surrounding the HVCEO planning region. Representatives from Putnam County (NY), Westchester County (NY), the Northwest Hills Council of Governments (CT), Greater Bridgeport Regional Council (CT), and Council of Governments Central Naugatuck Valley (CT) were copied on this correspondence.

- Fourth, HVCEO/WCCOG communities (in this case, Bridgewater, Brookfield, New Fairfield, and Sherman) were given the opportunity to directly discuss hazards that may span municipal boundaries and collaborate on potential projects that may benefit multiple communities.

The City of Danbury and the Town of Brookfield are the HVCEO/WCCOG communities most suited to work with New Milford toward flood hazard mitigation because the floodprone Still River flows through all three communities. Coordination with the Still River Alliance, a watershed non-profit group, could also result in flood mitigation projects. The Town of New Milford also participates in the Housatonic River Commission with upstream river communities.

The Candlewood Lake Authority (CLA) is an organization consisting of appointed officials from the five lake municipalities; Brookfield, Danbury, New Fairfield, New Milford and Sherman. The CLA is charged with managing recreation, public safety, and specific environmental initiatives regarding the lake. The Executive Director of the Authority, Mr. Larry Marsicano, was contacted to provide an opportunity for the Authority to participate in the planning process. Because local officials from each community were already involved with the planning process, some redundancy exists as any concerns related to the lake have already been raised during the project meetings. Mr. Marsicano recommended that First Light Power Resources, the owner of Candlewood Lake, be contacted regarding management of the dams and dikes that impound the lake. Refer to Section 8.0 for a review of the Emergency Action Plan for the Candlewood Lake dams and dikes.

2.0 COMMUNITY PROFILE

2.1 Physical Setting

Settled in 1707 and incorporated in 1712, the Town of New Milford is located in southwestern Litchfield County and home to a population of 28,142 (2010 U.S. Census). New Milford is bordered by the municipalities of Kent to the north, Washington and Roxbury to the east, Bridgewater and Brookfield to the south, and New Fairfield and Sherman to the west. The town is the northernmost community in the WCCOG region. Refer to Figure 2-1 and Figure 2-2 for maps showing the location of New Milford in comparison to the state and current planning region. The varying terrain and land uses in New Milford makes the town vulnerable to an array of natural hazards.

2.2 Existing Land Use

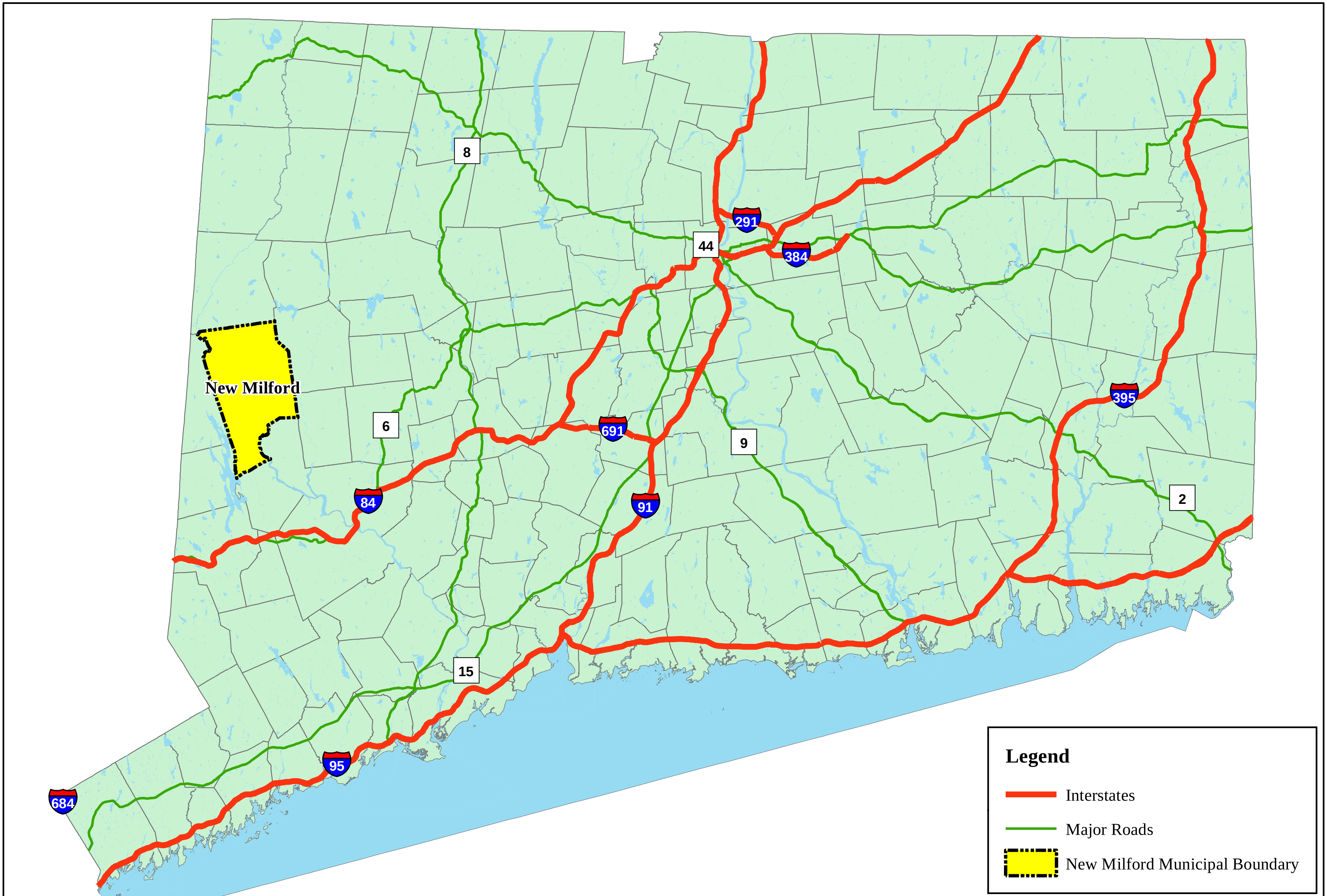
The area of New Milford is approximately 63.9 square miles, making New Milford the largest municipality in the state in terms of area. New Milford is considered a suburb of the City of Danbury, with significant residential zoning and a significant commercial and industrial corridor along Route 7 and Route 202. The most concentrated development is near the Downtown area in the vicinity of the intersection of Route 202 and Route 67. Outlying areas contain a mix of single family residential, protected and unprotected open space, and vacant (developable) lands. Access to major highways is provided via Route 7 / Route 202 south into Brookfield, where the limited-access “Super 7” provides a connection to Interstate 84 in Danbury. State parks in New Milford include the Lovers Leap State Park and Scenic Reserve at the upstream end of Lake Lillinonah. Other protected lands in New Milford include the many Town parks and the Mine Hill Preserve on the eastern end of town owned by the Roxbury Land Trust.

Table 2-1 summarizes 2006 land cover data which was derived from satellite imagery. Areas shown as turf and grass are maintained grasses such as residential and commercial lawns or golf courses. According to these data, approximately 58% of New Milford is forested and approximately 15% is developed.

According to the 2010 New Milford *Plan of Conservation and Development* (POCD), approximately 60% of the land in New Milford is either developed for a specific use (residential, commercial, industrial, municipal, or institutional) or committed to a specific use such as recreation, roads, or open space. The remaining 40% of the land in New Milford is considered to be vacant, meaning that it may be developed. Approximately 9,800 acres are committed to residential use (24% of the total land area). Open space, including state forest lands, municipal recreation areas, and land trust lands, occupy approximately 24% of the town’s land area.

The vast majority of the town is zoned as residential, with the highest density zones including a combination of residential, commercial, and industrial zoning and land uses near the Downtown area. New Milford has 12 residential zones, seven commercial and industrial zones, and four specialty zones (airport, village center, junkyard, and landmark).

> ***From the 2010 New Milford POCD:***
>
> **The vast majority (85%) of New Milford’s land is zoned residential. The seven business zones (commercial and industrial) comprise a total of 8% of the town. The remaining areas are either specialty zones or not zoned.**



SOURCE:
CT DEEP

N

Figure 2-1: Location Map of New Milford

Town of New Milford
Hazard Mitigation Plan

LOCATION:
New Milford, CT

Map By: CPS
MMI#: 3101-14
MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Figure 2-1 Locati
Date: 01/14/2014
Scale: 1 in = 11 miles

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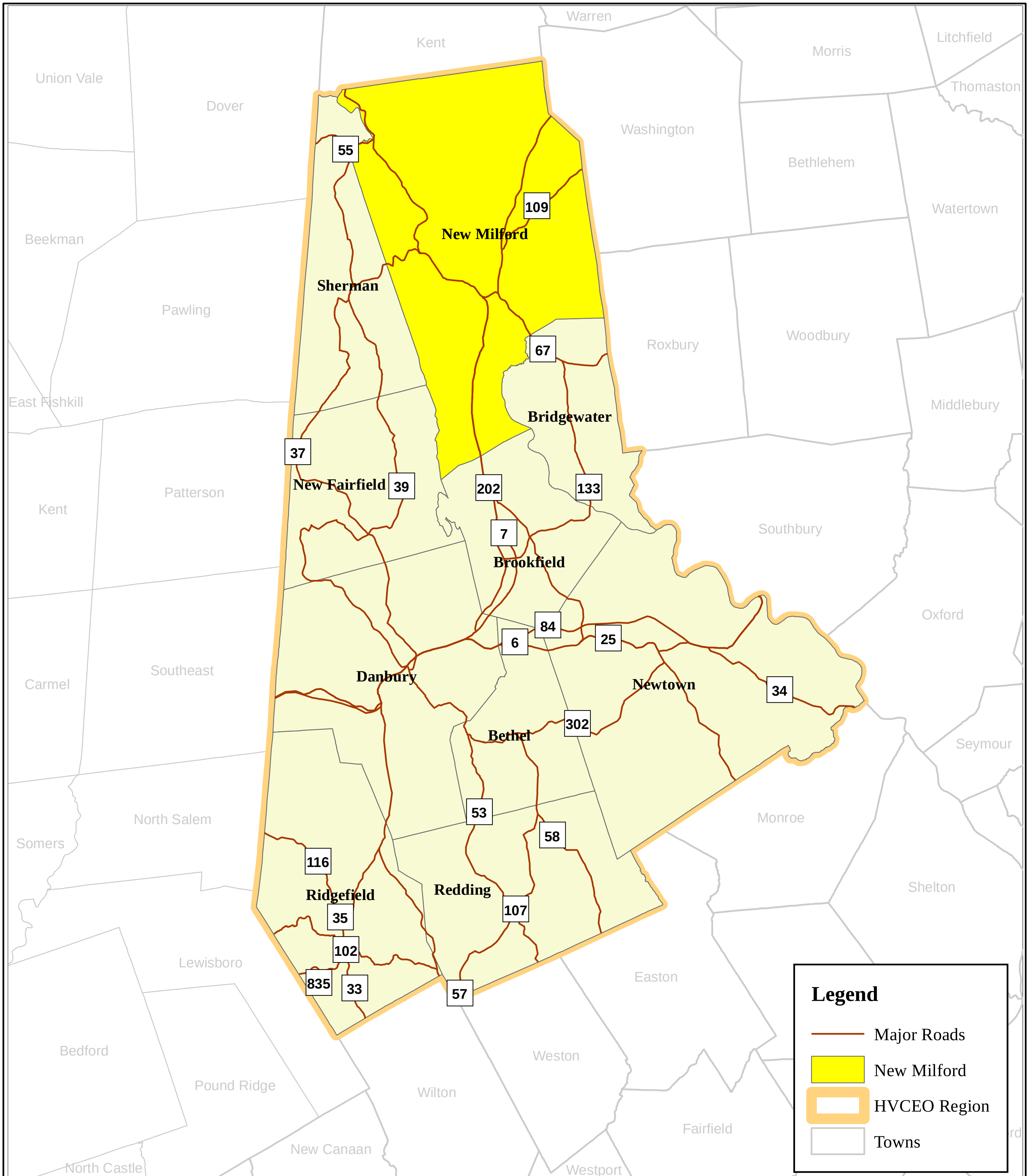

SOURCE(S):
CT DEEP

Figure 2-2: New Milford in the HVCEO Planning Region

LOCATION:
New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 2-2- New Milford COG.mxd

Map By: JDW
MMI#: 3101-14
Original: 3/27/2014
Revision: 6/22/2015
Scale: 1 inch = 4 miles

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Table 2-1
2006 Land Cover by Area

Land Cover	Area (acres)	Percent of Community
Deciduous Forest	19,887	48.6%
Developed	5,896	14.4%
Agricultural Field	3,815	9.3%
Turf & Grass	3,789	9.3%
Coniferous Forest	3,242	7.9%
Water	1,756	4.3%
Other Grasses	955	2.3%
Forested Wetland	615	1.5%
Barren	552	1.4%
Utility (Forest)	241	0.6%
Non-forested Wetland	134	0.3%
Tidal Wetland	0	0.0%
Total	**40,882**	**100%**

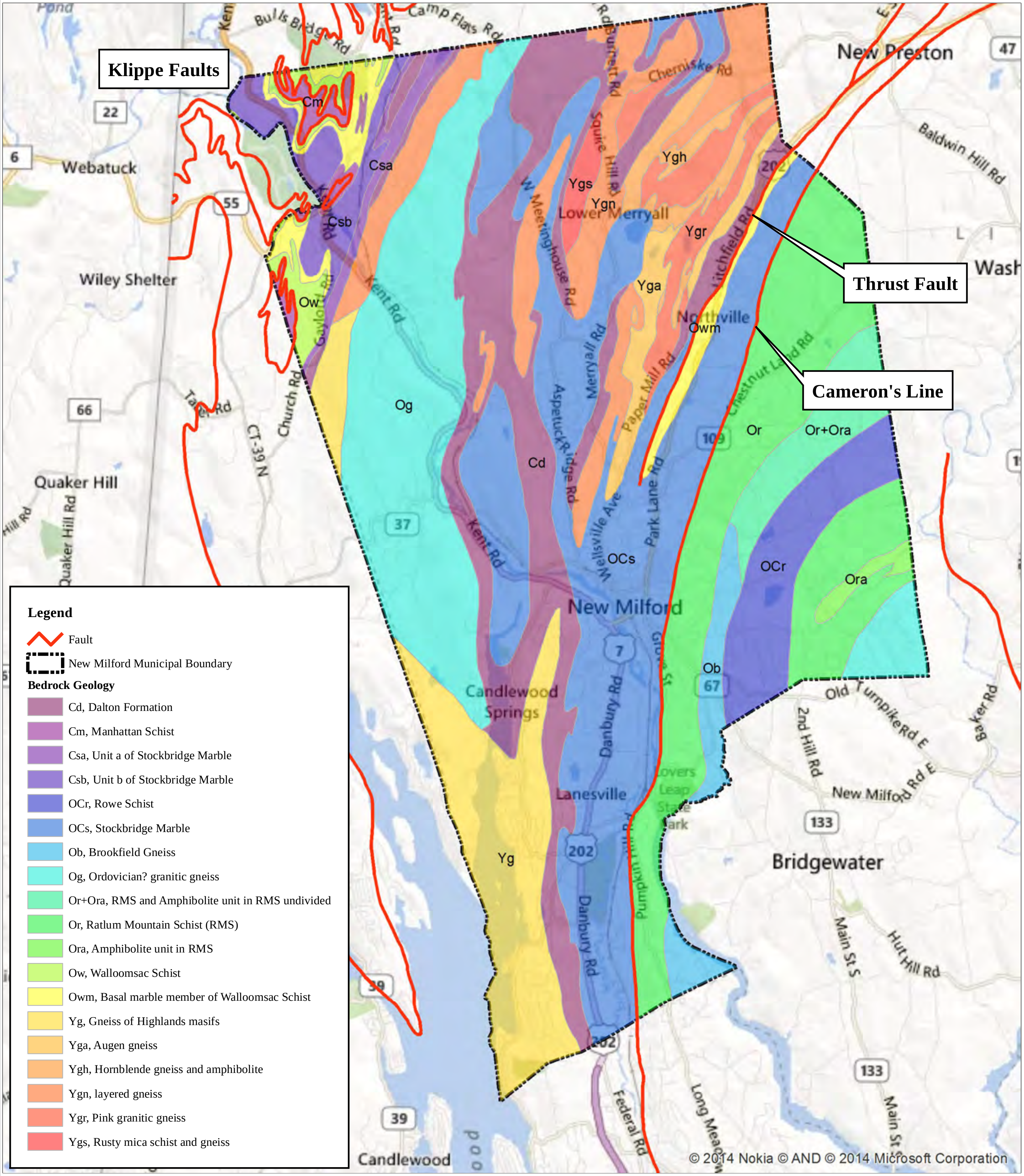
Source: UCONN Center for Land Use Education and Research (CLEAR)

2.3 Geology

Geology is important to the occurrence and relative effects of natural hazards such as floods and earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in New Milford. Geologic information discussed in the following section was acquired in GIS format from the United States Geological Survey and the Connecticut DEEP.

> ***Stratified Glacial Meltwater Deposits***
>
> **The amount of stratified glacial meltwater deposits present in a community is important as areas of stratified materials are generally coincident with inland floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present day streams and rivers. Oftentimes these deposits are associated with public water supply aquifers or with wetland areas that provide significant floodplain storage. However, the smaller glacial till watercourses throughout New Milford can also cause flooding.**
>
> **The amount of stratified drift also has bearing on the relative intensity of earthquakes.**

New Milford is underlain by relatively hard metamorphic bedrock including a variety of gneiss, schist, and marble (Figure 2-3). The bedrock formations trend generally southwest to northeast across the town. An overturned thrust fault from the Ordovician period known as Cameron's Line divides the marble formation from the schist and gneiss formations in the southern and eastern portions of New Milford. Additional fault lines of undetermined origin are mapped striking southwest to northeast in northeastern New Milford, and several klippe (or outlier) faults are located in northwestern New Milford where erosion has worn away bedrock that formerly connected the bounded formations to similar nearby bedrock formations.



SOURCE(S):
"Base" Microsoft
"Bedrock Geology" CT DEEP
"Town Boundary" CT DEEP

Figure 2-3: Bedrock Geology

LOCATION:

New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 2-3 New Milford Bedrock Geology.mxd

Map By: scottb
MMI#: 3101-14
Original: 02/6/2014
Revision: 7/8/2014
Scale: 1 in = 8,000 ft

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Continental ice sheets moved across Connecticut at least twice in the late Pleistocene era. As a result, New Milford's surficial geology is characteristic of the depositional environments that occurred during glacial and postglacial periods. Refer to Figure 2-4 for a depiction of surficial geology.

New Milford is covered primarily by glacial till. Glacial till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. The deposits are generally less than 50 feet thick, although deeper deposits of till are scattered across the hillier sections of New Milford. Stratified glaciofluvial deposits are generally coincident with stream corridors in the community. In some areas, such as along the Route 7 / Route 202 corridor from the Downtown area to the Brookfield boundary, stratified glaciofluvial deposits are greater than 50 feet thick, with the deepest deposits being located near Downtown (more than 100 feet thick).

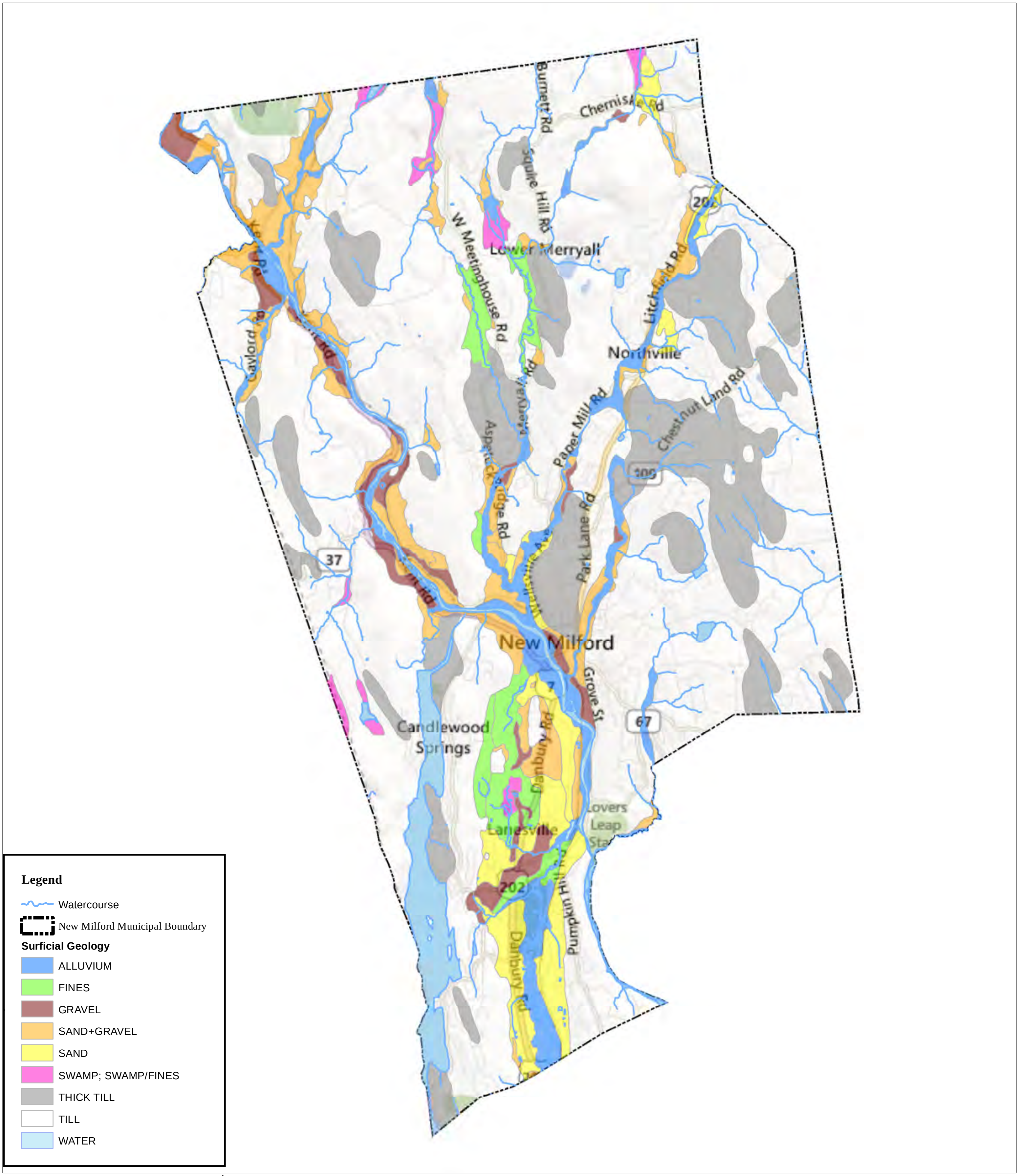
The type of soil present affects the ability of precipitation to infiltrate the ground, which in turn affects the timing and magnitude of flooding. According to the United States Department of Agriculture (USDA), 67.2% of the soils in New Milford are considered to be well-drained, 8.9% are considered to be somewhat excessively drained, and 5.7% are considered to be excessively drained. Poorly drained and very poorly drained soils comprise 6.1% and 2.5% of the soils, respectively. Moderately well drained soils (9.1%) and undefined drainage characteristics (due to being mapped as water, dumps, or urban areas) at 0.5% comprise the remainder of the soils in New Milford. As such, nearly 90% of mapped soil areas in New Milford promote infiltration. This percentage is reduced due to the presence of impervious surfaces that restrict or prevent infiltration.

2.4 Current Climate Conditions and Climate Change

The town of New Milford has an agreeable climate characterized by moderate but distinct seasons. The mean annual temperature is 49.7 degrees Fahrenheit based on temperature data compiled by the National Climatic Data Center (NCDC) from 1971-2000. Summer high temperatures typically rise in the mid-80s and winter temperatures typically dip into the mid-teens as measured in Fahrenheit. Extreme conditions raise summer temperatures to near 100 degrees and winter temperatures to below zero. Mean snowfall is 38 inches per year. Mean annual precipitation is 51.8 inches, with at least four inches of precipitation occurring in most months.

By comparison, average annual statewide precipitation based on more than 100 years of record is less at 45 inches. Average annual precipitation in Connecticut has been increasing by 0.95 inches per decade since the end of the 19th century (Miller et. al., 1997; NCDC, 2005). Likewise, annual precipitation in New Milford has increased over time.

Like many communities in the United States, New Milford experienced a population boom following World War II. This population increase led to concurrent increases in impervious surfaces and the amount of drainage infrastructure. Many post-war storm drainage systems and culverts were likely designed using rainfall data published in "Technical Paper No. 40" by the U.S. Weather Bureau (now the National Weather Service) (Hershfield, 1961). The rainfall data in this document dates from the years 1938 through 1958. These values are the standard used in the current *Connecticut DOT Drainage Manual* (2000) and have been the engineering standard in Connecticut for many years.



SOURCE(S):
"Base" Microsoft
"Surficial Geology" CT DEEP
"Watercourse" CT DEEP

Figure 2-4: Surficial Geology

LOCATION:

New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 2-4 New Milford Surficial Geology.mxd

Map By: scottb
MMI#: 3101-14
Original: 02/6/2014
Revision: 7/8/2014
Scale: 1 in = 8,000 ft

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This engineering standard was based on the premise that extreme rainfall series do not change through time such that the older analyses reflect current conditions. Recent regional and state-specific analyses have shown that this is not the case as the frequency of two-inch rainfall events has increased and storms once considered to have a 1% chance to occur each year are now likely to occur twice as often. As such, the Northeast Regional Climate Center (NRCC) has partnered with the Natural Resources Conservation Service (NRCS) to provide a consistent, current regional analysis of rainfall extremes for engineering design (http://precip.eas.cornell.edu/). The availability of updated data has numerous implications for hazard mitigation as will be discussed in Section 3.0.

The continued increase in precipitation only heightens the need for hazard mitigation planning as the occurrence of floods may change in accordance with the greater precipitation.

2.5 Drainage Basins and Hydrology

New Milford is located in the central portion of the Housatonic River valley. The topography of New Milford is characterized by higher elevations that gently to steeply slope into tributaries of the Housatonic River. Peaks in the northern and eastern sections of New Milford rise well above 1,000 feet above sea level, while peaks in the southern section of New Milford rise to 700 to 800 feet. Much of the Downtown area is located below 400 feet in elevation.

New Milford is divided among nine sub-regional watersheds as shown on Figure 2-5. The associated watercourses are summarized below and described in the following sections. All of the water that passes through New Milford eventually drains to the Housatonic River and empties into Long Island Sound.

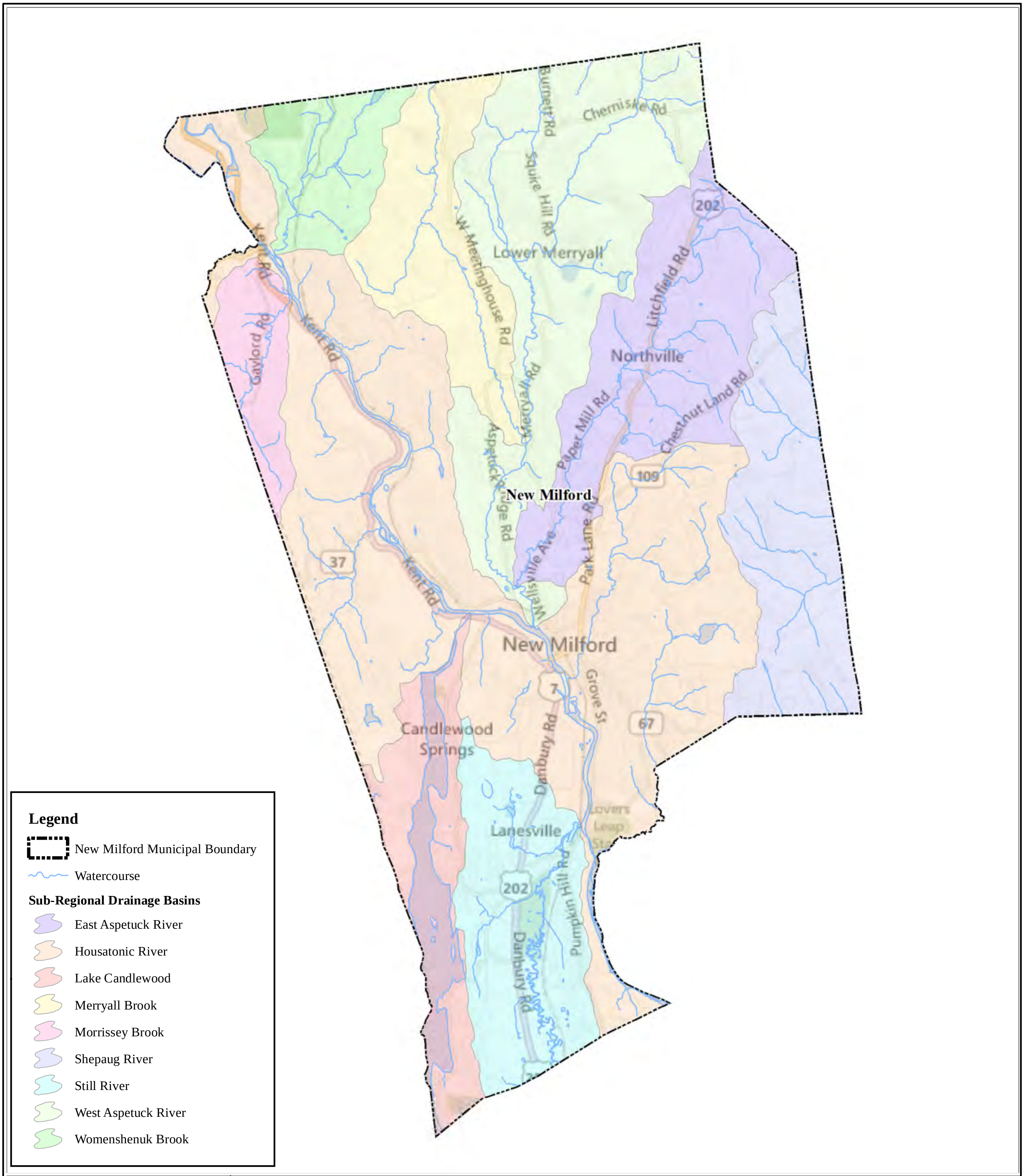
- The lower reaches of Womenshenuk Brook, Morrissey Brook, Candlewood Lake, the West Aspetuck River, and the Still River each lie within New Milford and empty into the Housatonic River. The Housatonic River is impounded at Lake Lillinonah. Conditions on these tributary streams typically only exacerbate flooding in New Milford, although backwater conditions on the Still River can exacerbate flooding upstream in Brookfield, Danbury, and Bethel.

- The lower reaches of Merryall Brook and the East Aspetuck River drain into the lower reach of the West Aspetuck River just north of Downtown.

- The headwaters of small tributary streams to the Shepaug River drain east from New Milford into Washington and Roxbury. As such, conditions on these tributary streams can potentially impact downstream communities.

Candlewood Lake

The Candlewood Lake watershed covers a total area of 4.04 square miles in New Milford. Candlewood Lake is the country's first pump-storage reservoir and at 5,400 acres is the largest lake in Connecticut. The reservoir was constructed to support power generation at the Rocky River power station on Route 7 in New Milford. Since 1926, water has been diverted from the Housatonic River and pumped uphill into the Lake. During low-flow conditions on the Housatonic River, water is released from Lake Candlewood to run the generation turbines and discharged back to the Housatonic River.



SOURCE(S):
CT DEEP

Figure 2-5: Sub-Regional Drainage Basins

LOCATION:
New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 2-5 New Milford Sub-Regional Drainage Basins.mxd

Map By: scottb
MMI#: 3101-14
Original: 02/6/2014
Revision: 7/8/2014
Scale: 1 in = 8,000 ft

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The Lake Candlewood watershed comprises 6.3% of the town's land area. There is a delineated 1% annual chance floodplain surrounding the lake without elevations defined. Larger tributaries to the lake include Sawmill Brook and Glen Brook in Sherman and Ball Pond Brook in New Fairfield. The lake is impounded once in Danbury and in four separate areas in New Milford:

- By the Lake Candlewood Dam (Class C) in the Hayestown section of Danbury off the southern end of the lake;
- By Candlewood Lake Dam #2 (Class B) off Candlewood Lake Road South on the eastern side of the lake;
- By the Middle Lanesville Dam (Class C) upstream of Sullivan Farm;
- By the North Lanesville Dam (Class C) upstream of Sherry Lane; and
- By the Candlewood Lake North Dam upstream of Route 7. This dam includes infrastructure to provide flow to the Rocky River power station.

In total, Candlewood Lake drains a total area of 42.19 square miles in Brookfield, Danbury, New Fairfield, New Milford, Sherman, and portions of New York State.

East Aspetuck River

The East Aspetuck River watershed is the third-largest watershed in New Milford, covering a total area of 7.05 square miles. The river has its headwaters in the New Preston area of northwestern Washington as the outflow from Lake Waramaug. The river flows generally southwest into New Milford parallel to Route 202 and is conveyed beneath several minor roads, Route 202, Paper Mill Road, and Wellsville Avenue prior to reaching the confluence with the West Aspetuck River downstream of Wells Road. The East Aspetuck River drains a total area of 25.26 square miles in Kent, New Milford, Warren, and Washington.

Housatonic River

The Housatonic River drains an area of 1,948 square miles from Pittsfield, Massachusetts to Milford, Connecticut where it flows into Long Island Sound. The river flows a total of 134 miles from its upper reach to the sound with 1,234 square miles of the total drainage area existing in Connecticut. All of the land in New Milford eventually drains to the Housatonic River.

Land draining directly to the Housatonic River represents the largest sub-regional watershed in New Milford, covering a total area of 22.57 square miles. The river flows generally southeast across the town, with major crossings being located on Route 7 just north of Route 55, at Boardman Road just south of the intersection of Route 7 and Route 37, the Route 67 crossing in the Downtown area, the railroad bridge crossing west of Grove Street, and at Pumpkin Hill Road near Lovers Leap State Park. The river is impounded in New Milford by the Bleachery Dam, a low-hazard dam off the southern terminus of West Street, and by the Shepaug Dam in Southbury which creates Lake Lillinonah, an impounded area of the river that stretches upstream to Lovers Leap State Park.

Merryall Brook

The Merryall Brook watershed covers a total area of 4.49 square miles in New Milford. The brook has its headwaters in a small pond in southern Kent upstream of Treasure Hill Road. The brook flows generally southwest through the Iron Mountain Preserve in southern Kent into New

Milford where it is conveyed beneath West Meetinghouse Road. The brook turns south to generally parallel West Meeting House Road and is conveyed beneath several minor roads and Aspetuck Ridge Road prior to reaching the confluence with the West Aspetuck River downstream of Chinmoy Lane. The East Aspetuck River drains a total area of 5.88 square miles in Kent and New Milford.

Morrissey Brook

The Morrissey Brook watershed covers a total area of 1.85 square miles in New Milford. The brook has its headwaters in a small pond in Quaker Hill, New York upstream of Route 66. The brook flows generally southeast into Sherman before turning north to flow into New Milford. The brook flows generally parallel to Gaylord Road and is conveyed beneath that road twice and is also conveyed beneath Cedar Hill Road prior to reaching the confluence with the Housatonic River downstream of Route 7. Morrissey Brook drains a total area of 7.26 square miles in New York State, New Milford, and Sherman.

Shepaug River

The Shepaug River watershed covers a total area of 5.56 square miles in New Milford. The river flows through Warren, Washington, Roxbury, and Bridgewater prior to reaching its confluence with the Housatonic River in Lake Lillinonah, and drains a total area of 155.44 square miles. The land within the watershed in New Milford drains to minor tributaries to this river, such as Walker Brook, Second Hill Brook, and several unnamed tributaries.

Still River

The Still River has its headwaters western Danbury near Mill Plain where it forms from the outflow from Sanfords Pond. The river flows generally southeast through Danbury to Mill Plain Swamp before turning generally northeast through the city center and then into Brookfield. The Still River then flows generally northward through Brookfield into New Milford.

The Still River watershed covers a total area of 5.54 square miles in New Milford. The river flow generally north parallel to Route 202. The channel is very flat, resulting in numerous meanders from the town line to the Candlewood Valley Country Club. The river then turns generally northeast and is conveyed beneath Still River Drive prior to its confluence with the Housatonic River just downstream of the railroad crossing. The total area of the Still River watershed is approximately 71 square miles within Putnam County, New York and Bethel, Brookfield, Danbury, New Fairfield, Newtown, Redding, and Ridgefield, Connecticut.

West Aspetuck River

The West Aspetuck River watershed is the second-largest watershed in New Milford, covering a total area of 10.32 square miles. The river has its headwaters in the South Kent area of eastern Kent as the outflow from North Spectacle Lake. The river flows generally south into New Milford and is conveyed beneath Cherniske Road, Squire Hill Road, and Merryall Road (twice), prior to reaching the confluence with Merryall Brook.

The river continues to flow south beneath several minor roads and Aspetuck Ridge Road (twice) prior to reaching the confluence with the East Aspetuck River downstream of Aspetuck Ridge

Road. After this confluence, the river continues south and is conveyed beneath the railroad tracks and Housatonic Avenue prior to its confluence with the Housatonic River. In total, the West Aspetuck River drains a total area of 19.60 square miles in Kent, New Milford, Warren, and Washington. The total drainage area at the Housatonic River, including the sub-regional basins of Merryall Brook and the East Aspetuck River, is 41.46 square miles.

Womenshenuk Brook

The Womenshenuk Brook watershed covers a total area of 2.57 square miles in New Milford. The brook has its headwaters in a small pond in southern Kent as the outflow from Leonard Pond. The brook flows generally south into New Milford where it generally parallels South Kent Road. The brook is conveyed beneath Browns Forge Road and Waller Road prior to reaching the confluence with the Housatonic River downstream of Riverview Road. In total, Womenshenuk Brook drains a total area of 9.36 square miles in Kent and New Milford.

2.6 Population and Demographic Setting

Elderly, linguistically isolated, and disabled populations have numerous implications for hazard mitigation as they may require special assistance or different means of notification before and during natural hazards.

According to the 2000 U.S. Census, the town of New Milford had a population of 27,121. New Milford had a population of 28,142 in 2010 according to the U.S. Census, an increase of 3.7%. The overall population density of New Milford is 446 persons per square mile. New Milford ranks second out of the ten former HVCEO municipalities in terms of population, and sixth in terms of population density. The Connecticut State Data Center projections from 2012 predict that the population of New Milford will hold generally steady through 2020 and slightly decrease to 27,703 by 2025. Table 2-2 presents the population of New Milford in comparison with the remainder of the former HVCEO region and with Connecticut.

Table 2-2
Population Density by Municipality, Region, and State, 2010

Municipality	Total Population	Land Area (square miles)	Population Density per Square Mile
Bethel	18,584	16.94	1,094
Bridgewater	1,727	17.36	109
Brookfield	16,452	20.37	819
Danbury	80,893	43.93	1,815
New Fairfield	13,881	25.16	560
New Milford	28,142	63.88	446
Newtown	27,560	58.90	425
Redding	9,158	32.03	276
Ridgefield	24,638	34.86	695
Sherman	3,581	23.39	176
HVCEO Region	224,616	336.82	658
Connecticut	3,574,097	4,844.80	738

Source: United States Census Bureau, 2010

The town of New Milford has significant populations of people who are linguistically isolated, elderly, and/or disabled. According to data collected by the U.S. Census Bureau for the period around 2010-2012, 11.8% of the population is aged 65 or over, 6.7% speak English “less than very well”, and 7.0% have a disability.

2.7 Governmental Structure

The Town of New Milford is governed by a Mayor-Council form of government in which legislative responsibilities are performed by the Town Council. The Mayor serves as the chief executive.

In addition to the Town Council, there are boards, commissions and committees providing input and direction to Town administrators while Town departments provide municipal services and day-to-day administration. Many of these commissions and departments play a role in hazard mitigation, including the following (in alphabetical order):

- The Building Department reviews plans to ensure conformance with all applicable codes and inspects work for final approval.
- The Emergency Management Director coordinates emergency response activities and planning.
- The volunteer Fire Department is the primary responder to emergency situations caused by natural hazards.
- The Fire Marshal reviews zoning applications for fire protection safety concerns, and enforces the Connecticut Fire Safety Code for all applicable residences and facilities within the community. The Fire Marshall investigates all fires that occur in the town and inspects open burn areas prior to issuing open burning permits.
- The Inland Wetlands Commission is New Milford’s Inland Wetlands Agency and reviews applications with wetland impacts.
- The Planning Commission reviews and approves subdivision applications and drafts regulation changes for approval.
- The Land Use Department staff is responsible for the administration and enforcement of the zoning, subdivision, and wetland regulations, and provides technical support to related commissions.
- The Police Department provides traffic control during emergencies and provides assistance staffing shelters.
- The Public Works Department provides response, rescue, recovery, and investigation assistance; cleanup and repair support following disasters; and is relied upon to barricade and/or provide access to areas during storm events. They also maintain and construct culverts, bridges, and roads on public land, and oversee all engineering aspects of new construction within the community.
- The Tree Warden identifies dangerous trees and hires contractors to perform trimming and removal.
- The Zoning Commission reviews and approves zoning applications and drafts regulation changes for approval.
- The Zoning Board of Appeals reviews requests for variances and handles appeals for rejected applications.

Complaints related to natural hazards are typically received by multiple departments. These complaints are usually received via phone, electronic or snail mail, or via personal communication. The complaints are distributed to the most applicable department and investigated and remediated as necessary or as the budget allows. For example, drainage complaints are directed to public works, while complaints about burning are directed to the Fire Marshall's office.

2.8 Development Trends

According to the 2010 POCD, the land within the New Milford municipal boundary was originally settled by Europeans in the early 18th century. New Milford became a separate municipality in 1712. Early industry in New Milford included quarrying marble, iron works, a paper mill, and agriculture. Development in New Milford has been historically centered on the Downtown area near the confluence of the West Aspetuck River and the Housatonic River, and in Gaylordsville in the northwestern corner of town. The opening of the railroad line between New Milford and Bridgeport in the mid-19th century helped the town emerge as a trading center. The paving of Route 7 in the 1920's and the construction of other state roads promoted the growth of businesses away from the Downtown area focused on serving automobile drivers.

Today, New Milford plays a significant regional role in the economy as, with the exception of Brookfield, it is significantly more developed than its neighbors. Residents of surrounding communities utilize commercial zones in New Milford for hospital services, dining, retail, and other needs. The recent completion of "Super 7" – the limited-access highway portion of Route 7 into northern Brookfield – has not spurred additional residential growth in New Milford according to Town staff, but has made commercial development more attractive in New Milford as residents from surrounding communities commute through. According to the 2010 POCD, New Milford is primarily an exporter of workers to other parts of the region despite approximately 8,600 jobs being estimated in the community.

New Milford is primarily accessible from the principal arterial Route 7 (Danbury Road / Kent Road) which runs generally parallel to the Housatonic River from Brookfield to Kent. Route 7 provides access to Interstate 84 in Danbury, and access to Route 44 far to the north in Canaan. Route 202 provides access from the Downtown area northeast to Torrington (and Route 8) via Washington and Litchfield. Other state roads include Route 37 and Route 55 which lead from western New Milford into Sherman, Route 109 which leads east into Washington, and Route 67 which leads southeast through Bridgewater, Roxbury, and Southbury to Interstate 84. Most development in New Milford has occurred along these major arterial roadways and their associated collector roads.

Similar to Route 7, a railroad line parallels the Housatonic River through New Milford. The Housatonic Railroad Company currently operates the railroad. The existing track structure can only accommodate freight service. Field investigations are currently ongoing related to a proposal to electrify and extend the Danbury Branch of the Metro-North Railroad from Danbury to New Milford. This would allow the railroad to carry commuters to destinations in southern Fairfield County or New York City.

The vast majority of homes in New Milford are detached single-family homes (accounting for approximately 74% of all residential structures). The majority of homes in New Milford (58%) were built between 1950 and 1990, with 19% built before 1950 and 23% built after 1990. Newer buildings are constructed to more recent building codes and are considered to be less vulnerable to natural hazards than older buildings.

New Milford had 10,710 total housing units in 2000 which increased to 11,731 in 2010. Housing permits averaged approximately 40 per year from 1990 to 2000, and peaked at over 80 per year in 2001. The number of housing permits being issued declined from 2004 through 2007, but began recovering in 2008. The number of new housing permits issued for the years 2011 through 2013 were 11, 18, and 18 (all for single family homes). Four homes were constructed in 2013, and ten permits for single family homes have been issued in January 2014. The recent economic downturn appears to have slowed the overall construction of new homes in New Milford, although residential development of new homes and subdivisions continues as a reduced rate.

Compared to surrounding communities, New Milford has a higher concentration of manufacturing and retail jobs. However, the types of jobs in New Milford are varied. Approximately 18% of jobs in New Milford are in the manufacturing sector, with 18% being in educational, health, and social services; 13% in retail trades; 10% in professional, scientific, management, administrative, or waste management services; 8% in construction; and 8% finance, real estate, rental, and leasing. The remaining job categories include the arts, entertainment, recreation, accommodation and food services (6%); other services (except public administration) (5%); transportation, warehousing, and utilities (4%), information (4%), wholesale trade (3%), public administration (2%), and agriculture, forestry, fishing, hunting, and mining (1%).

In general, the Town of New Milford encourages future residential and non-residential development that can be supported by existing infrastructure and that is consistent with the Town's POCD. The first POCD was enacted in 1959 such that this type of planning has long been a fixture in New Milford. The 2010 POCD calls for future development to be consistent with and enhance the existing character of the town while avoiding adverse impacts to the environment (particularly in sensitive areas). The POCD encourages the extension of sewer in economic development areas, but discourages expansion of sewer service outside of the sewer area unless there are public health concerns that must be addressed.

Should new or expanded infrastructure be required to serve a new development, such expansion is to be paid by the developer whenever possible. The Subdivision Regulations require that all new utilities must be located underground, and the Zoning Regulations require that all utilities must be placed underground in new developments in Planned Residential Development zones and in Cluster Conservation Subdivision Districts.

Public water supply is provided by the Aquarion Water Company along Route 7 and in the Downtown area to approximately 8,000 residents and approximately 700 commercial and industrial customers. Smaller community water systems also provide public water services to small developments. Sewage is directed to the New Milford Water Pollution Control Facility for treatment, with treated effluent released to the Housatonic River.

Land zoned as commercial and industrial has primarily been built out although some land is still available for development. The presence of public water and sewer services in New Milford located in areas zoned for commercial and industrial use enhances the potential for development and redevelopment. No significant commercial or industrial developments are currently planned. Route 202 has had recent commercial development, and a substantial retail development was recently proposed along Route 202 but was not in conformance with the Zoning Regulations.

The Bleachery, a renovated historic mill on Lake Lillinonah, has over 100 commercial units and is considered one of the most successful and active developments located within the floodplain.

Residential developments since 2000 have focused primarily either on single family homes or on small subdivisions. The Town of New Milford indicates that most new building permits issued over the past five years have been for single family homes. Similar to commercial and industrial development, Town staff indicate that there is significant potential for residential redevelopment. Transit-oriented developments could also be proposed over the next two decades if the Metro North expansion into New Milford is realized.

A build-out analysis in the 2010 POCD estimates a maximum town population of 43,281 based on zoning at the time and accounting for undevelopable areas. Approximately 5,500 potential new housing units could be developed. This new housing would be scattered around the Town in areas that are currently characterized by lower densities, as well as around Candlewood Lake. Town planners do not anticipate this level of development occurring for several decades. There is very little developable land near the town's core developed areas, namely Downtown and along the southern Route 7 corridor. Any new residential development is expected to increase the overall vulnerability of the community to natural hazards, although these projects are expected to be generally free from flooding.

The 2010 POCD did not identify development potential in commercial and industrial zones. While New Milford has traditionally attracted water-dependent industry along the Housatonic River, those industries are generally in decline. The 2010 POCD suggests performing a market analysis and consider rezoning some business and industrial zones for Corporate Office Parks. Most commercially and industrially zoned areas in New Milford are located in areas with public water and sewer service such that this infrastructure will support future commercial and industrial development and redevelopment activities. In addition, much of the Route 7 corridor that is zoned commercial or industrial is coincident with the 1% annual chance floodplain; these properties would be developed in accordance with the Zoning Regulations. As indicated above, any new commercial or industrial development is expected to increase the overall vulnerability of the community to natural hazards.

2.9 Critical Facilities, Sheltering Capabilities, and Emergency Response

The Town of New Milford has identified many critical facilities as listed below in Table 2-3. Many critical facilities, such as police, fire, and governmental buildings as well as utilities are required to ensure that day-to-day management of the town continues. Other facilities such as nursing homes, schools, and emergency supply storage areas are also considered critical facilities since these contain populations that are more susceptible in an emergency or house important supplies. Not all municipal buildings are critical facilities.

Critical facilities that are particularly vulnerable to one or more natural hazards will be discussed as appropriate in this document. For example, the Public Works Department is located in the 1% annual chance floodplain, and the access road to the Ambulance Facility / Emergency Operations Center (EOC) can be cut off by flooding. **As such, the Town of New Milford would like to relocate the public works garage, and obtain a generator for the Town Hall and move the EOC to this facility.**

Table 2-3
Critical Facilities

Facility	Address or Location	Comment	Emergency Power?	Shelter?	In 1% Annual Chance Floodplain?
New Milford Community Ambulance Corporation	1 Scovill Street	Floodprone access, Houses EOC	✓		
Richmond Citizen Center	40 Main Street	Senior Center	✓	✓	
"The Maxx" New Milford Youth Agency	94 Railroad Street	Teen Center	✓	✓	
Police Department	49 Poplar Street		✓		
Water Witch Hose Co. No. 1	16 Lanesville Road	Fire Department			
Water Witch Hose Co. No. 2	8 Prospect Hill road	Fire Department	✓		
Northville Fire Department	355 Litchfield Road		✓		
Gaylordsville Fire Department	700 Kent Road		✓		
Town Hall	10 Main Street				
Public Works Garage	6 Youngs Field Road		✓*		✓
Water Pollution Control Facility	123 West Street		✓		✓
Sarah Noble School	25 Sunny Valley Road	Intermediate School	✓	✓	

*Highway garage has generator, but a generator is needed for the mechanic shed.

Shelter Capacity

The Sarah Noble School, the Teen Center, and the Senior Center are utilized as shelters. Each of these facilities has a generator. In case of a sustained power outage, it is anticipated that 10 to 20% of the population (2,800 to 5,600 people) would relocate, although not all of those relocating would necessarily utilize the shelter facilities. If overflow sheltering space is needed, other schools in town would be utilized although these are not equipped as shelters.

The 2010 POCD indicates that all of the shelter facilities are located in the Downtown area, and not in outlying areas. If a larger Fire Station is built in Gaylordsville, the POCD suggests that this facility include shelter space.

Public Water Supply

The town of New Milford has public water supply provided by the Aquarion Water Company. The service area includes southern Route 7 and the vicinity of the Downtown area. Potable water is provided by a series of groundwater wells. Aquarion Water Company is in the process of raising well heads to be above the 1% annual chance floodplain and installing backup generators for its wellfields.

Emergency Response

Emergency response capabilities are overseen by the Emergency Management Director. The Town has an Emergency Operations Plan (EOP) that is updated annually. Evacuation routes are not defined for New Milford and instead would be activated based on the situation with coordination with State and regional entities. The Town does have typical detour routes that it utilizes during flooding and emergency conditions.

The Town maintains communications towers for emergency communications. These facilities have backup generators. According to the 2010 POCD, emergency communications within the town could be improved, as there were many “dead” zones due to topography. The Town worked toward upgrading its emergency communications capabilities in 2012-2013 and this capability was improved.

The Town of New Milford utilizes the State of Connecticut “CT Alert” Emergency Notification System to provide emergency notifications to residents of New Milford. Emergency notification systems are extremely useful for natural hazard mitigation, as a community warning system that relies on radios and television is less effective at warning residents during the night when the majority of the community is asleep.

The CT Alert system is defaulted to listings of landline phone numbers. Residents are encouraged to sign up at http://www.ctalert.gov/ to personalize how they receive emergency notifications (to cellular phones, via text message, electronic mail, etc.).

The Town of New Milford distributes public information regarding natural hazards and preparedness to residents via FEMA flyers being available in the municipal buildings and through information available on the Town website. Evaluation of emergency services, shelters, equipment, and supplies is performed at least annually (concurrent with the EOP review) or more often if necessary. Similarly, emergency training is conducted as appropriate and the Town of New Milford purchases new equipment when funding is available.

3.0 FLOODING

3.1 Setting

According to FEMA, most municipalities in the United States have at least one clearly recognizable floodprone area around a river, stream, or large body of water. The area that has a 1% annual chance to flood each year are delineated as Special Flood Hazard Areas (SFHA) for the purposes of the National Flood Insurance Program (NFIP). Floodprone areas are addressed through a combination of floodplain management criteria, ordinances, and community assistance programs sponsored by the NFIP and individual municipalities.

Many communities also have localized flooding areas outside the SFHA. These floods tend to be shallower and chronically reoccur in the same area due to a combination of factors. Such factors can include ponding, poor drainage, inadequate storm sewers, clogged culverts or catch basins, sheet flow, obstructed drainageways, sewer backup, or overbank flooding from minor streams.

In general, the potential for flooding is widespread across New Milford, with the majority of major flooding occurring along established SFHAs. The areas impacted by overflow of river systems are generally limited to river corridors and floodplains. Indirect flooding that occurs outside floodplains and localized nuisance flooding along tributaries are also common problems in the town. This type of flooding occurs particularly along roadways as a result of inadequate drainage and other factors. The frequency of flooding in New Milford is considered likely for any given year, with flood damage potentially having significant effects during extreme events (refer to Table 1-3 and Table 1-4).

3.2 Hazard Assessment

Flooding is the most common and costly natural hazard in Connecticut. The state typically experiences floods in the early spring due to snowmelt and in the late summer/early autumn due to frontal systems and tropical storms although localized flooding caused by thunderstorm activity can be significant. Flooding can occur as a result of other natural hazards, including hurricanes, summer storms, and winter storms. Flooding can also occur as a result of ice jams or dam failure (Section 8.0) and may also cause landslides and slumps in affected areas. According to FEMA, there are several different types of inland flooding:

- ❑ **Riverine Flooding**: Also known as overbank flooding, it occurs when channels receive more rain or snowmelt from their watershed than normal, or the channel becomes blocked by an ice jam or debris. Excess water spills out of the channel and into the channel's floodplain area.

- ❑ **Flash Flooding:** A rapid rise of water along a water channel or low-lying urban area, usually a result of an unusually large amount of rain and/or high velocity of water flow (particularly in hilly areas) within a very short period of time. Flash floods can occur with limited warning.

- ❑ **Shallow Flooding:** Occurs in flat areas where a lack of a water channel results in water being unable to drain away easily. The three types of shallow flooding include:
  - **Sheet Flow:** Water spreads over a large area at uniform depth.
  - **Ponding:** Runoff collects in depressions with no drainage ability.

- **Urban Flooding:** Occurs when man-made drainage systems are overloaded by a larger amount of water than the system was designed to accommodate.

Flooding presents several safety hazards to people and property and can cause extensive damage and potential injury or loss of life. Floodwaters cause massive damage to the lower levels of buildings, destroying business records, furniture, and other sentimental papers and artifacts. In addition, floodwaters can prevent emergency and commercial egress by blocking streets, deteriorating municipal drainage systems, and diverting municipal staff and resources.

Furthermore, damp conditions trigger the growth of mold and mildew in flooded buildings, contributing to allergies, asthma, and respiratory infections. Snakes and rodents are forced out of their natural habitat and into closer contact with people, and ponded water following a flood presents a breeding ground for mosquitoes. Gasoline, pesticides, poorly treated sewage, and other aqueous pollutants can be carried into areas and buildings by floodwaters and soak into soil, building components, and furniture.

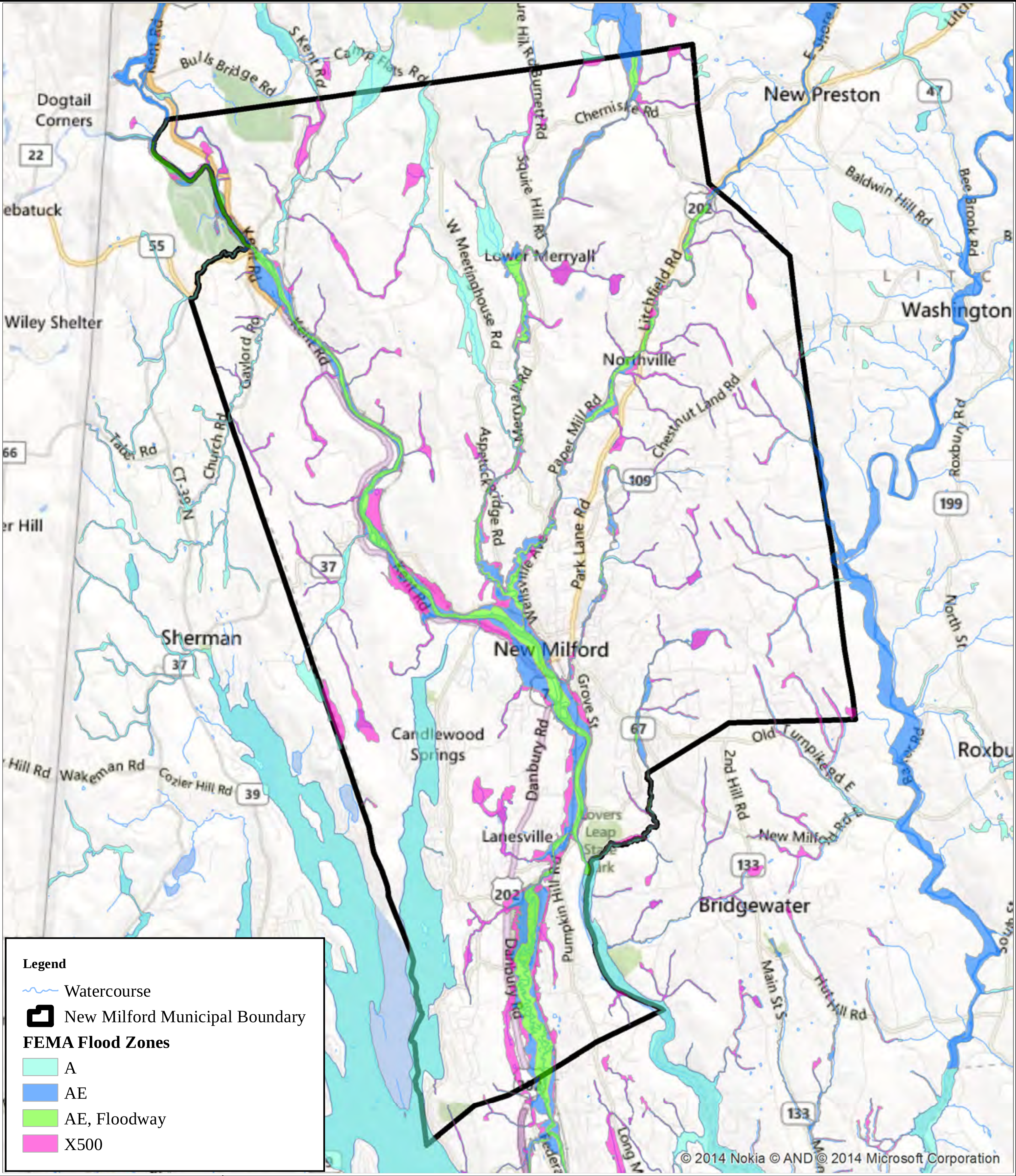
Floodplains are lands along watercourses that are subject to periodic flooding; floodways are those areas within the floodplains that convey the majority of flood discharge. Floodways are subject to water being conveyed at relatively high velocity and force. The floodway fringe contains those areas of the 1% annual chance floodplain that are outside the floodway and are subject to inundation but do not convey the floodwaters at a high velocity.

In order to provide a national standard without regional discrimination, the 1% annual chance flood has been adopted by FEMA as the base flood for purposes of floodplain management and to determine the need for insurance. The risk of having a flood of this magnitude or greater increases when periods longer than one year are considered. For example, FEMA notes that a structure located within a 1% annual chance flood zone has a 26% change of suffering flood damage during the term of a 30-year mortgage. Similarly, a 500-year flood has a 0.2% chance of occurring in a given year. The 500-year floodplain indicates areas of moderate flood hazard.

SFHAs in New Milford are delineated on a Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS). Major watercourses in New Milford generally have SFHAs mapped as Zone AE, while smaller tributary streams are mapped as Zone A. Other small streams are mapped as Zone X500 representing the 0.2% annual chance floodplain. Refer to Figure 3-1 for the areas of New Milford susceptible to flooding based on FEMA SFHAs. Table 3-1 describes the various zones depicted on the FIRM panel for New Milford.

Table 3-1
FIRM Zone Descriptions

Zone	Description
A	An area with a 1% chance of flooding in any given year for which no base flood elevations (BFEs) have been determined.
AE	An area with a 1% chance of flooding in any given year for which BFEs have been determined. This area may include a mapped floodway.
X	An area that is determined to be outside the 1% and 0.2% annual chance floodplains.
X500	An area with a 0.2% chance of flooding in any given year, for which no base flood elevations have been determined.



SOURCE(S):
"Roads" Microsoft
"Town Boundary" CT DEEP
"Q3 Flood Layer" CT DEEP
"Watercourse" CT DEEP

Figure 3-1: FEMA | Special Flood Hazard Areas (SFHA)

LOCATION:
New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 3-1 New Milford FEMA Special Flood Hazard Areas.mxd

Map By: scottb
MMI#: 3101-14
Original: 1/14/2014
Revision: 7/14/2014
Scale: 1 in = 8,000 ft

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Flooding can occur in some areas with a higher frequency than those mapped by FEMA. This nuisance flooding occurs during heavy rains with a much higher frequency than those used to calculate the 1% annual chance flood event and often in different areas than those depicted on the FIRM panels. These frequent flooding events occur in areas with insufficient drainage; where conditions may cause flashy, localized flooding; and where poor maintenance may exacerbate drainage problems (see Section 3.5).

During large storms, the recurrence interval level of a flood discharge on a tributary tends to be greater than the recurrence interval level of the flood discharge on the main channel downstream. In other words, a 1% annual chance flood event on a tributary may only contribute to a 2% annual chance flood event downstream. This is due to the distribution of rainfall throughout large watersheds during storms and the greater hydraulic capacity of the downstream channel to convey floodwaters. Dams and other flood control structures can also reduce the magnitude of peak flood flows if pre-storm storage is available.

The recurrence interval level of a precipitation event also generally differs from the recurrence interval level of the associated flood. An example would be Tropical Storm Floyd in 1999, which caused rainfall on the order of a 0.4% annual chance event while flood frequencies were only slightly greater than a 10% annual chance event on the Naugatuck River in Beacon Falls, Connecticut. Flood events can also be mitigated or exacerbated by in-channel and soil conditions, such as low or high flows, the presence of frozen ground, or a deep or shallow water table, as can be seen in the following historic record.

3.3 Historic Record

The town of New Milford has experienced various degrees of flooding in every season of the year throughout its recorded history. Melting snow combined with early spring rains has caused frequent spring flooding. Numerous flood events have occurred in late summer to early autumn resulting from storms of tropical origin moving northeast along the Atlantic coast. Winter floods result from the occasional thaw, particularly during years of heavy snow or periods of rainfall on frozen ground. Other flood events have been caused by excessive rainfalls upon saturated soils, yielding greater than normal runoff.

According to the revised October 2013 FEMA FIS, at least 26 major storms occurred in the Housatonic River basin since 1693. The notable historical floods in the early 20th century occurred in March 1936, September 1938, January 1949, August 1955, October 1955, and September 1960. In terms of damage to the town of New Milford, the most severe flood occurred in August 1955 and had an estimated return period of 100 years. This flood was the result of high intensity rainfall falling on saturated ground, and caused $600,000 in residential and municipal damage. Estimates of damage to industrial properties and personal property losses were not available in the FIS.

According to the 1987 FIS for the town of New Milford, the areas of town most frequently subject to flooding include the entire Housatonic River, the East and West Aspetuck Rivers near their confluence, and the entire Still River corridor in New Milford. Minor flooding is also prevalent on Town Farm Brook and Great Brook. Extreme storm events have the potential to put many homes and businesses at risk. Flooding of drainage systems and poor drainage flooding also occurs in many areas of the community.

According to the NCDC Storm Events Database, since 1996 there have been 41 days with flooding and 29 days with flash flooding events in Litchfield County. The following are descriptions of historic floods in the vicinity of the Town of New Milford based on historic records and information in the NCDC storm Events Database, as supplemented by correspondence with municipal officials. Note that flooding was not necessarily limited to the described areas.

- January 24-25, 1996: Heavy rainfalls produced flooding on the Housatonic River. The flooding throughout New Milford was exacerbated by an ice jam near New Milford.

- April 16, 1996: Rainfall on already saturated soil caused small stream and street flooding in New Milford. The East Aspetuck River spilled over its banks and flooded several areas.

- October 19-20, 1996: Heavy rains produced five to six inches of rainfall in Western Connecticut, producing road flooding across much of Litchfield County. Minor flooding occurred along the Housatonic and Aspetuck Rivers. A home was flooded by the Aspetuck River in New Milford near the confluence with the Housatonic River.

- July 9, 1997: Severe thunderstorms produced torrential rain which caused flash flooding along the Aspetuck River in New Milford. Flooding of several homes and secondary roads was reported.

- February 2, 1999: Mild temperatures and rain produced rapid melting of snow, resulting in minor flooding along the East Aspetuck River in New Milford.

- September 16-17, 1999: Torrential record rainfall preceded the remnants of Hurricane Floyd causing serious widespread urban, small stream, and river flooding in Western Connecticut. Rainfall amounts of six to eight inches were common throughout the area. Fairfield, Litchfield, and Hartford Counties were declared disaster areas, with damages in Litchfield County totaling $1.1 million to the public sector alone. Significant flooding occurred on the Housatonic River and many smaller streams. The rains not only flooded many roadways but also washed out portions of them, including several portions of Route 7 such as near Veterans Plaza in New Milford.

  The greatest property damage occurred in nearby Danbury along the Still River and its tributaries. Flooding along the Still River exacerbated the backwater conditions that can extend well upstream into Brookfield, Danbury, and Bethel. A total of 11.13 inches of rainfall was measured at Danbury Airport, and maximum rainfall rates of one to two inches per hour were sustained for at least three consecutive hours in Danbury. Strong, gusty winds (50 to 60 miles per hour, mph) downed many trees, limbs, and power lines across the area resulting in significant power outages. Approximately 5,000 customers were without power in Litchfield County.

- July 15, 2000: A heavy rainstorm produced three to five inches of rainfall in the area. The Aspetuck River rose out of its banks in New Milford.

- September 18-20, 2004: The Housatonic River and the East Aspetuck River both entered flood stage. The East Aspetuck River was over its banks along Wells Road in New Milford.

- October 13-17, 2005: Flooding toward the end of an extended rain event caused damage throughout New Milford. This event resulted in a disaster declaration for the State of Connecticut. Refer to Appendix D for a damage assessment report completed by the Town.

- April 15-16, 2007: Flooding associated with a spring nor'easter caused damage throughout New Milford. This event resulted in a disaster declaration for the State of Connecticut. Refer to Appendix D for a damage assessment report completed by the Town.

- June 14, 2008: Showers and thunderstorms produced locally heavy rainfall that produced flash flooding in the area. Several roads were closed in New Milford, including Summit Street, 2nd Hill Road, and Heacock-Crossbrook Road.

- September 6, 2008: The remnants of tropical cyclone Hanna produced heavy rainfall of three to six inches across Litchfield County. The heavy rainfall led to flooding of Route 7 in New Milford, resulting in several cars stalling in floodwaters.

- December 12, 2008: Heavy rainfall of one to four inches fell across Litchfield County, producing minor flooding particularly in low-lying and urban areas due to ice blocking storm drains. Moderate flooding was reported along the Housatonic River. A supermarket in New Milford had to remove food to prevent flood damage when the Housatonic River flooded the store.

- March 7, 2011: Heavy rainfall of three to four inches combined with runoff from snowmelt to cause widespread flooding in New Milford. Sections of Route 7 were closed due to the heavy rainfall as well as the Housatonic River overflowing its banks from Kent to just south of the Route 202 bridge. Widespread street and basement flooding was reported in New Milford. A mudslide occurred on Grove Street which prompted the evacuation of several families.

- Late August to early September, 2011: Rainfall and heavy winds associated with Tropical Storms Irene and Lee combined to cause many road washouts and closures in New Milford. The winds blew down many trees and branches into the rivers and streams in town, exacerbating flooding conditions along Route 7, Erickson Road, River Road, Youngs Field Road, West Street, Cross Road, Aspetuck Avenue, and Spring Street.

- May 27, 2014: In addition to the widespread wind damage caused by the severe thunderstorm described in Section 5.3, rainfall from the storm produced a mud slide that closed Grove Street.

3.4 Existing Capabilities

The Town of New Milford has in place a number of measures to mitigate flood damage. These are categorized below.

Prevention

The Town of New Milford has consistently participated in the NFIP since April 15, 1980 and intends to continue participation in the NFIP. The FIRM (originally prepared April 15, 1980 and revised June 4, 1987) delineates areas within New Milford that are vulnerable to flooding. The hydrologic and hydraulic analyses from the FIS report dated 1980 were performed by Harris-Toups Associates for FEMA under Contract No. H-3987. That work, which was completed in July 1978, covered the significant flooding sources affecting New Milford. The hydrologic and hydraulic analysis were updated for portions of the Housatonic River, Town Farm Brook, and the West Aspetuck River for the June 4, 1987 FIS by Flaherty Giavara Associates for FEMA under Contract No. EMW-84-C-1594. That work was completed in August 1985. To date, areas along the Housatonic River, Town Farm Brook, the Still River, Great Brook, the East Aspetuck River, and the West Aspetuck River have been mapped as Zone AE, with the upper reaches of several of these watercourses and other smaller watercourses and water bodies mapped as Zone A.

Regulations that apply to flood hazard mitigation in conjunction with and in addition to NFIP regulations include:

- ***Zoning Regulations***. Adopted December 1971 and last amended June 10, 2013, the Town of New Milford Zoning Regulations have been enacted promote beneficial and convenient relationships among residential, commercial, industrial, and public areas within the town. Several sections are applicable to flood mitigation, including:

    - Chapter 95, Housatonic River district, has been designed for the purpose of protecting with appropriate standards a carefully identified area of land along the Housatonic River. This district lies upstream of the Boardman bridge. Allowed uses include open space, game management, fishing, hunting, other recreational activities, farming, and golf courses that do not significantly alter the natural character of the corridor. Anyone proposing a different use must apply for a special permit, and special permits will not be issued if the proposal will increase erosion or sedimentation, create danger of flood damage, obstruct flood flow, among other restrictions.

    - Chapter 104, Candlewood Lake Watershed District, has been designed to minimize the negative impact of stormwater runoff affecting Candlewood Lake. Proposals for new building construction, or any addition, alteration, or enlargement that results in an increase in impervious surfaces on a lot where the total impervious surface is 20% or greater must submit a Stormwater Management Plan for the project describing any risk or threat to Candlewood Lake or the water resources in its watershed, best management practices to be implemented by the applicant to reduce any such risk or threat, and supporting documentation to illustrate compliance with state stormwater management design guidelines.

    - Chapter 107, Cluster Conservation Subdivision District, has been designed to provide an opportunity for greater flexibility in the design of subdivisions to allow greater tracts of undeveloped, dedicated, contiguous conservation open space. Open space associated with these subdivisions is to be maintained to conserve soils, wetlands, and marshes; protect natural drainage systems and ensure safety from flooding; and to protect other types of features.

    - Chapter 117, Major Planned Residential Development District No. 1, provides an opportunity for flexible development of large parcels of land greater than 150 acres in size in western New Milford. No less than 60% of the total area shall be preserved as open space to protect soils, wetlands, marshes, and natural drainage systems and to ensure safety from flooding, among other requirements.

- Chapter 119, Housatonic Riverfront Zone, has been designed to encourage redevelopment and adaptive reuse of properties along the banks of the Housatonic River. A special permit is required. The regulations require a detailed stormwater management plan be provided to allow maximum protection of the water quality in the Housatonic River. Each application must include an emergency evacuation plan providing details regarding the flood zone classification, the proposed evacuation route and locations of directional signage, and the proposed method of notification of pending flood conditions.

- Chapter 120, Floodplain Management Regulations, are the local version of the NFIP regulations. The purpose and objective of these regulations is to promote the health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

    - Restrict or prohibit uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in flood heights or velocities;
    - Require that uses vulnerable to floods, including facilities which service such uses, be protected against flood damage at the time of initial construction;
    - Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters;
    - Control filling, grading, dredging, and other development which may increase erosion or flood damage;
    - Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands;
    - Protect human life and public health;
    - Minimize expenditure of money for costly flood control projects;
    - Minimize the need for rescue and relief efforts associated with flooding that are generally undertaken at the expense of the general public;
    - Minimize damage to public facilities and utilities such as water and gas mains; electric, telephone, and sewer lines; and streets and bridges located in SFHAs;
    - Maintain a stable tax base by providing for the sound use and development of SFHAs in such a manner as to minimize future flood blight areas; and
    - Ensure that potential buyers are notified that a property is in a SFHA.

  Section 015 defines "lot area" as not including any portion of the property classified as inland wetland, watercourse, natural slopes in excess of 25%, portions of the lot that are less than 25 feet wide, and the private right-of-way leading to a rear lot.

  Section 020 specifically identifies the June 4, 1987 FIS and accompanying FIRM as adopted by reference into the Zoning Regulations. The Zoning Enforcement Officer is responsible for administering and implementing the provisions of the regulations and, by extension, the NFIP regulations. No structure may be constructed or substantially improved within SFHAs until a plan of the proposed construction has been approved by the Zoning Commission. Subsection 030 defines the SFHA as the regulatory floodplain.

  Section 040 presents the NFIP standards for new construction and substantial improvements including locating utilities to prevent flooding damage, use of anchoring to prevent floatation, and the requirement to maintain flood capacity when watercourses are altered. New construction or substantial improvement (both residential and non-residential) must have the lowest floor, including basement, elevated to or above the base flood elevation. Recreational vehicles placed on a site within the SFHA shall be allowed for no more than 180 consecutive days and must be fully ready for highway use. New and replacement water supply, sewage, and waste disposal systems must be located to minimize or eliminate infiltration of floodwaters into the systems. No encroachments, including fill, new construction, substantial improvements, or other developments are permitted in the floodway unless a certification is provided by a registered professional engineer that the encroachments will not result in an increase in flood levels during the base flood discharge.

Section 060 provides the Zoning Enforcement Officer with enforcement powers, including obtaining and recording as-built elevations of the lowest floor, including basement, or all new or substantially improved structure; obtain and record the as-built elevation of any floodproofing measures; and assure that maintenance is provided when watercourses are altered or relocated such that the flood carrying capacity of the watercourse is not diminished.

- Chapter 125, Erosion and Sediment Control Regulations, provides the standards and procedures for erosion and sediment control when the disturbance is not for a single family dwelling and the total disturbed area is cumulatively more than one-half acre. A sediment and erosion control plan must be submitted, approved, and adhered to by the applicant.

- Chapter 160, Nonconforming Lots, Uses, Buildings, and/or Structures, is designed to bring nonconforming uses, lots, buildings, and structures into conformity. Any building or structure containing a nonconforming use, which has been destroyed by fire, explosion, flood, or any act of God or public enemy may be restored to the same dimensions, floor area, and cubic volume lawfully existing immediate prior to such damage or destruction, provided the restoration is commenced within two years of the such damage or destruction. Failure to commence construction within such time frame is construed as an intention by the owner to abandon the nonconforming use.

- Chapter 175, Site Plan Application, includes provisions related to drainage. Stormwater management systems are required to be consistent with the 2004 Connecticut Stormwater Quality Manual, and proposed conditions cannot increase peak flows leaving a site. Stormwater management systems must be designed to pass the 25-year storm event, and adequately handle the 50-year and 100-year storm events such that flows from the site will not adversely affect downstream properties. Drainage pipes must be adequately sized to accommodate a 10-year storm event.

❑ ***Subdivision Regulations***. Effective June 2, 2001 and last amended March 7, 2002, the Town of New Milford Subdivision Regulations provide specific uniform controls for certain types of development. Section 1.2(2) indicates that the policy of the Planning Commission is that:

> *"…land to be subdivided shall be of such character that it can be used for building purposes without danger to health or the public safety, that proper provision shall be made for water, sewerage, and drainage, including the upgrading of any downstream ditch, culvert, or other drainage structure which, through the*

introduction of additional drainage due to such subdivision, becomes undersized and creates the potential for flooding on a state highway, and, in areas contiguous to brooks, rivers or other bodies of water subject to flooding, that proper provision shall be made for protective flood control measures…"

The regulations utilize the SFHA delineated by FEMA to determine floodprone areas. Section 2.2 indicates that any lot which cannot provide the necessary area for occupancy due to water or flooding conditions may be eliminated. Section 2.4 indicates that the discharge of all stormwater shall be into suitable streams or rivers or into Town drains with adequate capacity to carry the additional water. If Town drainage facilities are insufficient, the developer must upgrade them as part of the project. No land may be subdivided if the effect is to increase the likelihood of flood hazard or flood damage in a SFHA. Section 2.7 requires that electric power, telephone, and other cable systems shall be placed underground in all subdivisions except when the utility company decides that it is not feasible. Section 2.9 requires the creation of open space in subdivisions in part to avoid the potential for flooding, and that not less than 15% of the total area of the subdivision shall be so reserved.

- ***Wetlands and Watercourse Regulations***. Adopted October 13, 1988 and last amended March 6, 2010, the Inland Wetlands and Watercourses Regulations in New Milford require a permit for certain regulated activities which take place within 100 feet of a wetland or the ordinary high water line of a watercourse; within 200 feet of the ordinary high water line of Candlewood Lake, the east or west branch of the Aspetuck River, the Still River, the Housatonic River, or any watercourses within the West Aspetuck River watershed; or that may impact a wetland or watercourse. These regulations build on the preventative flood mitigation provided by the Zoning Regulations and Subdivision Regulations by preventing fill and sedimentation that could lead to increased flood stages.

As indicated above, the Zoning Enforcement Officer is the NFIP administrator for New Milford and oversees enforcement of NFIP regulations. The degree of flood protection established by the variety of regulations in New Milford meets the minimum reasonable for regulatory purposes under the NFIP. The Town of New Milford plans to remain compliant with the NFIP and will continue to participate in the NFIP. Given the relatively low number of structures impacted by flooding (see Section 3.3 and Section 3.5), the Town of New Milford is not currently considering enrollment in the Community Rating System program.

An additional level of preventative oversight is in effect over the northern portion of the Housatonic River upstream of Gaylordsville. Applicants who apply for a zoning or subdivision application along the Housatonic River must also submit an application to the Housatonic River Commission. This commission is comprised of representatives from several towns upstream of New Milford and coordinates the local management and protection of the Housatonic River Valley in northwestern Connecticut. The Commission reviews and comments on developments within the river corridor.

The current regulations are believed to be generally effective at preventing flood damage to new development and substantial improvements. Town staff indicated that they strongly encourage one foot of freeboard, although this is not directly identified in the regulations. Most of the flooding issues in the community occur to buildings that pre-date New Milford joining the NFIP. In addition, in many areas entire parcels lie within the floodplain, so land use restrictions such as removing SFHAs from the buildable area of the lot are not feasible. As such, there is currently little political will to revise the floodplain regulations to further restrict development.

The New Milford *2010 Plan of Conservation and Development* is not scheduled for a comprehensive update until after 2020. Several of the goals of this plan are pertinent to hazard mitigation, including conservation goals such as protecting natural resources, addressing drainage issues, and preserving open space and greenways; and infrastructure goals such as addressing community facility and utility needs. The POCD identifies watercourses, wetlands, steep slopes greater than 25%, and the SFHA as resources to preserve and avoid to the extent possible. The 0.2% annual chance floodplain is identified as a resource for conservation. The goal in the POCD is for the Town to encourage future development away from sensitive natural resources and minimize potential impacts.

The 2010 POCD identifies drainage as a particular concern for New Milford. Review of drainage design and enforcement are fragmented, and the topography of the town exacerbates drainage issues. Suggestions from the POCD are listed below.

a) Adopt a standardized drainage policy to ensure consistency between developments. Currently drainage requirements and standards are found in the Town Road Ordinance, the Subdivision Regulations, and in the Zoning Regulations;
b) Consider adopting low-impact development standards into the zoning and subdivision regulations;
c) Encourage town practices to employ measures to reduce stormwater flow; and
d) Educate residents and property owners on ways that they can reduce stormwater runoff, and possibly adopt regulatory incentives over the long term.

<u>Property Protection</u>

Several property protection measures may be useful to prevent damage to individual properties from inland and nuisance flooding. Refer to Section 3.6.2 for details. For example, the Big Y Supermarket installed flood doors several years ago to help protect its business. Local officials are prepared to provide outreach and education in these areas where appropriate. These intermittent outreach efforts are considered to be generally effective, although additional staff and funding would be necessary to make them a regular, formalized occurrence.

Many property protection measures are costly and may require acquisition of grant funding to successfully complete. The Town of New Milford has experience in preparing grant applications such that this effort can be performed when applicable.

A recent example of a property protection project as performed by the Town along Larson Road around 2007-2008. The Town acquired a property and demolished the remaining structures in order to excavate a stormwater management system. The system provides additional storage for floodwaters along a tributary to the Still River that would otherwise affect Larson Road and nearby properties.

<u>Emergency Services</u>

The Town of New Milford implements many emergency services mitigation measures such as maintaining an EOP. The Town of New Milford also utilizes the CT Alerts statewide emergency notification system to provide emergency notification to residents.

The Emergency Management Director is responsible for monitoring local flood warnings. The Town can access the National Weather Service website at http://www.weather.gov/ to obtain the latest flood watches and warnings before and during precipitation events.

The Town receives regular weather updates through Division of Emergency Management and Homeland Security (DEMHS) Region 5 email alerts as well as watches and warnings through the National Weather Service. The National Weather Service issues a flood watch or a flash flood watch for an area when conditions in or near the area are favorable for a flood or flash flood, respectively. A flash flood watch or flood watch does not necessarily mean that flooding will occur. The National Weather Service issues a flood warning or a flash flood warning for an area when parts of the area are either currently flooding, highly likely to flood, or when flooding is imminent.

Although the Aquarion Water Company operates wellfields that are in and adjacent to mapped floodplains, infrastructure related to water supply sources reportedly have not experienced significant flood damage. Wellheads are being elevated above the level of the 1% annual chance flood per state regulations. The utility performs regular maintenance around their wells to prevent exacerbation of potential flooding conditions near their infrastructure.

First Light Power Resources operates several dams along the Housatonic River and the Candlewood Lake Dams. First Light constantly monitors water levels in the Housatonic River and provides forewarning to the Town when flooding is predicted or imminent. First Light often lowers water levels behind its downstream dams in advance of a flood event. This helps to alleviate some of the flooding along the Housatonic River in New Milford.

<u>Public Education and Awareness</u>

The Town of New Milford makes a variety of information available for the public at its municipal buildings regarding mitigating flood hazards, including FEMA pamphlets on preparedness. The Emergency Management Director, Town Engineer, and the Zoning Enforcement Officer are local resources for guidance on preparedness and mitigation activities. The availability of these materials and resources is considered sufficient for the amount of flooding that occurs in the community.

The Town of New Milford is committed to working with its neighbors to resolve flooding concerns to a mutually acceptable level. The City of Danbury and the Town of Brookfield are the most suited to work with the Town of New Milford toward flood hazard mitigation because all three communities are affected by flooding along the Still River. The Town also works with the Town of Kent and other upstream communities regarding the Housatonic River (such as through the Housatonic River Commission). New Milford also regularly coordinates with Sherman, New Fairfield, Bridgewater, and Brookfield through regular WCCOG meetings.

<u>Natural Resource Protection</u>

Open space preservation is required for all subdivision projects as well for many other development projects within certain zones. Areas set aside for open space preservation must include a significant amount of land that would be considered “useable” and often contains floodplain areas. The set-aside requirement has been effective at informally maintaining stream buffers in the community.

The 2010 POCD encourages the Town to create an open space plan that develops Open Space System criteria that will prioritize future open space acquisition, move forward with planned trails and greenways, and continue to seek funding sources for open space. The POCD also identifies that the Parks and Recreation Department would like to provide more walking trails and additional playing fields. **Such recreational uses are appropriate in SFHAs and should be encouraged.**

Structural Projects

Major flood control projects do not exist within or upstream of New Milford. The USACE studied the potential for installing a flood protection project at Lovers Leap Gorge in southern New Milford on the Housatonic River. The Water Resources Commission also studied a local flood protection project to protect certain areas from flooding of the Housatonic River. According to the 1987 FIS, neither of these projects proceeded to construction due to unfavorable benefit-cost ratios.

Structural projects related to flood mitigation are instead aimed at drainage system installation and maintenance and increasing conveyance at culverts and bridges. The Connecticut Department of Transportation (DOT) is responsible for maintenance along state roadways, and the Town coordinates with the state when issues need to be addressed.

The Department of Public Works (DPW) is in charge of the maintenance of the town's drainage systems for all 184 miles of paved roads and 26 miles of gravel roads in New Milford, performs clearing of the 60 bridges, 4,600 catch basins, and 120 miles of drainage system piping, performs beaver dam removal and management, and performs other maintenance as needed. As indicated in the 2010 POCD, DPW has developed a management system to track maintenance needs for town drainage infrastructure. This system is helping DPW target needed repairs and upgrades in a more efficient manner.

The Town of New Milford currently has an “as needed” schedule of drainage system maintenance, with regular inspections of drainage systems supplemented by problem areas and complaints received by the Town and routed to the DPW. Maintenance includes programs to clean out blockages caused by growth and debris. The current frequency of these inspection and maintenance programs is considered sufficient to meet the needs of the town of New Milford in most areas. Increasing the budget for these preventative activities would slightly improve the effectiveness of local drainage systems.

Several drainage projects are ongoing in New Milford. The Town is working on replacing a bridge on Riverview Road, and is rehabilitating a bridge on Aspetuck Ridge Road. DPW plans to begin rehabilitation work in 2015 to a second bridge of Aspetuck Ridge Road, a bridge on Wellsville Road, and a bridge on Mill Street. Portions of this work includes installing wingwalls and/or riprap protection to minimize scour. DPW has requested funding to replace a bridge on Merryall Road in future budget years. The Town DPW also routinely performs minor culvert repair, replacement, and stabilization projects. For example, larger pipe diameters were recently installed within Paper Mill Road to more appropriately control drainage.

Connecticut DOT commenced a “Climate Change and Extreme Weather Pilot Project” in 2013 that will include vulnerability assessments of culverts and bridges in Litchfield County. The assessment will evaluate the existing storm event design standards, the recent 10-year historic actual rainfall intensity and frequency, and evaluate the hydraulic capacity of these structures using projected increases in rainfall. While no structures are being evaluated in New Milford as part of the pilot study, the potential exists that structures will be evaluated in the future.

Finally, The Housatonic Valley Association will be conducting Stream Habitat Continuity Surveys in 2014 and 2015. As these assessments will focus on improving areas where roads cross over streams, there is the potential to tie these surveys into hazard mitigation planning activities.

3.5 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to flooding within the town of New Milford As shown in the historic record, flooding can impact a variety of river corridors and cause severe damages during extreme events. Flooding due to poor drainage and other factors is also a persistent hazard in the town and can cause minor infrastructure damage, expedite maintenance, and create nuisance flooding of yards and basements. The complexity of the sources of flooding in New Milford necessitates a variety of mitigation strategies.

3.5.1 Vulnerability Analysis of Private Property

According to the 1987 FEMA FIRM, approximately 3,726 acres of land is mapped within the 1% annual chance floodplain in New Milford, with an additional 2,093 acres of land mapped within the 0.2% annual chance floodplain. Based on correspondence with the State of Connecticut NFIP Coordinator at the Connecticut DEEP, a total of 15 repetitive loss properties (RLPs) are located in the town of New Milford. General details are summarized on Table 3-2. The source of flooding at the 15 RLPs is well-understood by Town of New Milford staff.

Town staff indicated that the Town is not currently interested in contributing funding to perform acquisitions or elevations of RLPs or other floodprone properties within SFHAs. Many of the floodprone properties are commercial and it may not be feasible to relocate or elevate the buildings. The Town may be interested in assisting residential property owners with acquiring grant funding to assist with self-funded elevations, but there has not been any serious interest in the topic to date. **The Town should assist residential property owners who are interested in obtaining grant funding to perform self-funded elevations.**

Table 3-2
Repetitive Loss Properties

Type	Flooding Source	Mapped Floodplain
Residential	East Aspetuck River	1% Annual Chance
Residential	Great Brook	0.2% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance

Type	Flooding Source	Mapped Floodplain
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Commercial	Housatonic River	1% Annual Chance
Residential	Housatonic River	1% Annual Chance
Residential	Housatonic River	1% Annual Chance
Residential	Housatonic River	1% Annual Chance
Residential	West Aspetuck River	1% Annual Chance

The Zoning Enforcement Officer is required by local regulation to record the elevation of new or improved structures within the SFHA, as well as to record the elevation of floodproofing measures. **The Zoning Commission should consider adopting a requirement requiring the use of the FEMA Elevation Certificate to formally record elevations for compliance with the Zoning Regulations.** Elevation certificates help to identify the relative magnitude of a flood event and provide information that is often necessary for federal grant applications. The 2012 Biggert-Waters Reform Act has restructured the NFIP such that insurance rates for pre-FIRM homes will no longer be subsidized. As such, elevation certificates will be critical to ensure that a property receives a proper insurance rating.

One of the best methods of property protection is for the homeowner to purchase flood insurance through the NFIP. While insurance does not prevent flooding, insurance payouts assist homeowners in restoring their properties more quickly than could be performed with savings alone. **Local officials should encourage residents within the 1% annual chance floodplain to purchase flood insurance through the NFIP and complete elevation certificates for their structures.** The Town of New Milford should utilize available mapping to identify structures in the SFHA to target for outreach.

The Town of New Milford Zoning Regulations require new developments or substantial improvements to be constructed such that the first floor is at or above the base flood elevation. A specific value of freeboard is not specified. Freeboard requirements provide an additional level of protection to floodprone properties by requiring new development or substantial improvement to be elevated to the base flood elevation plus an additional amount. **The Town of New Milford should consider adopting a freeboard requirement of a minimum of one foot for all new development or substantial improvement within the SFHA.**

One particular area of concern for private property is the Bleachery, a renovated historic mill on the Housatonic River. This building is located in the 1% annual chance floodplain and has over 100 commercial units. The only mode of egress to this facility is via West Street, which is also located in the 1% annual chance floodplain. Portions of West Street flood during 10- to 15-year storm events. **The Town should consider elevating portions of West Street or developing an emergency mode of egress from this facility**, such as via a controlled emergency crossing of the railroad tracks at Anderson Avenue.

Another area of flooding concern for Town officials is the Pratt Nature Center, a 201-acre wildlife preserve and environmental education center located on Paper Mill Road adjacent to the

East Aspetuck River. One of the structures and a portion of the facility may be floodprone. This is a concern for emergency officials because a summer camp operates at this facility.

3.5.2 Vulnerability Analysis of Critical Facilities

The list of critical facilities provided by the Town of New Milford (Section 2.9) was used in combination with aerial photographs to accurately locate each critical facility. Several critical facilities lie within or near the SFHA, including the Public Works Garage, EOC, and Water Pollution Control Facility. Town staff indicate that these facilities become inaccessible during 10- to 15-year storm events.

The Public Works Garage lies within the SFHA of the Housatonic River, and access to the facility (Youngs Field Road) is also floodprone. Floodproofing is the initial preventative strategy, but **relocation is the long term goal for the Public Works Garage.** According to the 2010 POCD, the DPW has been considering locations on Pickett District Road.

The EOC is currently located in the Ambulance Facility on Scovill Street. While the building is located in the 0.2% annual chance floodplain, Scovill Street, Aspetuck Ridge Road, and Housatonic Avenue are all located in the 1% annual chance floodplain such that this facility may become inaccessible during severe flood events. As discussed in Section 2.9, the Town wishes to obtain a generator for the Town Hall and relocate the EOC to this facility, as the Town Hall is not susceptible to flooding. The Water Pollution Control Facility is located in the floodplain, but this is a water dependent use and the facility was designed with floodplain conditions in mind. However, West Street is within the 1% annual chance floodplain such that the facility may become inaccessible during flood events. **Town staff are considering elevating the level of one or more roads to the Ambulance facility and the Water Pollution Control Facility such that at least one mode of egress will be maintained during severe flood events.**

Although the Aquarion Water Company public water supply wellfield is in the SFHA, flooding is not a significant issue at this facility. Aquarion Water Company maintains an emergency contingency plan that details response procedures in case of flooding at the wellfield.

Flooding along the Housatonic River closes Route 7 between Bridge Street and Sunny Valley Road approximately seven to ten days per year. This closure impacts emergency vehicles, school transportation, and the general public. Police typically must remove people from flooded areas and flooded cars in this vicinity on six to seven days per year. Detours are set up via Fort Hill Road, but the road is narrow and not suited to carry the traffic load. Any solution to flooding in this area would be extremely complex and would need coordination with Connecticut DOT. **One option the Town may consider is to widen portions of the detour route to better accommodate the extra traffic.**

There are three bridge crossings of the Housatonic River in New Milford. The three bridges include the Boardman Road bridge, the Veterans Bridge that carries Route 67/Route 202 (Bridge Street), and the Marsh Bridge on Lower Grove Street near Lovers Leap State Park. Each of these bridges provide critical access between the east and west sides of town. There is concern that a severe flood event could damage or destroy these bridges, eliminating access to Route 7 from the east. Of the three, Bridge Street is considered to be most susceptible to flooding. **The Town should consider elevating one of these bridges above the 0.2% annual chance floodplain to**

ensure that access is maintained during a severe flood event. Any project at Bridge Street would need to be implemented by Connecticut DOT as it is a state road.

Scouring and washouts have occurred along the railroad line that traverses New Milford. There is concern among Town staff about possible derailment of trains from settling tracks if the erosion is left unchecked. This could become an even bigger issue if passenger service to New Milford along Metro North is introduced in the next few years. New Milford staff will continue to encourage the railroad owner to repair erosion damage as it occurs along the railroad line.

The Iroquois gas pipeline and station is also a concern for Town staff. The meter station is located in the 1% annual chance floodplain, and gas pipelines also traverse through mapped floodplain areas. New Milford staff will continue to encourage the utility to utilize sound floodplain management principles to ensure this facility remains online during flooding.

The Town also has concerns about the types of materials and containment areas that are located in industrial portions of the SFHA. Town staff will continue to encourage these industries to exercise sound floodplain management principles to ensure that the materials in the floodplain are not compromised by flooding.

3.5.3 Vulnerability Analysis of Areas along Watercourses

The majority of overbank flooding issues in New Milford occur along the Housatonic River, the East and West Aspetuck Rivers, and the Still River. Other smaller brooks and streams are also floodprone, but flooding along these watercourses does not typically impact structures or infrastructure. Ice jams occur frequently at Lovers Leap Gorge on the Housatonic River, but only occasionally result in flooding. The majority of the flooding problems in New Milford are caused by heavy spring rains combined with normal spring thaws.

Housatonic River

The Housatonic River flows from the northwestern corner of town near Gaylordsville generally southeast across New Milford to the southeastern corner of town at Lake Lillinonah. Flooding typically occurs in stages along the Housatonic River in New Milford based on a variety of factors. The Bleachery Dam (see Section 8.0) is typically the water level control for the Housatonic River up to 10% annual chance flood elevation. This provides a relatively consistent gradient throughout New Milford under most conditions. When water levels exceed the 10% annual chance flood event, the Lovers Leap Gorge becomes the water level control. This constriction can create a backwater effect which travels upstream to the central and northern portions of the community as well as backwater conditions on the Still River. The backwater conditions exacerbate the impact of the peak flood wave as it moves downstream through the community.

Although the water level control provided by the Bleachery Dam may exacerbate flooding levels along the river, the dam is important for other reasons. First, the backwater condition provided by this dam helps to maintain water levels in the river that facilitate pumping of water up into Candlewood Lake. This water is used for recreation and to generate electricity. Second, the backwater condition helps to slow velocities along the Housatonic River, mitigating erosion of the riverbed that could cause the release of contaminated soil that is buried in the riverbed.

The USACE has had discussions with the town about replacing part or all of the spillway at the dam with inflatable flashboards. The flashboards would allow the Town to raise water levels in the summertime when flows are low, but lower the water levels in the winter and spring with flows are higher. The flashboards could also be lowered in advance of a major predicted flood event. **The Town should continue to evaluate this potential mitigation measure.** A hydraulic model could be utilized to determine the flood mitigation value of this project, which could make this project eligible for federal funding.

Figure 3-2. Floodprone Area near Bridge Street / Route 7 Intersection (Aerial from Microsoft)

Emergency officials "chase" the peak flood wave along the Housatonic River during flood events. Road closures typically first occur near Bridge Street, which is a major intersection between Route 67 and Route 202 at Route 7 with many commercial properties in the area (Figure 3-2). Additional roads are closed and subsequently reopened as the flood wave moves downstream. The Police Department experiences many challenges redirecting traffic during these periods. One particular issue is that when the Housatonic River begins to flood, floodwaters back-water into drainage systems on Route 7, exacerbating flooding conditions along the roadway in areas that may not otherwise be under-water.

Town officials have been considering a variety of additional mitigation options to mitigate flooding along the Housatonic River. **The Town would like to perform a drainage study along the Housatonic River to identify drainage systems that should be outfitted with check valves / flap gates to prevent water coming back up through storm drains on Route 7.** The installation of strategically-placed flood barriers is another option to mitigate the overbank effects of the river.

<u>Still River</u>

The Still River flows north from Brookfield to its confluence with the Housatonic River just upstream of Lake Lillinonah. When flows begin to rise along the Housatonic River upstream of Lovers Leap Gorge, backwater conditions typically begin to occur along the very flat lower reach of the Still River in New Milford. While some commercial and industrial properties in New Milford along Route 7 can be affected by flooding in the Still River, the backwater condition also exacerbates flooding conditions at properties and along tributary streams in upstream Brookfield, Danbury, and Bethel. The Town of New Milford endeavors to keep the channel clear as much as possible to minimize exacerbating the backwater condition, but its jurisdiction for direct efforts is limited by the fact that much of the river lies on private property. The Town will continue to conduct outreach to private property owners when impediments to streamflow are identified.

East and West Aspetuck Rivers

Although the land abutting these rivers has been historically floodprone, the impacts of flooding along these watercourses is less significant than the issues with the Housatonic River and the Still River. Some structures and properties are directly affected by overbank flooding, but most of the problematic flooding is caused by trees falling into the rivers. In many areas the banks are steep and the soils become unstable when wet, eventually causing trees to fall into the river channels. Route 202 is primarily affected by this issue, and clearing has had to be performed approximately four or five times over the past 15 years. Similar to the Still River, much of the river channel lies on private property such that the Town's jurisdiction is limited. The Town will continue to conduct outreach to private property owners when slope stability appears compromised, and will continue to perform tree removals as permitted.

Other Overbank Flooding

While beaver dams are not widespread in New Milford, there are areas that experience recurring minor flooding issues due to beaver dam activity. Such beaver dams are often located adjacent to Mud Pond Road at Mud Pond, off Tamarac Road near Denman Brook, off Fort Hill Road near Ferris Pond, and on Larson Road near an unnamed tributary to the Housatonic River. The greatest short-term concern is that the beaver activity is ruining the drainage infrastructure on Tamarac Road. In some areas, beaver activity can also exacerbate flooding along Route 7. Town DPW staff breach the dams when necessary.

3.5.4 Vulnerability of Other Areas

The town of New Milford has several areas that are subject to flooding away from defined watercourses. Many of these areas flood due to clogged or undersized drainage systems, or flooding is due to the complete lack of a drainage system. Such minor flood events can damage roads and cause ponding of nearby yards, basement flooding, and other damages. These events can usually be repaired by the Department of Public Works through cleaning, curb repair, and asphalt patching. More extreme events can require complete infrastructure replacement. As noted in Section 2.4, the frequency of damaging events is expected to increase in the future as the intensity and magnitude of rainfall continues to increase.

Drainage concerns have been discussed in this section for areas along the Housatonic River, and also addressed in Section 3.4 from a planning standpoint. **Given that rainfall intensity and magnitude has been increasing over the past few decades since the time that many local bridges and culverts were designed, the conveyance of each structure should be checked utilizing more recent rainfall data, and the structure redesigned if necessary.** This could be done on a case-by-case basis, or as part of a larger watershed modeling and mitigation effort.

Several areas of New Milford are also prone to mudslides. The Town indicated that several areas along Route 7 are likely to experience such a slide in the near future. The slides in these areas will likely be caused by heavy rainfall falling on steep slopes comprised of poorly-draining soils.

The Grove Street area has long been a concern for mudslides (Figure 3-3). Grove Street is a major connector road between Route 67 and Route 7 that is located on the east side of the Housatonic River, and is the primary access to one of the three bridges that crosses the Housatonic River in New Milford. Heavy rain events routinely result in mudslides flowing over Grove

Street south of Fordyce Road immediately downstream of a very steep slope. An engineering study was conducted in the early 1980's that resulted in a USACE stabilization project in 1983.

In recent years, increases in the magnitude and intensity of rainfall have coupled with land use changes upstream of the slope to result in more frequent mud slides. An engineering study of the area was conducted in 2012 concluded that land use changes (the most significant of which was legally conducted without Town oversight as certain types of land clearing is not regulated by local ordinances) have resulted in runoff increases of 35% for some areas of the upgradient watershed. The study recommended that the Town establish a regular maintenance schedule for maintaining the USACE-installed drop inlets, underdrain, and catch basins managing storm water on this embankment, redoubling outreach efforts with upstream landowners, and potentially pursuing an HMA grant to fund slope stabilization at the site. **The Town should consider applying for grant funding for a slope stabilization project.**

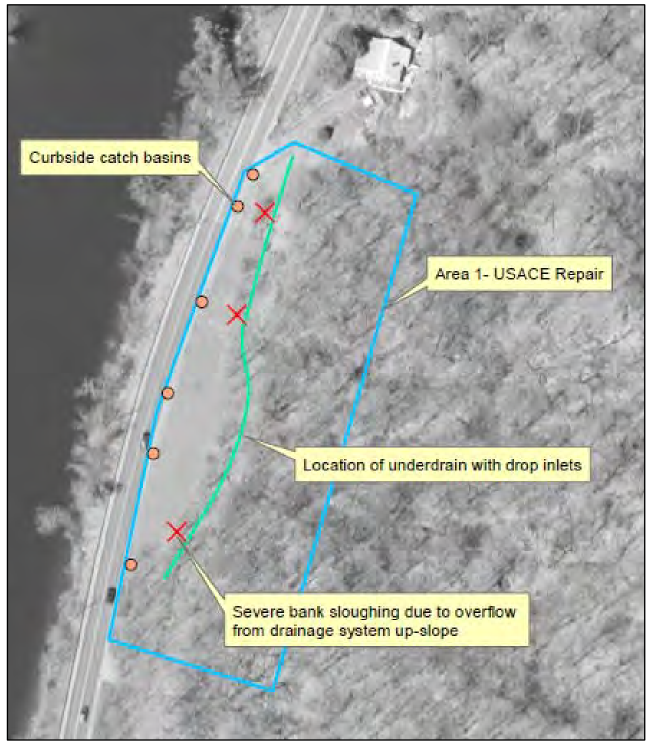


Figure 3-3: Grove Street Mudslide Area and 1983 USACE Repair (Aerial from CT DEEP)

3.5.5 *HAZUS-MH* Vulnerability Analysis

HAZUS-MH is FEMA's loss estimation methodology software for flood, wind, and earthquake hazards. The current version of the software utilizes year 2000 U.S. Census data and a variety of engineering information to calculate potential damages (valued in year 2006 dollars) to a user-defined region. The software was utilized to perform a basic analysis to generate potential damages along major streams in New Milford from a 1% annual chance riverine flood event. Hydrology and hydraulics for the streams and rivers were generated within HAZUS-MH utilizing the Flood Information Tool to compile information digitized from the New Milford FIRM, cross-sectional data from the FIS, and digital elevation models available from the DEEP that were prepared using the 2000 LiDAR study. HAZUS-MH output is included in Appendix E. The results are considered an initial estimate of potential flooding damage suitable for planning purposes. The following paragraphs discuss the results of the HAZUS-MH analysis.

Streams in New Milford that were simulated by HAZUS-MH include those with SFHAs, and only the areas within the SFHAs with elevations (Zone AE) were simulated. These include the streams below:

- East Aspetuck River;
- Great Brook;

- ❑ Housatonic River;
- ❑ Still River;
- ❑ Town Farm Brook; and
- ❑ West Aspetuck River

A summary of the default building counts and values is shown in Table 3-3. Approximately $2.6 billion of building value was estimated to exist within the town of New Milford. HAZUS-MH estimated that 10,627 buildings exist within New Milford, with 90.5% of the buildings being residential housing.

Table 3-3
HAZUS-MH Flood Scenario – Basic Information

Occupancy	Dollar Exposure
Residential	$ 1,966,616,000
Commercial	$ 461,031,000
Industrial	$ 135,117,000
Other	$ 68,672,000
Total	**$ 2,634,436,000**

The *HAZUS-MH* simulation estimates that during a 1% annual chance flood event, 129 buildings will be substantially damaged (and likely uninhabitable) in the community from flooding, and an additional 40 will be moderately damaged. All of the damaged buildings are were estimated to be residential, wood-framed buildings except for one manufactured home that would be substantially damaged near the Housatonic River. Table 3-4 presents the expected damages along each stream.

Table 3-4
HAZUS-MH Flood Scenario – Building Stock Damages

Stream	1-10% Damaged	11-20% Damaged	21-30% Damaged	31-40% Damaged	41-50% Damaged	Substantially Damaged
East Aspetuck River	0	0	0	5	17	65
Great Brook	0	0	0	0	0	0
Housatonic River	0	0	0	2	10	48
Still River	0	0	0	2	4	16
Town Farm Brook	0	0	0	0	0	0
West Aspetuck River	0	0	0	0	0	0
Total						

HAZUS-MH utilizes a subset of critical facilities known as "essential facilities" that are important following natural hazard events. These include one hospital, two fire stations, one police station, and seven schools in New Milford. The software output indicates that essential facilities were not expected to experience moderate or greater flooding damage during the 1% annual chance flood event.

The HAZUS-MH simulation estimated the following tons of debris would be generated by flood damage for the 1% annual chance flood scenario along each stream. The simulation also estimates the number of truckloads (at approximately 25 tons per truck) that will be required to remove the debris. The breakdown of debris generation is as follows:

Table 3-5
HAZUS-MH Flood Scenario – Debris Generation (Tons)

Stream	Finishes	Structural	Foundations	Total	Truckloads
East Aspetuck River	1,066	1,507	1,102	3,675	147
Great Brook	127	83	67	277	11
Housatonic River	2,373	7,912	5,538	15,823	633
Still River	411	841	616	1,868	75
Town Farm Brook	32	16	10	58	2
West Aspetuck River	118	109	84	311	12
Total	**4,127**	**10,468**	**7,417**	**22,012**	**880**

HAZUS-MH calculated the potential sheltering requirement for the 1% annual chance flood event along each stream. Displacement includes households evacuated from within or very near to the inundated areas. Of these households, some people will seek temporary shelter in public shelters, while others are predicted to stay with friends, family, or in hotels or motels. The predicted sheltering requirements for flood damage are relatively large as presented in Table 3-6. Additional sheltering space may be needed beyond the existing shelters to accommodate the population needing shelter during such an event.

Table 3-6
HAZUS-MH Flood Scenario – Sheltering Requirements

Stream	Displaced Households	Population Using Public Shelters
East Aspetuck River	145	313
Great Brook	27	27
Housatonic River	140	277
Still River	31	80
Town Farm Brook	13	8
West Aspetuck River	35	18
Total	**391**	**723**

HAZUS-MH also calculated the predicted economic losses due to the 1% annual chance flood event along each stream. Economic losses are categorized between building-related losses and business interruption losses. Building-related losses (damages to building, content, and inventory) are the estimated costs to repair or replace the damage caused to the building and its contents. This information is presented in Table 3-7. Business interruption losses are those associated with the inability to operate a business because of the damage sustained during the flood and include lost income, relocation expenses, lost rental income, lost wages, and temporary living expenses for displaced people. This information is presented in Table 3-8. Values presented in the tables may not necessarily be zero but are rounded down if less than $5,000.

Table 3-7
HAZUS-MH Flood Scenario – Building Loss Estimates

Stream	Residential	Commercial	Industrial	Others	Total
East Aspetuck River	$23,040,000	$4,065,000	$2,330,000	$300,000	$30,320,000
Great Brook	$2,180,000	$2,490,000	$220,000	$490,000	$5,380,000
Housatonic River	$24,830,000	$29,490,000	$14,580,000	$4,960,000	$73,860,000
Still River	$6,010,000	$10,160,000	$4,530,000	$1,300,000	$22,010,000
Town Farm Brook	$1,220,000	$120,000	$70,000	$50,000	$1,460,000
West Aspetuck River	$2,290,000	$530,000	$1,130,000	$70,000	$4,020,000
Total	**$59,570,000**	**$46,855,000**	**$22,860,000**	**$7,170,000**	**$137,050,000**

Table 3-8
HAZUS-MH Flood Scenario – Business Interruption Estimates

Stream	Residential	Commercial	Industrial	Others	Total
East Aspetuck River	$20,000	$30,000	$0	$0	$40,000
Great Brook	$10,000	$10,000	$0	$10,000	$20,000
Housatonic River	$20,000	$190,000	$0	$30,000	$230,000
Still River	$0	$60,000	$0	$0	$60,000
Town Farm Brook	$0	$0	$0	$0	$0
West Aspetuck River	$0	$0	$0	$0	$0
Total	**$50,000**	**$290,000**	**$0**	**$40,000**	**$350,000**

The HAZUS-MH results are generally consistent with the magnitude of flooding damages typically observed along the floodprone streams in town, with most of the damages occurring along the Housatonic River, the East Aspetuck River, and the Still River. However, the simulated estimate of nearly $137.5 million in damages for a combined 1% annual chance flood event may be high.

3.6 Potential Mitigation Strategies and Actions

A number of measures can be taken to reduce the impact of a local or nuisance flood event. These include measures that prevent increases in flood losses by managing new development, measures that reduce the exposure of existing development to flood risk, and measures to preserve and restore natural resources. These are listed below under the categories of *prevention*, *property protection*, *structural projects*, *public education and awareness*, *natural resource protection*, and *emergency services*. All of the recommendations discussed throughout this chapter are reprinted in a bulleted list in Section 3.7.

3.6.1 Prevention

Prevention of damage from flood losses often takes the form of floodplain regulations and redevelopment policies that restrict the building of new structures within defined areas. These are usually administered by building, zoning, planning, and/or code enforcement offices through capital improvement programs and through zoning, subdivision, floodplain, and wetland regulations. Preventative mitigation also occurs when land is protected from being developed through the use of conservation easements or conversion of land into permanent open space.

Drainage System Maintenance: An effective drainage system must be continually maintained to ensure efficiency and functionality. The use of GIS technology can greatly aid the identification and location of problem areas.

Planning and Zoning: Zoning and Subdivision ordinances regulate development in flood hazard areas. Flood hazard areas should reflect a balance of development and natural areas, although ideally they will be free from development. Site plan and new subdivision regulations typically include the following:

It is important to promote coordination among the various departments that are responsible for different aspects of flood mitigation. Coordination and cooperation among departments should be reviewed every few years as specific responsibilities and staff change.

- ❑ Requirements that every lot have a buildable area above the flood level;
- ❑ Construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers, and drainage-ways; and
- ❑ A requirement that developers dedicate open space and flood flow, drainage, and maintenance easements.
- ❑ Policies requiring the design and location of utilities to areas outside of flood hazard areas when applicable and the placement of utilities underground when possible.
- ❑ A variety of structural-related mitigation strategies, including the use of freeboard, can be applied to new development and substantial redevelopment although these are beyond the minimum requirements of the NFIP.
- ❑ Adherence to the State Building Code requires that the foundation of structures will withstand flood forces and that all portions of the building subject to damage are above or otherwise protected from flooding.

FEMA encourages local communities to use more accurate topographic maps to expand upon the FIRMs published by FEMA. This is because many FIRMs were originally created using quadrangle maps prepared by the United States Geological Survey with 10-foot contour intervals, but many municipalities today have contour maps of one- or two-foot intervals that show more recently constructed roads, bridges, and other anthropologic features. An alternate approach is to record high water marks and establish those areas inundated by a recent severe flood to be the new regulatory floodplain. While these maps cannot replace the FIRM for insurance purposes, they may be used to regulate development provided that the mapped area is the same size or larger than that mapped on the FIRM.

Adoption of a different floodplain map is allowed under NFIP regulations as long as the new map covers a larger floodplain than the FIRM. It should be noted that the community's map will not affect the current FIRM or alter the SFHA used for setting insurance rates or making map determinations; it can only be used by the community to regulate floodplain areas. The FEMA Region I office has more information on this topic. Contact information can be found in Section 11.

Reductions in floodplain area or revisions of a mapped floodplain can only be accomplished through revised FEMA-sponsored engineering studies or Letters of Map Change (LOMC). To date, several Letters of Map Amendment (LOMA) and Letters of Map Revision (LOMR) have been submitted under the LOMC program for New Milford, which is expected given the relatively developed nature of the local floodplains.

Stormwater Management Policies: Development and redevelopment policies to address the prevention of flood damage must include effective stormwater management policies. Developers are typically required to build detention and retention facilities where appropriate. Additional techniques include enhancing infiltration to reduce runoff volume through the use of swales, infiltration trenches, vegetative filter strips, and permeable paving blocks. The goal is that post-development stormwater does not leave a site at a rate higher than under predevelopment conditions.

Due to its topography, various parts of New Milford lie situated in the upper, middle, *and* lower portions of several watersheds. Standard engineering practice is to avoid the use of detention measures if the project site is located in the lower one-third of the overall watershed. The effects of detention are least effective and even detrimental if used at such locations because of the delaying effect of the peak discharge from the site that typically results when detention measures are used. By detaining stormwater in close proximity to the stream in the lower reaches of the overall watershed, the peak discharge from the site will occur later in the storm event, more closely coincide with the peak discharge of the stream, thereby exacerbating the peak discharge of the stream during any given storm event.

3.6.2 Property Protection

A variety of steps can be taken to protect existing public and private properties from flood damage. Performing such measures for RLPs typically provide the greatest benefit to the town and the NFIP. Potential measures for property protection include:

- ***Relocation of structures at risk for flooding to a higher location on the same lot or to a different lot outside of the floodplain***. Moving an at-risk structure to a higher elevation can reduce or eliminate flooding damages to the structure. If the structure is relocated to a new lot, the former lot can be converted to open space (See Section 3.6.5).

- ***Elevation of the structure***. Building elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located above the 1% annual chance flood elevation. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first floor level. The area below the first floor may only be used for building access and parking.

- ***Construction of property improvements such as barriers, floodwalls, and earthen berms***. Such structural projects can be used to prevent shallow flooding as discussed in Section 3.6.6.

- ***Performing structural improvements that can mitigate flooding damage***. Such improvements can include:

  - ***Dry floodproofing of the structure to keep floodwaters from entering***. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents would be either permanently closed or covered with removable shields. Flood protection should extend only two to three feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water.

- ⇨ ***Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded***. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 1% annual chance flood elevation.

> **<u>Dry floodproofing</u> refers to the act of making areas below the flood level watertight.**
>
> **<u>Wet floodproofing</u> refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures.**

- ⇨ ***Performing other potential home improvements to mitigate damage from flooding***. FEMA suggests several measures to protect home utilities and belongings, including:

    - Relocating valuable belongings above the 1% annual chance flood elevation to reduce the amount of damage caused during a flood event;
    - Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the high water mark (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
    - Anchor the fuel tank to the wall or floor with non-corrosive metal strapping and lag bolts.
    - Install a septic backflow valve to prevent sewer backup into the home.
    - Install a floating floor drain plug at the lowest point of the lowest finished floor.
    - Elevate the electrical box or relocate it to a higher floor, and elevate electric outlets to at least 12 inches above the high water mark.

- ❑ ***Encouraging property owners to purchase flood insurance under the NFIP and to make claims when damage occurs***. While having flood insurance will not prevent flood damage, it will help a family or business put things back in order following a flood event. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

3.6.3 <u>Emergency Services</u>

A natural hazard mitigation plan addresses actions that can be taken before a disaster event. In this context, emergency services that would be appropriate mitigation measures for flooding include:

- ❑ Forecasting systems to provide information on the time of occurrence and magnitude of flooding;
- ❑ A system to issue flood warnings to the community and responsible officials;
- ❑ Emergency protective measures, such as an EOP outlining procedures for the mobilization and position of staff, equipment, and resources to facilitate evacuations and emergency floodwater control; and
- ❑ Implementing an emergency notification system that combines database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas or specific groups of people, such as emergency responder teams.

The use of an emergency notification system can help communities avoid casualties due to flash flooding. As the volume of calls that can be generated through these systems is very high, emergency notification systems are typically used to issue warnings to the entire community even if only a small area is affected.

3.6.4 Public Education and Awareness

The objective of public education is to provide an understanding of the nature of flood risk and the means by which that risk can be mitigated on an individual basis. Public information materials should encourage individuals to be aware of flood mitigation techniques, including discouraging the public from changing channel and detention basins in their yards and dumping in or otherwise altering watercourses and storage basins. Individuals should be made aware of drainage system maintenance programs and other methods of mitigation. The public should also understand what to expect when a hazard event occurs, and the procedures and time frames necessary for evacuation.

The promotion of awareness of natural hazards among citizens, property owners, developers, and local officials is necessary for proper preparedness. Technical assistance for local officials, including workshops, can be helpful in preparation for dealing with the massive upheaval that can accompany a severe flooding event. Research efforts to improve knowledge, develop standards, and identify and map hazard areas will better prepare a community to identify relevant hazard mitigation efforts.

3.6.5 Natural Resource Protection

Floodplains can provide a number of natural resources and benefits, including storage of floodwaters, open space and recreation, water quality protection, erosion control, and preservation of natural habitats. Retaining the natural resources and functions of floodplains can not only reduce the frequency and consequences of flooding but also minimize stormwater management and nonpoint pollution problems. Through natural resource planning, these objectives can be achieved at substantially reduced overall costs.

Measures for preserving floodplain functions and resources typically include:

- **Adoption of floodplain regulations to control or prohibit development that will alter natural resources**
- **Development and redevelopment policies focused on resource protection**
- **Information and education for both community and individual decision-makers**
- **Review of community programs to identify opportunities for floodplain preservation**

Projects that improve the natural condition of areas or restore diminished or destroyed resources can reestablish an environment in which the functions and values of these resources are again optimized. Acquisitions of floodprone property with conversion to open space are the most common of these types of projects, as acquisition of heavily damaged structures (particularly repetitive loss properties) after a flood may be an economical and practical means to accomplish restoration of floodplains. In some cases, it may be possible to purchase floodprone properties adjacent to existing recreation areas which will allow for the expansion of such recreational use or the creation of floodplain storage areas. Administrative measures that assist such projects include the development of land reuse policies focused on resource restoration and review of community programs to identify opportunities for floodplain restoration.

Based on the above guidelines, the following typical *natural resource protection* mitigation measures to help prevent damage from inland and nuisance flooding include:

- Pursue additional open space properties in floodplains by acquiring and demolishing repetitive loss properties and other floodprone structures and converting the parcels to open space. This type of project eliminates future flooding damage potential to the structure, and such a project could be designed to increase floodplain storage which would reduce future flooding potential to remaining properties;
- Pursue the acquisition of additional municipal open space properties as discussed in the *Plan of Conservation and Development*, particularly near existing open space;
- Selectively pursue conservation objectives listed in the Plan of Conservation and Development and/or more recent planning studies and documents; and
- Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains.

Municipalities should work with local land trusts to identify undeveloped properties (or portions thereof) worth acquiring that are within or adjacent to floodplains.

3.6.6 Structural Projects

Structural projects include the construction or modification of structures to lessen the impact of a flood event. Examples of structural projects include:

- Stormwater controls such as drainage systems, detention dams and reservoirs, and culvert resizing can be employed to modify flood flow rates.
- On-site detention can provide temporary storage of stormwater runoff.
- Barriers such as levees, floodwalls, and dikes physically control the hazard to protect certain areas from floodwaters.
- Channel alterations can be made to confine more water to the channel and modify flood flows.
- Individuals can protect private property by raising structures and constructing walls and levees around structures.

Care should be taken when using these techniques to ensure that problems are not exacerbated in other areas of the impacted watersheds.

Given the many culverts and bridges in a typical community and the increasing rainfall rates in Connecticut described in Section 2.4, reevaluation of the drainage computations on culverts and bridges is recommended.

3.7 Summary of Recommended Strategies and Actions

Section 3.4 outlined the Town of New Milford's existing capabilities for mitigating flooding damage. Section 3.5 discussed potential strategies that the Town of New Milford should consider implementing to mitigate flooding damage. These include the potential mitigation strategies reviewed in Section 3.6. This section provides a summary of the recommended mitigation strategies for addressing inland flooding problems in the town of New Milford.

Prevention

- ❑ Adopt a standardized drainage policy to ensure consistency between developments.
- ❑ Adopt low-impact development standards into the Zoning Regulations and Subdivision Regulations.
- ❑ Adopt a regulation requiring the use of the FEMA Elevation Certificate to formally record building floor and floodproofing elevations for compliance with the Zoning Regulations.
- ❑ Adopt a freeboard requirement of one foot for all new development or substantial improvement within the SFHA.

Property Protection / Natural Resource Protection / Public Education

- ❑ Encourage town practices to employ measures to reduce stormwater flow.
- ❑ Educate residents and property owners on ways that they can reduce stormwater runoff, and possibly adopt regulatory incentives over the long term.
- ❑ Create an Open Space Plan to prioritize future open space acquisition that encourages the creation of recreational open space within SFHAs.
- ❑ Assist residential property owners interested in obtaining grant funding to elevate properties within SFHAs.
- ❑ Encourage property owners within the SFHA to purchase flood insurance through the NFIP and complete FEMA Elevation Certificates for their structures.

Emergency Services

- ❑ Relocate the Public Works Garage out of the SFHA.
- ❑ Elevate one or more roads leading to the Ambulance facility to ensure that egress is available during the 1% annual chance flood.
- ❑ Elevate portions of West Street to ensure that egress is maintained to the Water Pollution Control Facility during floods.

Structural Projects

- ❑ Elevate portions of West Street or develop an emergency mode of egress to the Bleachery commercial development.
- ❑ Widen portions of the side roads that are used to detour traffic when flooding occurs along Route 7 between Bridge Street and Sunny Valley Road.
- ❑ Elevate one of the three bridges over the Housatonic River to be unaffected by the 0.2% annual chance flood event.
- ❑ Evaluate the potential flood mitigation effects of installing inflatable flashboards at the Bleachery Dam.
- ❑ Perform a drainage study along the Housatonic River to identify drainage systems that should be outfitted to prevent floodwater from flowing back up through storm drains on Route 7.
- ❑ Check the conveyance of all bridges and culverts based on more recent rainfall data statistics.
- ❑ Construct a slope stabilization project to prevent mudslides along Grove Street.

In addition, mitigation strategies important to all hazards are included in Section 10.1.

4.0 HURRICANES

4.1 Setting

Several types of hazards may be associated with tropical storms and hurricanes including heavy or tornado winds, heavy rains, and flooding. While only some of the areas of New Milford are susceptible to flooding damage caused by hurricanes, wind damage can occur anywhere in the town. Hurricanes therefore have the potential to affect any area within the town of New Milford. A hurricane striking New Milford is considered a possible event each year and could cause critical damage to the town and its infrastructure (refer to Table 1-3 and Table 1-4).

4.2 Hazard Assessment

Hurricanes are a class of tropical cyclones that are defined by the National Weather Service as warm-core, non-frontal, low-pressure, large-scale systems that develop over tropical or subtropical water and have definite organized circulations. Tropical cyclones are categorized based on the speed of the sustained (one-minute average) surface wind near the center of the storm. These categories are Tropical Depression (winds less than 39 miles per hour [mph]), Tropical Storm (winds 39-74 mph, inclusive), and Hurricanes (winds at least 74 mph).

The geographic areas affected by tropical cyclones are called tropical cyclone basins. The Atlantic tropical cyclone basin is one of six in the world and includes much of the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. The official Atlantic hurricane season begins on June 1 and extends through November 30 of each year although occasionally hurricanes occur outside this period.

Inland Connecticut is vulnerable to hurricanes despite moderate hurricane occurrences when compared with other areas within the Atlantic tropical cyclone basin. Since hurricanes tend to weaken within 12 hours of landfall, inland areas are relatively less susceptible to hurricane wind damages than coastal areas in Connecticut; however, the heaviest rainfall often occurs inland as was seen in Tropical Storm Irene in 2011. Therefore, inland areas are vulnerable to riverine and urban flooding during a hurricane.

The Saffir-Simpson Scale

The "Saffir-Simpson Hurricane Scale" was used prior to 2009 to categorize hurricanes based upon wind speed, central pressure, and storm surge, relating these components to damage potential. In 2009, the scale was revised and is now called the "Saffir-Simpson Hurricane Wind Scale." The modified scale is more scientifically defensible and is predicated only on surface wind speeds. The following descriptions are from the 2010 *Connecticut Natural Hazard Mitigation Plan Update*.

A Hurricane Watch is an advisory for a specific area stating that a hurricane poses a threat to coastal and inland areas. Individuals should keep tuned to local television and radio for updates.

A Hurricane Warning is then issued when the dangerous effects of a hurricane are expected in the area within 24 hours.

- **Category One Hurricane:** Sustained winds 74-95 mph (64-82 kt or 119-153 km/hr). *Damaging winds are expected*. Some damage to building structures could occur, primarily to unanchored mobile homes (mainly pre-1994 construction). Some damage is likely to poorly constructed signs. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne debris risk injury and possibly death. Numerous large branches of healthy trees will snap. Some trees will be uprooted, especially where the ground is saturated. Many areas will experience power outages with some downed power poles.

- **Category Two Hurricane:** Sustained winds 96-110 mph (83-95 kt or 154-177 km/hr). *Very strong winds will produce widespread damage*. Some roofing material, door, and window damage of buildings will occur. Considerable damage to mobile homes (mainly pre-1994 construction) and poorly constructed signs is likely. A number of glass windows in high-rise buildings will be dislodged and become airborne. Loose outdoor items will become projectiles, causing additional damage. Persons struck by windborne debris risk injury and possibly death. Numerous large branches will break. Many trees will be uprooted or snapped. Extensive damage to power lines and poles will likely result in widespread power outages that could last a few to several days.

- **Category Three Hurricane:** Sustained winds 111-130 mph (96-113 kt or 178-209 km/hr). *Dangerous winds will cause extensive damage.* Some structural damage to houses and buildings will occur with a minor amount of wall failures. Mobile homes (mainly pre-1994 construction) and poorly constructed signs are destroyed. Many windows in high-rise buildings will be dislodged and become airborne. Persons struck by windborne debris risk injury and possibly death. Many trees will be snapped or uprooted and block numerous roads. Near total power loss is expected with outages that could last from several days to weeks.

- **Category Four Hurricane:** Sustained winds 131-155 mph (114-135 kt or 210-249 km/hr). *Extremely dangerous winds causing devastating damage are expected.* Some wall failures with some complete roof structure failures on houses will occur. All signs are blown down. Complete destruction of mobile homes (primarily pre-1994 construction). Extensive damage to doors and windows likely. Numerous windows in high-rise buildings will be dislodged and become airborne. Windborne debris will cause extensive damage and persons struck by the wind-blown debris will be injured or killed. Most trees will be snapped or uprooted. Fallen trees could cut off residential areas for days to weeks. Electricity will be unavailable for weeks after the hurricane passes.

- **Category Five Hurricane:** Sustained winds greater than 155 mph (135 kt or 249 km/hr). *Catastrophic damage is expected*. Complete roof failure on many residences and industrial buildings will occur. Some complete building failures with small buildings blown over or away are likely. All signs blow down. Complete destruction of mobile homes. Severe and extensive window and door damage will occur. Nearly all windows in high-rise buildings will be dislodged and become airborne. Severe injury or death is likely for persons struck by wind-blown debris. Nearly all trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months.

4.3 Historic Record

Through research efforts by the National Oceanic and Atmospheric Administration's (NOAA) National Climate Center in cooperation with the National Hurricane Center, records of tropical cyclone occurrences within the Atlantic cyclone basin have been compiled from 1851 to present. These records are compiled in NOAA's hurricane database (HURDAT), which contains historical data recently reanalyzed to current scientific standards as well as the most current hurricane data. During HURDAT's period of record (1851-2011), two Category Three Hurricanes, seven Category Two Hurricanes, seven Category One Hurricanes, and 39 tropical storms have tracked within a 150-nautical-mile radius of New Milford. The representative storm strengths were measured as the peak intensities for each individual storm passing within the 150-mile radius. The 16 hurricanes noted above occurred in August through October as noted in Table 4-1.

Table 4-1
Tropical Cyclones by Month within 150 Miles of New Milford Since 1851

Category	July	August	September	October
Tropical Storm[1]	6	13	12	5
One	0	2	3	2
Two	0	3	3	1
Three	0	0	2	0
Total	**6**	**18**	**20**	**8**

[1]One tropical storm occurred in May, one occurred in June, and one occurred in November.

A description of the historic record of tropical cyclones near New Milford follows:

- An unnamed hurricane in August 1893 was a Category One Hurricane when its center made landfall near New York City and traveled north over western Connecticut.

- An unnamed hurricane in October 1894 was a Category One Hurricane when its center made landfall near Clinton, Connecticut.

- An unnamed hurricane in September 1924 was a Category One Hurricane when its center made landfall near New York City and traveled north over western Connecticut.

- The most devastating hurricane to strike Connecticut, and believed to be the strongest hurricane to hit New England in recorded history, is believed to have been a Category Three Hurricane at its peak. Dubbed the "Long Island Express of September 21, 1938," this name was derived from the unusually high forward speed of the hurricane (estimated to be 70 mph). As a Category Two Hurricane, the center of the storm passed over Long Island, made landfall near Milford, Connecticut, and moved quickly northward into northern New England.

  The majority of damage was caused from storm surge and wind damage. Surges up to 18 feet were recorded along portions of the Connecticut coast, and 130 mile per hour gusts flattened forests, destroyed nearly 5,000 cottages, farms, and homes, and damaged an estimated 15,000 more throughout New York and southern New England. The storm resulted in catastrophic fires in New London and Mystic, Connecticut. Fourteen to 17 inches of rain were reported in central Connecticut, causing severe flooding. Overall, the storm left an estimated 564 dead, 1,700 injured, and caused physical damages in excess of $38 million (1938 USD).

- Hurricane Carol (naming of hurricanes began in 1950), made landfall near Clinton, Connecticut in late August of 1954 shortly after high tide and produced storm surges of 10 to

15 feet in southeastern Connecticut. This storm was also a Category Three Hurricane at peak intensity and a Category Two Hurricane upon making landfall. Rainfall amounts of six inches were recorded in New London, and wind gusts peaked at over 100 mph. Near the coast, the combination of strong winds and storm surge damaged or destroyed thousands of buildings, and the winds toppled trees that left most of the eastern part of the state without power. Overall damages in the northeast were estimated at one billion dollars (1954 USD), and 48 people died as a direct result of the hurricane.

- The year 1955 was a devastating year for flooding in Connecticut. Connie was a declining tropical storm over the Midwest when its effects hit Connecticut in August 1955, producing heavy rainfall of four to six inches across the state. The saturated soil conditions exacerbated the flooding caused by Tropical Storm Diane five days later, the wettest tropical cyclone on record for the northeast. The storm produced 14 inches of rain in a 30-hour period, causing destructive flooding conditions along nearly every major river system in the state.

- Hurricane Belle of August 1976 was a Category One Hurricane as it passed over Long Island but was downgraded to a tropical storm before its center made landfall near Stratford, Connecticut. Belle caused five fatalities and minor shoreline damage.

- Hurricane Gloria of September 1985 was a Category Three Hurricane when it made landfall in North Carolina and weakened to a Category Two Hurricane before its center made landfall near Bridgeport, Connecticut. The hurricane struck at low tide, resulting in low to moderate storm surges along the coast. The storm produced up to six inches of rain in some areas and heavy winds that damaged structures and uprooted thousands of trees. The amount and spread of debris and loss of power were the major impacts from this storm, with over 500,000 people suffering significant power outages.

- Tropical Storm Floyd seriously impacted Connecticut in 1999. Floyd was the storm of record in the Connecticut Natural Hazard Mitigation Plan for many years and is discussed in more detail in Section 3.3 due to heavy rainfall that caused widespread flood damage. The winds associated with Tropical Storm Floyd also caused power outages throughout New England and at least one death in Connecticut.

- Hurricane Irene peaked as a Category Three storm before it made landfall in North Carolina and tracked northward along the Delmarva Peninsula and New Jersey before the remnants of the eye crossed over New York City on Sunday, August 28, 2011. Anticipating storm surges along the Atlantic coastline, many states and municipalities issued mandatory evacuations on August 26 and 27, 2011. Many coastal towns ordered a mandatory evacuation to all residents in anticipation of Hurricane Irene's landfall on Saturday, August 27, 2011. The largest damage was done to electrical lines throughout the state of Connecticut. More than half of the state (over 754,000 customers) was without power following the storm, with some areas not having electricity restored for more than a week. Ten deaths were attributed to the storm in Connecticut. The town of New Milford was fortunate to not have lost power in most of the community, but experienced moderate damage to its infrastructure including roads and drainage systems.

- The remnants of Tropical Storm Lee hit New Milford less than two weeks after Irene, causing additional flooding along the Housatonic River and further damaging roads and drainage systems.

4.4 Existing Capabilities

Existing mitigation measures appropriate for flooding were discussed in Section 3.0. These include the ordinances, codes, and regulations that have been enacted to minimize flood damage, and the variety of efforts undertaken by the town to minimize damage from flooding.

Wind loading requirements are addressed through the state building code. The 2005 Connecticut State Building Code was amended in 2011 and adopted with an effective date of October 6, 2011, and subsequently amended to adopt the 2009 International Residential Code (IRC) effective February 28, 2014. The code specifies the design wind speed for construction in all the Connecticut municipalities, with the addition of split zones for some towns. For example, for towns along the Merritt Parkway such as Fairfield and Trumbull, wind speed criteria are different north and south of the parkway in relation to the distance from the shoreline. Effective December 31, 2005, the design wind speed for New Milford is 90 miles per hour. New Milford has adopted the Connecticut Building Code as its building code, and literature is available regarding design standards in the Building Department office.

Connecticut is located in FEMA Zone II regarding maximum expected wind speed. The maximum expected wind speed for a three-second gust is 160 mph. This wind speed could occur as a result of either a hurricane or a tornado in western Connecticut and southeastern New York. The American Society of Civil Engineers recommends that new buildings be designed to withstand this peak three-second gust.

Parts of tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. The recent severe storm events in Connecticut have identified a statewide need for improved communications between municipalities and local electric utilities. Eversource Energy (formerly Connecticut Light & Power), the local electric utility, provides tree maintenance near its power lines. Town staff have indicated that they have a good relationship with the utility and that they have been more aggressive in its maintenance in recent years. The Town will continue working with the utility on preparedness measures, although staff are concerned that when the Eversource Energy facility in town is relocated out of New Milford that response times will be lengthened.

The Public Works Department appoints a tree warden who encourages residents to cut trees that may be dangerous to power lines, and who identifies trees on town property and along rights of way that require trimming. Tree trimming and maintenance is performed by DPW, but larger jobs are contracted out from an annual budget of $100,000. The proactive and aggressive approach to tree trimming has helped to considerably reduce the amount of power outages that have occurred along Route 7 in recent years. For example, power was not lost throughout most of New Milford following Irene. Many neighboring communities relied on the commercial areas in New Milford along Route 7 to purchase fuel and supplies, as these facilities continued to operate.

All new utilities must be located underground in new subdivisions in order to mitigate storm-related damages. These regulations have been effective at reducing vulnerability for new developments. Town staff also encourage new utility installations to be placed underground in other types of developments. **The Town should consider making this an official regulation.** The Town also implements projects to bury utility lines when it is appropriate to protect the infrastructure. For example, the Town recently buried utilities along Bank Street and Railroad Street to protect them from future storm damage.

During emergencies, the Town currently has three designated emergency shelters available for residents as discussed in Section 2.9. As hurricanes typically pass an area within a day's time, additional shelters or distribution stations can be activated following a storm as needed for long-term evacuees. None of the facilities used as shelters are known to be specifically designed to resist the effects of wind.

The Town of New Milford utilizes radio, television, area newspapers, the internet, and the local and statewide CT Alert emergency notification systems to notify residents of oncoming storm danger and to announce the availability of shelters. Prior to severe storm events, the Town ensures that warning/notification systems and communication equipment are working properly and prepares for the possible evacuation of impacted areas. These protocols are considered effective preparation for storm events.

4.5 Vulnerabilities and Risk Assessment

NOAA issues an annual hurricane outlook to provide a general guide to each upcoming hurricane season based on various climatic factors. However, it is impossible to predict exactly when and where a hurricane will occur. NOAA believes that "hurricane landfalls are largely determined by the weather patterns in places the hurricane approaches, which are only predictable within several days of the storm making landfall."

NOAA has utilized the National Hurricane Center Risk Analysis Program (HURISK) to determine return periods for various hurricane categories at locations throughout the United States. As noted on the NOAA website, hurricane return periods are the frequency at which a certain intensity or category of hurricane can be expected with 75 nautical miles of a given location. For example, a return period of 20 years for a particular category storm means that on average during the previous 100 years a storm of that category passed within 75 nautical miles of that location five times. Thus, it is expected that similar category storms would pass within that radius an additional five times during the next 100 years.

Table 4-2 presents return periods for various category hurricanes to impact Connecticut. The nearest two HURISK analysis points were New York City and Block Island, Rhode Island. For this analysis, these data are assumed to represent western Connecticut and eastern Connecticut, respectively.

Table 4-2
Return Period (in Years) for Hurricanes to Strike Connecticut

Category	New York City (Western Connecticut)	Block Island, RI (Eastern Connecticut)
One	17	17
Two	39	39
Three	68	70
Four	150	160
Five	370	430

According to the *2014 Connecticut Natural Hazards Mitigation Plan*, hurricanes have the greatest destructive potential of all natural disasters in Connecticut due to the potential combination of high winds, storm surge and coastal erosion, heavy rain, and flooding that can accompany the hazard. It is generally believed that New England is long overdue for another major hurricane strike. As shown in Table 4-2, NOAA estimates that the return period for a Category Two or Category Three storm to strike Fairfield County to be 39 years and 68 years, respectively. The last major hurricane to impact Connecticut was Hurricane Bob in 1991. Category One Hurricane Earl in 2010 and Tropical Storm Irene in 2011 were reminders that hurricanes do track close to Connecticut.

The *2014 Connecticut Natural Hazards Mitigation Plan* also notes that some researchers have suggested that the intensity of tropical cyclones has increased over the last 35 years, with some believing that there is a connection between this increase in intensity and climate change. While most climate simulations agree that greenhouse warming enhances the frequency and intensity of tropical storms, models of the climate system are still limited by resolution and computational ability. However, given the past history of major storms and the possibility of increased frequency and intensity of tropical storms due to climate change, it is prudent to expect that there will be hurricanes impacting Connecticut in the near future that may be of greater frequency and intensity than in the past.

<u>Tropical Cyclone Vulnerability</u>

The town of New Milford is vulnerable to hurricane damage from wind and flooding and from any tornadoes accompanying the storm. Potential impacts from flooding are discussed in Section 3.5. Fortunately, the town of New Milford is less vulnerable to hurricane damage than coastal towns in Connecticut because it does not need to deal with the effects of storm surge. Factors that influence vulnerability to tropical cyclones in the town include building codes currently in place, local zoning and development patterns, and the age and number of structures located in highly vulnerable areas of the community.

In general, as the residents and businesses of the state of Connecticut become more dependent on the internet and mobile communications, the impact of hurricanes on commerce will continue to increase. A major hurricane has the potential of causing complete disruption of power and communications for up to several weeks, rendering electronic devices and those that rely on utility towers and lines inoperative.

Debris such as signs, roofing material, and small items left outside become flying missiles in hurricanes. Extensive damage to trees, towers, aboveground and underground utility lines (from uprooted trees or failed infrastructure), and fallen poles cause considerable disruption for residents. Streets may be flooded or blocked by fallen branches, poles, or trees, preventing egress. Downed power lines from heavy winds can also start fires during hurricanes with limited rainfall. While moving all utilities underground would prevent wind damage to this infrastructure, this activity is too cost-prohibitive for the community.

Town staff indicate that minor to moderate tree damage can occur during virtually all but the most minor storms. This is problematic as the vast majority of existing utilities are located above ground. The Town's aggressive and proactive tree-trimming efforts, coupled with Eversource Energy's tree-trimming efforts, help to mitigate potential damage to utilities.

Based on the population projections in Section 2.6 and the build-out analysis in Section 2.8, the population of the town of New Milford is estimated to slightly decrease over the next 10 years, although eventually an additional 15,000 people could be added to the town. All areas of growth and development increase the town's vulnerability to natural hazards such as hurricanes although new development is expected to mitigate potential damage by meeting the standards of the most recent building code. As noted in Section 4.1, wind damage from hurricanes and tropical storms has the ability to affect all areas of New Milford while areas susceptible to flooding are even more vulnerable. Areas of known and potential flooding problems are discussed in Section 3.0, and tornadoes (which sometimes develop during tropical cyclones) will be discussed in Section 5.0.

Some critical facilities are more susceptible than others to flooding damage associated with hurricane rainfall. Such facilities susceptible to flooding were discussed in Section 3.5.

Town of New Milford staff are uncertain whether any Town-owned critical facilities have wind-mitigation measures installed to specifically reduce the effects of wind. Thus, it is believed that nearly all of the critical facilities in the town are as likely to be damaged by hurricane-force winds as any other. Many of the Town's older structures may not meet current building codes with respect to wind and therefore may be more susceptible to wind damage, and structures with older roofs may also be more susceptible to wind damage. Newer critical facilities are more likely to meet more stringent building code requirements and are therefore considered to be the most resistant to wind damage even if they are not specifically wind-resistant. **The Town should consider requiring that new municipal critical facilities be hardened to reduce the effects of wind.**

The town of New Milford's housing stock consists of historic buildings greater than 50 and sometimes 100 years old, relatively younger buildings built before 1990 when the building code changed to address wind damage, and relatively recent buildings that utilize the new code changes. Since most of the existing housing stock in the town predates the recent code changes, many structures are highly susceptible to roof and window damage from high winds. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes. There are a few mobile home parks and manufactured homes in the community that are susceptible to high winds.

As the town of New Milford is not affected by storm surge, hurricane sheltering needs have not been calculated by the U.S. Army Corps of Engineers for the town. The Town determines sheltering need based upon areas damaged or needing to be evacuated within the town. Under limited emergency conditions, a high percentage of evacuees will seek shelter with friends or relatives rather than go to established shelters. In the case of a major (Category Three or above) hurricane, it is likely that the Town will depend on state and federal aid to assist sheltering displaced populations until normalcy is restored.

HAZUS-MH Simulations

In order to quantify potential hurricane damage, HAZUS-MH simulations were run for historical and probabilistic storms that could theoretically affect the town of New Milford. For the historical simulations, the results estimate the potential maximum damage that would occur in the present day (based on year 2006 dollar values using year 2000 census data) given the same storm track and characteristics of each event. The probabilistic storms estimate the potential maximum damage that would occur based on wind speeds of varying return periods. Note that the simulations calculate damage for wind effects alone and not damages due to flooding or other non-wind effects. Thus, the damage and displacement estimates presented below are likely lower than would occur during a hurricane associated with severe rainfall. Results are presented in Appendix E and summarized below.

Figure 4-1 depicts the spatial relationship between the two historical storm tracks used for the HAZUS simulations (Hurricane Gloria in 1985 and the 1938 hurricane) and the town of New Milford. These two storm tracks produced the highest winds to affect New Milford out of all the hurricanes in the HAZUS-MH software.

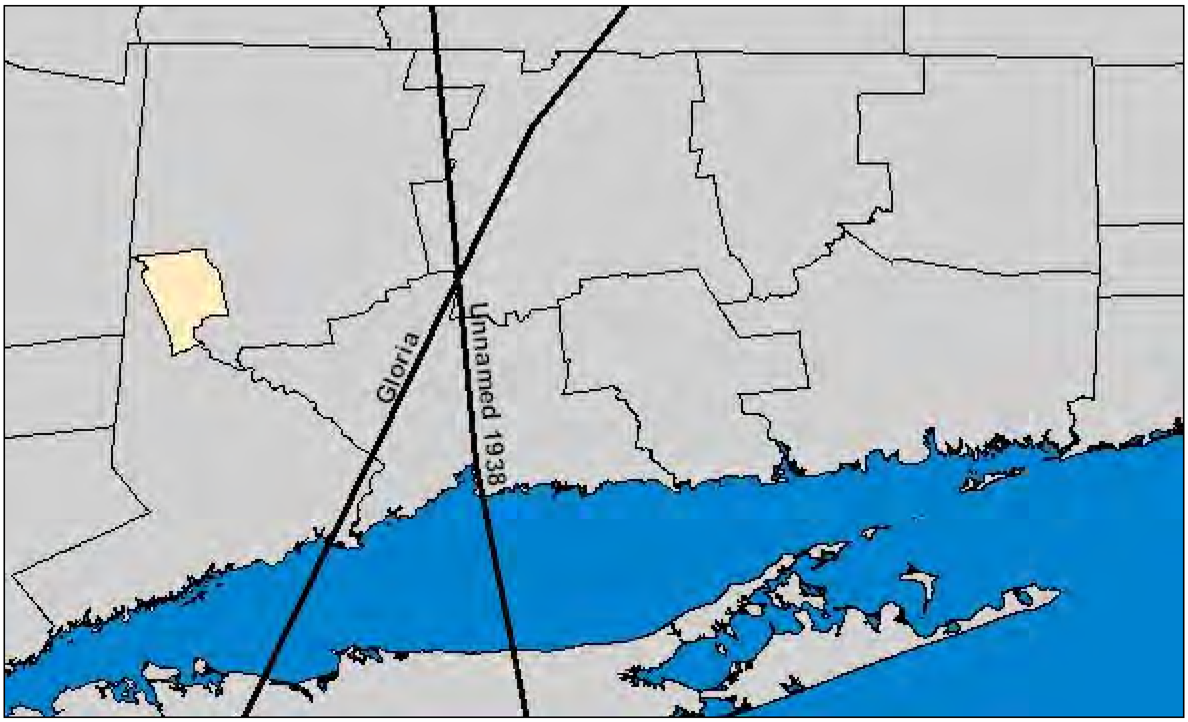


Figure 4-1: Historical Hurricane Storm Tracks

The FEMA default values were used for each census tract in the HAZUS simulations. A summary of the default building counts and values was shown in Table 3-3.

The FEMA *Hurricane Model HAZUS-MH Technical Manual* outlines various damage thresholds to classify buildings damaged during hurricanes. The five classifications are summarized below:

- **No Damage or Very Minor Damage**: Little or no visible damage from the outside. No broken windows or failed roof deck. Minimal loss of roof cover, with no or very limited water penetration.
- **Minor Damage**: Maximum of one broken window, door, or garage door. Moderate roof cover loss that can be covered to prevent additional water entering the building. Marks or dents on walls requiring painting or patching for repair.
- **Moderate Damage**: Major roof cover damage, moderate window breakage. Minor roof sheathing failure. Some resulting damage to interior of building from water.

- **Severe Damage**: Major window damage or roof sheathing loss. Major roof cover loss. Extensive damage to interior from water. Limited, local joist failures. Failure of one wall.
- **Destruction:** Essentially complete roof failure and/or more than 25% of roof sheathing. Significant amount of the wall envelope opened through window failure and/or failure of more than one wall. Extensive damage to interior.

Table 4-3 presents the peak wind speeds during each wind event simulated by HAZUS for the town of New Milford. The number of expected residential buildings to experience various classifications of damage is presented in Table 4-3, and the total number of buildings expected to experience various classifications of damage is presented in Table 4-4. Minimal damage is expected to buildings for wind speeds less than 60 mph, with overall damages increasing with increasing wind speed.

Table 4-3
HAZUS Hurricane Scenarios – Number of Residential Buildings Damaged

Return Period or Storm	Peak Wind Gust (mph)	Minor Damage	Moderate Damage	Severe Damage	Total Destruction	Total
10-Years	37-38	None	None	None	None	None
20-Years	52-53	None	None	None	None	None
Gloria (1985)	59	4	None	None	None	4
50-Years	68-70	17	1	None	None	18
100-Years	80-81	154	8	None	None	162
200-Years	90-92	618	54	None	None	672
Unnamed (1938)	95	859	88	2	None	949
500-Years	102-104	1,782	292	9	8	2,091
1000-Years	111-113	2,953	778	61	53	3,845

Table 4-4
HAZUS Hurricane Scenarios – Total Number of Buildings Damaged

Return Period or Storm	Minor Damage	Moderate Damage	Severe Damage	Total Destruction	Total
10-Years	None	None	None	None	None
20-Years	None	None	None	None	None
Gloria (1985)	6	None	None	None	6
50-Years	21	1	None	None	22
100-Years	166	9	None	None	175
200-Years	658	58	1	None	717
Unnamed (1938)	859	88	2	None	949
500-Years	1,907	326	15	9	2,257
1000-Years	3,169	877	84	54	4,184

The HAZUS simulations consider a subset of critical facilities termed "essential facilities" which are important during emergency situations. Note that the essential facilities in HAZUS-MH may not necessarily be the same today as they were in 2000. Nevertheless, the information is useful from a planning standpoint. As shown in Table 4-5, minimal damage to essential facilities is expected for wind speeds less than 95 mph. Minor damage to schools occurs at wind speeds of approximately 92 mph and greater, with loss of use to all schools occurring at wind speeds of 111 mph.

Table 4-5
HAZUS-MH Hurricane Scenarios – Essential Facility Damage

Return Period or Storm	Hospitals (1)	Fire Stations (2)	Police Stations (1)	Schools (7)
10-Years	None or Minor	None or Minor	None or Minor	None or Minor
20-Years	None or Minor	None or Minor	None or Minor	None or Minor
Gloria (1985)	None or Minor	None or Minor	None or Minor	None or Minor
50-Years	None or Minor	None or Minor	None or Minor	None or Minor
100-Years	None or Minor	None or Minor	None or Minor	None or Minor
200-Years	None or Minor	None or Minor	None or Minor	Minor damage with loss of use to 1 school greater than one day
Unnamed (1938)	Minor Damage, all beds out of use for one week	None or Minor	None or Minor	Minor damage with loss of use to 1 school greater than one day
500-Years	Moderate Damage, all beds out of use for one week	None or Minor	None or Minor	Minor damage with loss of use at 5 schools greater than one day
1000-Years	Moderate Damage, all beds out of use for one month	None or Minor	None or Minor	Minor damage with loss of use to all schools greater than one day

Table 4-6 presents the estimated tonnage of debris that would be generated by wind damage during each HAZUS storm scenario. The model breaks the debris into four general categories based on the different types of material handling equipment necessary for cleanup. As shown in Table 4-6, minimal debris are expected for storms less than the 20-year event, and reinforced concrete and steel buildings are not expected to generate debris. Much of the debris that is generated is tree-related.

Table 4-6
HAZUS-MH Hurricane Scenarios – Debris Generation (Tons)

Return Period or Storm	Brick / Wood	Reinforced Concrete / Steel	Eligible Tree Debris	Other Tree Debris	Total
10-Years	None	None	None	None	None
20-Years	None	None	None	None	None
Gloria (1985)	2	None	None	None	2
50-Years	81	None	None	None	81
100-Years	476	None	837	3,626	4,939
200-Years	1,505	None	4,055	16,137	21,697
Unnamed (1938)	1,988	None	4,610	18,058	24,656
500-Years	4,847	None	6,601	24,321	35,769
1000-Years	11,104	None	15,220	58,720	85,044

Table 4-7 presents the potential sheltering requirements based on the various wind events simulated by HAZUS. The predicted sheltering requirements for <u>wind damage</u> are relatively minimal except for the largest wind events and can be met through the use of existing shelters. However, it is likely that hurricanes will also produce heavy rain and flooding that will increase the overall sheltering need in New Milford.

Table 4-7
HAZUS Hurricane Scenarios – Shelter Requirements

Return Period or Storm	Number of Displaced Households	Short Term Sheltering Need (Number of People)
10-Years	None	None
20-Years	None	None
Gloria (1985)	None	None
50-Years	None	None
100-Years	None	None
200-Years	None	None
Unnamed (1938)	4	None
500-Years	30	6
1000-Years	115	23

Table 4-8 presents the predicted economic losses due to the various simulated wind events. Property damage loss estimates include the subcategories of building, contents, and inventory damages. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building or its contents. Business interruption loss estimates include the subcategories of lost income, relocation expenses, and lost wages. The business interruption losses are associated with the inability to operate a business due to the damage sustained during a hurricane, and also include temporary living expenses for those people displaced from their home because of the storm.

Table 4-8
HAZUS Hurricane Scenarios – Economic Losses

Return Period or Storm	Residential Property Damage Losses	Total Property Damage Losses	Business Interruption (Income) Losses	Total Losses
10-Years	None	None	None	None
20-Years	None	None	None	None
Gloria (1985)	$71,630	$71,630	$90	$71,720
50-Years	$1,133,770	$1,199,250	$5,170	$1,204,420
100-Years	$4,661,360	$4,842,370	$101,740	$4,944,110
200-Years	$11,438,830	$12,334,950	$603,120	$12,938,060
Unnamed (1938)	$14,291,050	$15,615,210	$1,072,980	$16,688,190
500-Years	$33,562,760	$38,980,520	$4,074,340	$43,054,850
1000-Years	$86,493,540	$103,804,110	$12,373,640	$116,177,750

Losses are minimal for storms with return periods of less than 20-years (54 mph) but increase rapidly as larger storms are considered. For example, a reenactment of the 1938 hurricane would cause approximately $16.7 million in wind damages to the town of New Milford. As these damage values are based on 2006 dollars, it is likely that these estimated damages will be higher today due to inflation.

In summary, hurricanes are a very real and potentially costly hazard to the town of New Milford. Based on the historic record and HAZUS-MH simulations of various wind events, the entire community is vulnerable to wind damage from hurricanes. These damages can include direct structural damages; interruptions to electricity, business, and commerce; emotional impacts; and injury and possibly death.

4.6 Potential Mitigation Strategies and Actions

Many potential mitigation measures for hurricanes include those appropriate for inland flooding. These were presented in Section 3.6. However, hurricane mitigation measures must also address the effects of heavy winds that are inherently caused by hurricanes. Mitigation for wind damage is therefore emphasized in the subsections below. Natural resource protection projects include those for reducing flooding damage as presented in Section 3.6.5.

4.6.1 Prevention

Although hurricanes and tropical storms cannot be prevented, a number of methods are available to continue preventing damage from the storms and perhaps to mitigate damage. The following actions have been identified as potential preventive measures:

- Instituting periodic tree limb inspection and maintenance programs to ensure that the potential for downed power lines is diminished.
- Locating utilities underground in new developments or during redevelopment whenever possible.
- Have current Emergency Operations Plans, evacuation plans, supply distribution plans, and other emergency planning documents for the community as appropriate.
- Utilize evacuation procedures whenever mobile home parks or campgrounds are threatened by hurricanes or severe tropical storms.
- Develop a phased approach to replacing aboveground utility lines with underground utility lines, taking advantage of opportunities such as streetscaping projects.

4.6.2 Property Protection

Most property owners perform basic property protection measures in advance of hurricanes, including cutting dangerous tree limbs, boarding windows, and moving small items inside that could be carried away by heavy winds. Property protection measures for hurricanes include those described for flooding in Section 3.6.2 due to the potential for heavy rainfall to accompany the storm. In terms of new construction and retrofits, various structural projects for wind damage mitigation on buildings are described in Section 4.6.5, including the use of shutters and wind-resistant windows.

Local tree wardens should attempt education and outreach regarding dangerous trees on private property, particularly for trees near homes with dead branches overhanging the structure or nearby power lines. These limbs are the most likely to fall during a storm.

4.6.3 Emergency Services

EOPs typically include guidelines and specifications for communication of hurricane warnings and watches as well as procedures for a call for evacuation. The public needs to be made aware of evacuation routes once established by the situation and the locations of public shelters in advance of a hurricane event, which can be accomplished (1) by placing this information on the community website, (2) by creating informational displays in local municipal buildings and high traffic businesses such as supermarkets, (3) through press releases to local radio and television stations and local newspapers, and (4) through the use of a community-wide emergency notification system. In addition, communities should identify and prepare additional backup facilities for evacuation and sheltering needs to prepare for contingencies. Communities should also continue to review their mutual aid agreements and update as necessary to ensure that help is available as needed, and ensure that the community is not hindered responding to its own emergencies as it assists with regional emergencies.

The Connecticut Public Utility Regulatory Authority is currently piloting a "micro-grid" program designed to provide backup power supplies to small areas critical to public supply distribution such as supermarkets, gas stations, and pharmacies. These infrastructure improvements will allow for small areas of the power grid to be isolated and operated independently through emergency generators. **Communities should consider areas where such micro-grids may be feasible.**

4.6.4 Public Education and Awareness

Tracking of hurricanes has advanced to the point where areas often have one week of warning time or more prior to a hurricane strike. The public should be made aware of available shelters prior to a hurricane event, as well as potential measures to mitigate personal property damage. This was discussed in Section 4.6.3 above. A number of specific proposals for improved public education are recommended to prevent damage and loss of life during hurricanes. These are common to all hazards in this Plan and are listed in Section 10.1.

4.6.5 Structural Projects

While structural projects to completely eliminate wind damage are not possible, potential structural mitigation measures for buildings include designs for hazard-resistant construction and retrofitting techniques. These generally take the form of increased wind and flood resistance as well as the use of storm shutters over exposed glass and the inclusion of hurricane straps to hold roofs to buildings. The four categories of structural projects for wind damage mitigation in private homes and critical facilities include the installation of shutters, load path projects, roof projects, and code plus projects and are defined below.

- Shutter mitigation projects protect all windows and doors of a structure with shutters, lamentations, or other systems that meet debris impact and wind pressure design requirements. All openings of a building are to be protected, including garage doors on residential buildings, large overhead doors on commercial buildings, and apparatus bay doors at fire stations.

- Load path projects improve and upgrade the structural system of a building to transfer loads from the roof to the foundation. This retrofit provides positive connection from the roof framing to the walls, better connections within the wall framing, and connections from the wall framing to the foundation system.

- Roof projects involve retrofitting a building's roof by improving and upgrading the roof deck and roof coverings to secure the building envelope and integrity during a wind or seismic event.

- <u>Code plus</u> projects are those designed to exceed the local building codes and standards to achieve a greater level of protection.

Given the relative infrequency of hurricane wind damage in the town of New Milford, it is unlikely that any structural project for mitigating wind damage would be cost effective (and therefore eligible for grant funding) unless it was for a critical facility. Communities should encourage the above measures in new construction and require it for new critical facilities. Continued compliance with the amended Connecticut Building Code for wind speeds is necessary. Literature should be made available by the Building Department to developers during the permitting process regarding these design standards.

4.7 Summary of Recommended Strategies and Actions

While many potential mitigation activities were addressed in Section 4.6, the recommended mitigation strategies for mitigating hurricane and tropical storm winds in the town of New Milford are listed below.

<u>Prevention</u>

- Update the Zoning Regulations to require underground utilities for all new buildings regardless of zone unless such installation is deemed infeasible by the utility.

<u>Property Protection</u>

- Encourage the use of structural techniques related to mitigation of wind damage in new structures to protect new buildings to a standard greater than the minimum building code requirements.

<u>Emergency Services</u>

- Require the use of structural mitigation techniques to harden new municipal critical facilities against wind damage.
- Consider locations where a micro-grid could be installed in New Milford.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

5.0 SUMMER STORMS AND TORNADOES

5.1 Setting

Like hurricanes and winter storms, summer storms and tornadoes have the potential to affect any area within the town of New Milford. Furthermore, because these types of storms and the hazards that result (flash flooding, wind, hail, and lightning) might have limited geographic extent, it is possible for a summer storm to harm one area within the town without harming another. The entire town of New Milford is therefore susceptible to summer storms (including heavy rain, flash flooding, wind, hail, and lightning) and tornadoes.

Based on the historic record, it is considered highly likely that a summer storm that includes lightning will impact the town of New Milford each year, although lightning strikes have a limited effect. Strong winds and hail are considered likely to occur during such storms but also generally have limited effects. A tornado is considered a possible event in Litchfield County each year that could cause significant damage to a small area (refer to Table 1-3 and Table 1-4).

5.2 Hazard Assessment

Heavy wind (including tornadoes and downbursts), lightning, heavy rain, hail, and flash floods are the primary hazards associated with summer storms. Flooding caused by heavy rainfall was covered in Section 3.0 of this HMP, and the effects of heavy wind were also discussed in Section 4.0. This chapter will primarily discuss specific types of wind events (tornadoes and downbursts) and other hazards associated with summer storms.

Tornadoes

NOAA defines a tornado as "a violently rotating column of air extending from a thunderstorm to the ground." The two types of tornadoes include those that develop from supercell thunderstorms and those that do not. While the physics of tornado development are fairly well understood, there are many unknowns still being studied regarding the exact conditions in a storm event required to trigger a tornado, the factors affecting the dissipation of a tornado, and the effect of cloud seeding on tornado development.

Supercell thunderstorms are long lived (greater than one hour) and highly organized storms feeding off an updraft that is tilted and rotating. This rotation is referred to as a "mesocyclone" when detected by Doppler radar. The figure below is a diagram of the anatomy of a supercell that has spawned a supercell tornado. Tornadoes that form from a supercell thunderstorm are a very small extension of the larger rotation; they are the most common and the most dangerous type of tornado as most large and violent tornadoes are spawned from supercells.

Non-supercell tornadoes are defined by NOAA as circulations that form without a rotating updraft. Damage from these types of tornadoes tends to be F2 or less (see Fujita Scale, below). The two types of non-supercell tornadoes are gustnadoes and landspouts.

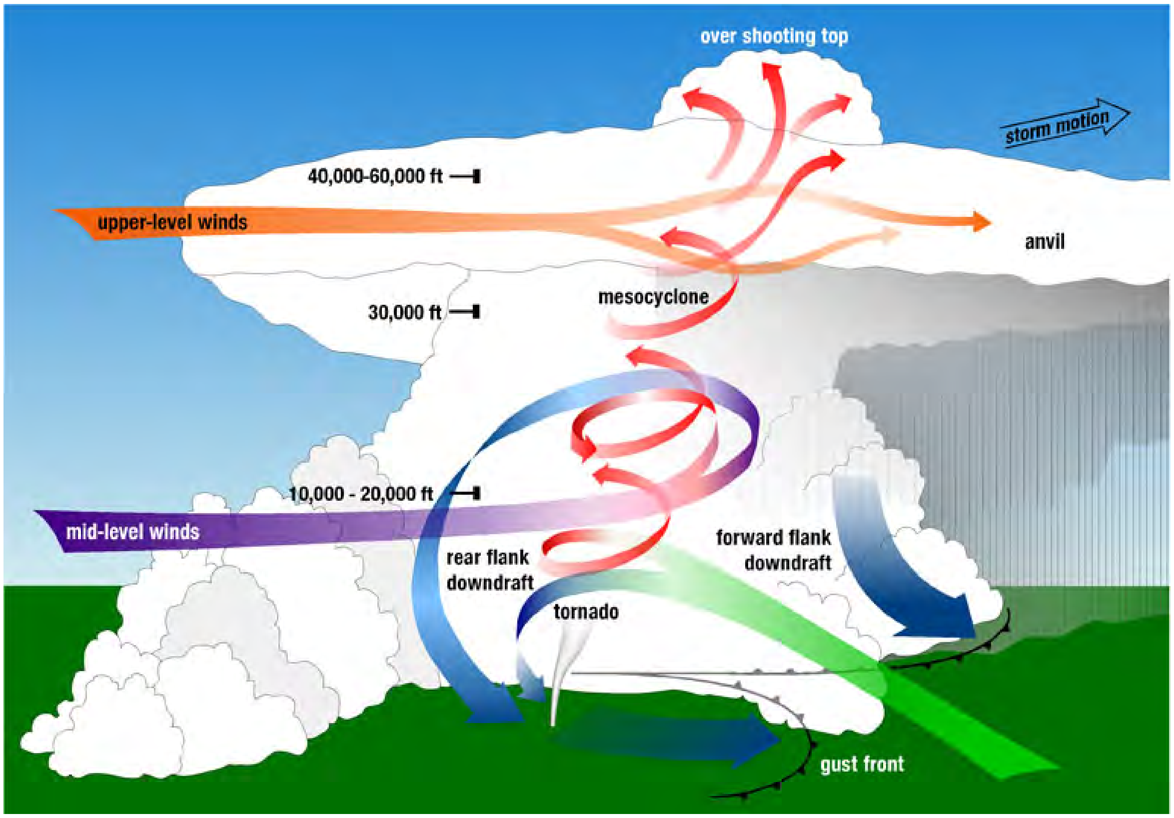
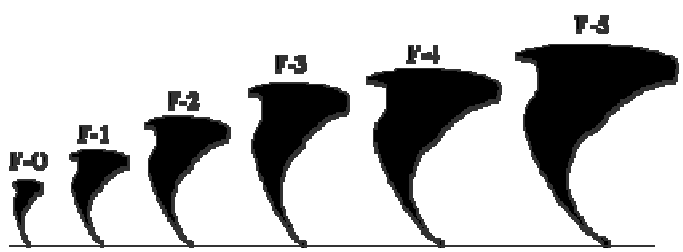


Figure 5-1: Anatomy of a Tornado. Image from NOAA National Severe Storms Laboratory.

- A gustnado is a whirl of dust or debris at or near the ground with no condensation tunnel that forms along the gust front of a storm.

- A landspout is a narrow, ropelike condensation funnel that forms when the thunderstorm cloud is still growing and there is no rotating updraft. Thus, the spinning motion originates near the ground. Waterspouts are similar to landspouts but occur over water.



Fujita Tornado Scale. Image courtesy of FEMA.

The Fujita Scale was accepted as the official classification system for tornado damage for many years following its publication in 1971. The Fujita Scale rated the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. The scale ranked tornadoes using the now-familiar notation of F0 through F5, increasing with wind speed and intensity. A description of the scale follows in Table 5-1.

Table 5-1
Fujita Scale

F-Scale Number	Intensity	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; branches broken off trees; shallow-rooted trees knocked over; damage to sign boards.
F1	Moderate tornado	73-112 mph	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off for some distance; cars thrown and large missiles generated.
F5	Incredible tornado	261-318 mph	Strong frame houses lifted off foundations and carried considerable distances to disintegrate; automobile-sized missiles fly through the air in excess of 100 meters; trees de-barked; steel-reinforced concrete structures badly damaged.

According to NOAA, weak tornadoes (F0 and F1) account for approximately 69% of all tornadoes. These tornadoes last an average of five to 10 minutes and account for approximately 3% of tornado-related deaths. Strong tornadoes (F2 and F3) account for approximately 29% of all tornadoes and approximately 27% of all tornado deaths. These storms may last for 20 minutes or more. Violent supercell tornadoes (F4 and above) are extremely destructive but rare and account for only 2% of all tornadoes. These storms sometimes last over an hour and result in approximately 70% of all tornado-related deaths.

The Enhanced Fujita Scale was released by NOAA for implementation on February 1, 2007. According to the NOAA website, the Enhanced Fujita Scale was developed in response to a number of weaknesses to the Fujita Scale that were apparent over the years, including the subjectivity of the original scale based on damage, the use of the worst damage to classify the tornado, the fact that structures have different construction depending on location within the United States, and an overestimation of wind speeds for F3 and greater.

Similar to the Fujita Scale, the Enhanced Fujita Scale is also a set of wind estimates based on damage. It uses three-second gusts estimated at the point of damage based on a judgment of eight levels of damage to 28 specific indicators. Table 5-2 relates the Fujita and Enhanced Fujita Scales.

Table 5-2
Enhanced Fujita (EF) Scale

Fujita Scale			Derived EF Scale		Operational EF Scale	
F Number	*Fastest 1/4-mile (mph)*	*3-Second Gust (mph)*	*EF Number*	*3-Second Gust (mph)*	*EF Number*	*3-Second Gust (mph)*
0	40-72	45-78	0	65-85	0	65-85
1	73-112	79-117	1	86-109	1	86-110
2	113-157	118-161	2	110-137	2	111-135
3	158-207	162-209	3	138-167	3	136-165
4	208-260	210-261	4	168-199	4	166-200
5	261-318	262-317	5	200-234	5	Over 200

Official records of tornado activity date back to 1950. According to NOAA, an average of 1,000 tornadoes is reported each year in the United States. The historic record of tornadoes near New Milford is discussed in Section 5.3. Tornadoes are most likely to occur in Connecticut in June, July, and August of each year.

Lightning

Image courtesy of NOAA.

Lightning is a discharge of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. According to NOAA, the creation of lightning during a storm is a complicated process that is not fully understood. In the initial stages of development, air acts as an insulator between the positive and negative charges. However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs.

In-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom. Cloud-to-cloud lightning occurs between the positive charges near the top of the cloud and the negative charges near the bottom of a second cloud. Cloud-to-ground lightning is the most dangerous. In summertime, most cloud-to-ground lightning occurs between the negative charges near the bottom of the cloud and positive charges on the ground.

According to NOAA's National Weather Service, there is an average of 100,000 thunderstorms per year in the United States. An average of 33 people per year died from lightning strikes in the United States from 2004 to 2013. Most lightning deaths and injuries occur outdoors, with 45% of lightning casualties occurring in open fields and ballparks, 23% under trees, and 14% involving water activities.

The historic record of lightning strikes both in Connecticut and near New Milford is presented in Section 5.3.

Downbursts

A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes in Connecticut. Depending on the size and location of downburst events, the destruction to property may be significant.

Downburst activity is, on occasion, mistaken for tornado activity. Both storms have very damaging winds (downburst wind speeds can exceed 165 miles per hour) and are very loud. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris such that the best way to determine the damage source is to fly over the area.

Downbursts fall into two categories:

- **Microbursts** affect an area less than 2.5 miles in diameter, last five to 15 minutes, and can cause damaging winds up to 168 mph.
- **Macrobursts** affect an area at least 2.5 miles in diameter, last five to 30 minutes, and can cause damaging winds up to 134 mph.

It is difficult to find statistical data regarding frequency of downburst activity. NOAA reports that there are 10 downburst reports for every tornado report in the United States. This implies that there are approximately 10,000 downbursts reported in the United States each year and further implies that downbursts occur in approximately 10% of all thunderstorms in the United States annually. This value suggests that downbursts are a relatively uncommon yet persistent hazard.

Hail

Hailstones are chunks of ice that grow as updrafts in thunderstorms keep them in the atmosphere. Most hailstones are smaller in diameter than a dime, but stones weighing more than 1.5 pounds have been recorded. NOAA has estimates of the velocity of falling hail ranging from nine meters per second (m/s) (20 mph) for a one centimeter (cm) diameter hailstone, to 48 m/s (107 mph) for an eight cm, 0.7 kilogram stone. While crops are the major victims of hail, larger hail is also a hazard to people, vehicles, and property.

According to NOAA's National Weather Service, hail caused two deaths and an average of 27 injuries per year in the United States from 2004 to 2013. Hailstorms typically occur in at least one part of Connecticut each year during a severe thunderstorm.

5.3 Historic Record

According to NOAA, the highest number of occurrences of tornadoes in Connecticut is in Litchfield (22 events between 1950 and 2009) and Hartford counties, followed by New Haven and Fairfield counties, and then Tolland, Middlesex, Windham, and finally New London County. NOAA reports that seven tornadoes have occurred in Litchfield County between 1996 and 2013.

An extensively researched list of tornado activity in Connecticut is available on Wikipedia. This list extends back to 1648 although it is noted that the historical data prior to 1950 is incomplete due to lack of official records and gaps in populated areas. Table 5-3 summarizes the tornado events near New Milford through July 2013 based on the Wikipedia list.

Table 5-3
Tornado Events near New Milford From 1648 to July 2013

Date	Location	Fujita Tornado Scale	Property Damage	Injuries / Deaths
August 17, 1784	Shipague-Neck (Roxbury, CT) to South Britain (Southbury, CT)	-	Ten houses, five barns, and three mills were badly damaged or destroyed	5 injured
August 9, 1878	South Kent	-	"Major damage"	None
August 21, 1951	New Milford, CT to Hartford County	F2	NR	9 injured
August 9, 1972	New Milford, CT	F1	NR	NR
July 3, 1974	Roxbury, CT to Woodbury, CT	F1	NR	NR
July 20, 1975	New Milford, CT	F1	NR	NR
July 5, 1992	New Fairfield, CT	F0	NR	NR
June 23, 2001	Washington, CT	F1	Two golf course buildings	1 injured
July 1, 2001	New Milford, CT to Roxbury, CT	F0	NR	NR
May 31, 2002	Brookfield, CT	F1	NR	NR
June 16, 2002	Lanesville (New Milford, CT)	F0	$10,000	NR

NR = None Reported

Five tornado events have been recorded in New Milford since 1951. The strongest was a long-tracked F2 tornado that touched down in New Milford and passed 40 miles into eastern Hartford County, injuring nine people.

Thunderstorms typically occur on 18 to 35 days each year in Connecticut. According to the NCDC, there have been a total of 11 days with a reported lightning strike in Litchfield County since 1996. Only 17 lightning-related fatalities occurred in Connecticut between 1959 and 2009, and only two have occurred since 2008. On June 8, 2008, lightning struck a pavilion at Hammonasset Beach in Madison, injuring four and killing one. On May 8, 2010, lightning struck three men fishing on a jetty at Seaside Park in Bridgeport, killing one and injuring two.

Hail is often a part of such thunderstorms as seen in the historic record for New Milford (below). According to the NCDC, there has been a total of 52 days with a hail event in Litchfield County since 1966. A limited selection of summer storm damage in and around New Milford, taken from the NCDC Storm Events database, is listed below:

- July 9, 1997 – Thunderstorms produced one-inch hail in New Milford in addition to causing flash flooding along the Aspetuck River as described in Section 3.3.

- November 4, 1997 – A line of showers and embedded thunderstorms produced lightning that destroyed the computer system at the New Milford public library and caused $20,000 in damage.

- July 1, 2001 – A powerful cold front produced a F0 tornado in New Milford. The tornado touched down along Route 37 near the Sherman/New Milford border and tracked along a discontinuous path east to Painter Hill in Roxbury. There were seven distinct touchdowns that caused snapped trees and limbs resulting in $75,000 in property damage. No injuries or fatalities were reported.

- June 16, 2002 – Severe thunderstorms produced a F0 tornado in Lanesville (southern New Milford) that caused tree damage along Route 7 approximately 0.4 miles south of the intersection of Cross Road. The path of the tornado was 25 yards wide and a quarter-mile long. Nickel-sized hail was also reported in New Milford.

- August 20, 2004 – A storm produced 0.75-inch diameter hail in New Milford.

- July 27, 2005 – Thunderstorm winds of 60 kts knocked numerous trees and power lines down in New Milford.

- July 19, 2007 – Straight line winds estimated at 85 mph to 95 mph downed numerous pine and poplar trees on Straight Rock Drive and Long Mountain Road in Gaylordsville in northwestern New Milford.

- June 14, 2008 – Severe thunderstorm winds knocked down multiple trees near Route 202 in New Milford.

- July 16, 2009 – Severe thunderstorms produced ping pong ball-sized hail along Route 202 in New Milford.

- July 26, 2009 – Severe thunderstorms produced nickel- to ping pong ball-sized hail along Route 202 in New Milford.

- October 7, 2009 – Strong winds blew down a few trees in New Milford, causing approximately $2,000 in property damage.

- April 29, 2010 – Strong wind gusts of up to 50 mph downed multiple trees in New Milford, causing approximately $2,000 in damage.

- December 1, 2010 – A cold front produced wind gusts of up to 55 mph that brought down power lines on Essex Road and Saxony Drive in New Milford.

- June 9, 2011 – Severe thunderstorms produced high winds that downed trees and power lines in New Milford. Dozens of trees were reported down across the Carmen Hill and Pumpkin Hill areas of the town. A tree was also reported down on a house.

- July 24, 2012 – Severe thunderstorms produced damaging winds and small hail, with nickel-sized hail being reported in New Milford on Wellsville Avenue. Trees and wires were reported down on Candlewood Mountain Road.

- July 26, 2012 – Thunderstorm winds produced widespread damage to trees in New Milford near Route 202.

- September 18, 2012 – Straight line winds associated with a thunderstorm brought down limbs on Route 37 and blew down a tree in a horse field adjacent to Candlewood Mountain Road.

- November 1, 2013 – Thunderstorm winds damaged trees and power lines near Route 202 in New Milford.

- May 27, 2014 – A collapsing thunderstorm produced 100-mph straight line winds that caused significant damage in New Milford. Many trees and branches were blown down, blocking roads and causing approximately 13,000 power outages. One person in New Milford died from electrocution when power lines were knocked onto his car. Storm damage was reported on West Meetinghouse Road, Upland road, Old Northville Road, Littlefield Road, Wellington Drive, Surrey Lane, Saxony Drive, Essex Road, Stone Castle Road, Archers Lane, Carriage Drive, Upper Reservoir Road, Old Park Lane Road, Park Lane East, Bradbury Road, Mulberry Lane, Ridge Road, Mallett Lane, Prospect Place, Prospect Place Extension, Prospect Street, Taylor Road, Town Farm Road, Beardsley Road, Waramaug Lane, Hine Hill Road, and on numerous minor roads between Paper Mill Road and Litchfield Road.

5.4 Existing Capabilities

Warning is the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. Tables 5-4 and 5-5 list the NOAA Watches and Warnings, respectively, as pertaining to actions to be taken by emergency management personnel in connection with summer storms and tornadoes.

Table 5-4
NOAA Weather Watches

Weather Condition	Meaning	Actions
Severe Thunderstorm	Severe thunderstorms are possible in your area.	Notify personnel and watch for severe weather.
Tornado	Tornadoes are possible in your area.	Notify personnel and be prepared to move quickly if a warning is issued.
Flash Flood	It is possible that rains will cause flash flooding in your area.	Notify personnel to watch for street or river flooding.

Table 5-5
NOAA Weather Warnings

Weather Condition	Meaning	Actions
Severe Thunderstorm	Severe thunderstorms are occurring or are imminent in your area.	Notify personnel and watch for severe conditions or damage (i.e., downed power lines and trees). Take appropriate actions listed in municipal emergency plans.
Tornado	Tornadoes are occurring or are imminent in your area.	Notify personnel, watch for severe weather, and ensure personnel are protected. Take appropriate actions listed in emergency plans.
Flash Flood	Flash flooding is occurring or imminent in your area.	Watch local rivers and streams. Be prepared to evacuate low-lying areas. Take appropriate actions listed in emergency plans.

Aside from warnings, several other methods of mitigation for wind damage are employed in New Milford as explained in Section 4.0. In addition, the Connecticut State Building Code includes guidelines for the proper grounding of buildings and electrical boxes.

A severe thunderstorm watch is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm (winds greater than 58 miles per hour, or hail three-fourths of an inch or greater, or can produce a tornado) is likely to develop.

A severe thunderstorm warning is issued when a severe thunderstorm has been sighted or indicated by weather radar.

Municipal responsibilities relative to summer storm and tornado mitigation and preparedness include:

- Developing and disseminating emergency public information and instructions concerning tornado, thunderstorm wind, lightning, and hail safety, especially guidance regarding in-home protection and evacuation procedures and locations of public shelters;
- Designating appropriate shelter space in the community that could potentially withstand lightning and tornado impact;
- Periodically testing and exercising tornado response plans;
- Putting emergency personnel on standby at tornado "watch" stage; and
- Utilizing the Everbridge emergency notification system to send warnings into potentially affected areas.

These protocols are considered effective for mitigating wind and summer storm-related damage in the town of New Milford. While additional funding could be utilized to strengthen the current level of mitigation, such funding is not currently considered cost-effective for the current level of vulnerability.

5.5 Vulnerabilities and Risk Assessment

Description – According to the *2014 Connecticut Natural Hazards Mitigation Plan*, Litchfield County is the most susceptible county in Connecticut to tornado activity. By virtue of its location in Litchfield County (high risk) but near Fairfield County (moderate risk), the town of New Milford has at least a moderate potential to experience tornado damage. Fortunately, New Milford has experienced only minor tornado damage. NOAA states that climate change has the potential to increase the frequency and intensity of tornadoes, so it is possible that the pattern of occurrence in Connecticut could change in the future.

Although tornadoes pose a threat to all areas of the state, their occurrence is not considered frequent enough in Connecticut to justify the construction of tornado shelters. Instead, the state has provided NOAA weather radios to all public schools as well as many local governments for use in public buildings. The general public continues to rely on mass media for knowledge of weather warnings, as supplemented by emergency notification system broadcasts. Warning time for tornadoes is very short due to the nature of these types of events, so pre-disaster response time can be limited. However, the NOAA weather radios and emergency notification systems provide immediate notification of all types of weather warnings in addition to tornadoes, making them very popular with communities.

The central and southern portions of the United States are at higher risk for lightning and thunderstorms than is the northeast. However, FEMA reports that more deaths from lightning occur on the East Coast than elsewhere. Lightning-related fatalities have declined in recent years due to increased education and awareness.

In general, thunderstorms and hailstorms in Connecticut are more frequent in the western and northern parts of the state and less frequent in the southern and eastern parts. Thunderstorms are expected to impact New Milford at least 20 days each year. The majority of these events do not cause any measurable damage. Although lightning is usually associated with thunderstorms, it can occur on almost any day. The likelihood of lightning strikes in the New Milford area is very high during any given thunderstorm although no one area of the town is at higher risk of lightning strikes. The risk of at least one hailstorm occurring in New Milford is considered moderate in any given year.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Straight-line winds occur as the first gust of a thunderstorm or from a downburst from a thunderstorm and have no associated rotation. Town personnel indicate that downbursts are the most common type of wind event that causes significant tree damage in New Milford. The risk of downbursts occurring during such storms and damaging the town of New Milford is believed to be likely for any given year (Table 1-3); for example, a severe downburst event struck New Milford and nearby Bridgewater on May 27, 2014, and other incidents are recorded in the historic record presented in Section 5.3 demonstrating that these events can occur in the region each year.

Town of New Milford personnel indicate that there is a wind corridor between several hills that often experiences straight line winds, with the most vulnerable areas being along Candlewood Lake Road North, Pumpkin Hill Road, Carmen Hill Road, and Ridge Road.

All areas of the town are susceptible to damage from high winds although more building damage is expected in the more densely populated Downtown area. More tree damage is expected in the less densely populated areas in the northern and eastern portions of the town, with the most vulnerable areas being the many ridges and hills located throughout New Milford.

Secondary damage from falling branches and trees is more common than direct wind damage to structures. Heavy winds can take down trees near power lines, leading to the start and spread of fires. Strong thunderstorms will cause power lines to fall anywhere in the town. Most downed power lines in New Milford are detected quickly, and any associated fires are quickly extinguished. Such fires can be extremely dangerous during the summer months during dry and drought conditions. It is important to have adequate water supply for fire protection to ensure the necessary level of safety is maintained (Section 9).

Similar to the discussion for hurricanes in Section 4.5, no critical facility is believed to be more susceptible to summer storm damage than any other. Some critical facilities are more susceptible than others to flooding damage due to summer storms. Such facilities susceptible to flooding damage were discussed in Section 3.5.

<u>*Loss Estimates*</u> – The *2014 Connecticut Natural Hazards Mitigation Plan* provides annual estimated losses on a countywide basis for several hazards. Based on the population of New Milford relative to Litchfield County, the annual estimated loss is $8,617 for thunderstorms and $229,412 for tornadoes. The very high figure for tornadoes is influenced by their infrequent

occurrence coupled with historical damages in Litchfield County, yet it is consistent with the fact that tornadoes *have occurred* in New Milford.

Summary – Most of the town of New Milford is at relatively equal risk for experiencing damage from summer storms and tornadoes. Areas of higher risk include those hilltops, ridges, and wind corridor areas that are considered more vulnerable to straight line winds. Based on the historic record, very few summer storms or tornadoes have resulted in costly damages to the town. Most damages are relatively site specific and occur to private property (and therefore are paid for by private insurance). For municipal property and roads, the Town budget for tree removal and minor repairs is generally adequate to handle the effects of summer storm damage.

5.6 Potential Mitigation Strategies and Actions

Most of the mitigation activities for summer storm and tornado wind damage are similar to those discussed in Section 4.6 and are not reprinted here. Natural resource protection projects are similar to those presented for flooding in Section 3.6.

More information is available at:
FEMA – http://www.fema.gov/library/ NOAA – http://www.nssl.noaa.gov/NWSTornado/

5.6.1 Prevention

Both the FEMA and the NOAA websites contain valuable information regarding preparing for and protecting oneself during a tornado as well as information on a number of other natural hazards. Available information from FEMA includes:

- Design and construction guidance for creating and identifying community shelters;
- Recommendations to better protect your business, community, and home from tornado damage, including construction and design guidelines for structures;
- Ways to better protect property from wind damage;
- Ways to protect property from flooding damage; and
- Construction of safe rooms within homes

NOAA information includes a discussion of family preparedness procedures and the best physical locations during a storm event. Residents should instead be encouraged to purchase a NOAA weather radio containing an alarm feature.

5.6.2 Property Protection

In addition to other educational documents, the Building Official should make literature available regarding appropriate design standards for grounding of structures.

5.6.3 Emergency Services

Warnings are critical to mitigating damage and casualties from hail, lightning, and tornadoes. These hazards can appear with minimal warning such that the ability to quickly notify a large area is critical. Emergency notification systems are the best method to inform the public when severe weather events may occur.

5.6.4 Public Education

Public education is the best way to mitigate damage from hail, lightning, and tornadoes. Annual pamphlets or messages, or information posted to the community website, can help to remind residents of potential dangers.

5.6.5 Structural Projects

Although tornadoes pose a legitimate threat to public safety, as stated in Section 5.2 their occurrence is considered too infrequent in Connecticut to justify the construction of tornado shelters. However, critical facilities should be hardened against potential tornado and summer storm damage.

5.7 Summary of Recommended Strategies and Actions

Several potential mitigation activities for addressing wind risks were addressed in Section 4.7. No additional mitigation activities related to summer storm or tornado damage are believed necessary at this time. Important recommendations that apply to all hazards are listed in Section 10.1.

6.0 WINTER STORMS

6.1 Setting

Similar to summer storms and tornadoes, winter storms have the potential to affect any area of the town of New Milford. However, unlike summer storms, winter events and the hazards that result (wind, snow, and ice) have more widespread geographic extent. The entire town of New Milford is susceptible to winter storms and, due to its variable elevation, can have higher amounts of snow in the outskirts of the town than in the Downtown area. In general, winter storms are considered highly likely to occur each year (although major storms are less frequent), and the hazards that result (nor'easter winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the town (refer to Table 1-3 and Table 1-4).

6.2 Hazard Assessment

This section focuses on those effects commonly associated with winter weather, including blizzards, freezing rain, ice storms, nor'easters, sleet, snow, winter storms and, to a secondary extent, extreme cold.

- **Blizzards** include winter storm conditions of sustained winds or frequent gusts of 35 mph or greater that cause major blowing and drifting of snow, reducing visibility to less than one-quarter mile for three or more hours. Extremely cold temperatures and/or wind chills are often associated with dangerous blizzard conditions.

- **Freezing Rain** consists of rain that freezes on objects, such as trees, cars, or roads and forms a coating or glaze of ice. Temperatures in the mid to upper atmosphere are warm enough for rain to form, but surface temperatures are below the freezing point, causing the rain to freeze on impact.

- **Ice Storms** are forecasted when freezing rain is expected to create ice build-ups of one-quarter inch or more that can cause severe damage.

- **Nor'easters** are the classic winter storm in New England, caused by a warm, moist, low pressure system moving up from the south colliding with a cold, dry high pressure system moving down from the north. The nor'easter derives its name from the northeast winds typically accompanying such storms, and such storms tend to produce a large amount of rain or snow. They usually occur between November 1 and April 1 of any given year, with such storms occurring outside of this period typically bringing rain instead of snow.

- **Sleet** occurs when rain drops freeze into ice pellets before reaching the ground. Sleet usually bounces when hitting a surface and does not stick to objects. It can accumulate like snow and cause a hazard to motorists.

- **Snow** is frozen precipitation composed of ice particles that forms in cold clouds by the direct transfer of water vapor to ice.

- **Winter Storms** are defined as heavy snow events that have a snow accumulation of more than six inches in 12 hours or more than 12 inches in a 24-hour period.

According to the National Weather Service, approximately 70% of winter deaths related to snow and ice occur in automobiles, and approximately 25% of deaths occur from people being caught in the cold. In relation to deaths from exposure to cold, 50% are people over 60 years old, 75% are male, and 20% occur in the home.

Impacts from severe winter weather can become dangerous and a threat to people and property. Most winter weather events occur between December and March although in 2011 Connecticut experienced a significant October snowstorm that left much of the state without power for a week. Winter weather may include snow, sleet, freezing rain, and cold temperatures. According to NOAA, winter storms were responsible for the death of 25 people per year from 2004 to 2013. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects include loss of power and heat, and flooding as a result of snowmelt.

Until recently, the Northeast Snowfall Impact Scale (NESIS) was used by NOAA to characterize and rank high-impact northeast snowstorms. This ranking system has evolved into the currently used Regional Snowfall Index (RSI). The RSI ranks snowstorms that impact the eastern two thirds of the United States, placing them in one of five categories: Extreme, Crippling, Major, Significant, and Notable. The RSI is based on the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population based on the 2000 census. RSI differs from NESIS in that it uses more refined geographic areas to define the population impact, resulting in a more region-specific analysis of a storm's impact. The use of population in evaluating impacts provides a measure of societal impact from the event. Table 6-1 presents the RSI categories, their corresponding RSI values, and a descriptive adjective.

Table 6-1
RSI Categories

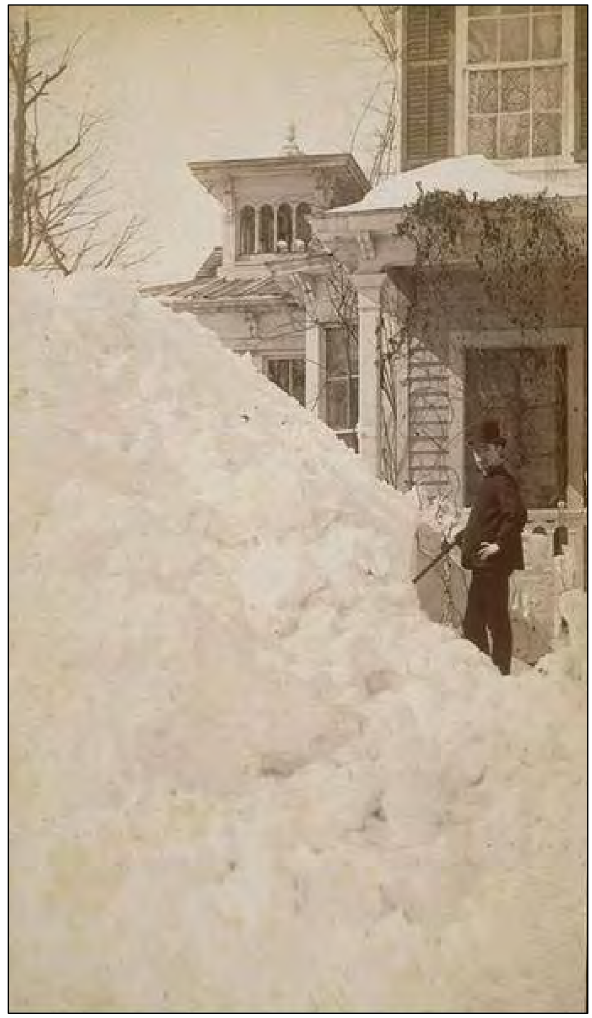
Category	RSI Value	Description
1	1-3	Notable
2	3-6	Significant
3	6-10	Major
4	10-18	Crippling
5	18.0+	Extreme

RSI values are calculated within a GIS. The aerial distribution of snowfall and population information are combined in an equation that calculates the RSI score, which varies from around one for smaller storms to over 18 for extreme storms. The raw score is then converted into one of the five RSI categories. The largest RSI values result from storms producing heavy snowfall over large areas that include major metropolitan centers. Approximately 200 of the most notable historic winter storms to impact the Northeast have been analyzed and categorized by RSI through February 2014.

6.3 Historic Record

The NCDC receives data from the Danbury Weather Station regarding snowfall. Mean annual snowfall is 38 inches per year, with a maximum of 85.6 inches recorded over 77 years of data.

The most significant blizzard to impact Connecticut occurred from March 11 through March 14, 1888. Nicknamed the "Great White Hurricane," the storm dropped 45 to more than 50 inches of snow in Connecticut with up to reportedly 80 mph wind gusts creating snow drifts 30 to 40 feet in height. The New York – New Haven railroad in Westport, Connecticut was closed for eight days while snowdrifts were removed. The storm shut down major cities throughout the Northeast. Over 400 people on the east coast died as a result of the blizzard, and fire stations were completely immobilized: Total damages from fire alone were estimated at over $25 million (1888 USD), and total damages in Connecticut were estimated at $20 million (1888 USD).



Shoveling through Danbury snowdrift after Blizzard of 1888. Image hosted by the website "Connecticut History Online" (http://www.cthistoryonline.org)

A February 1969 "Extreme" winter storm ranks highest for impact to the Northeast on the RSI scale. Over 20 inches of snow fell in the Northeast. The storm dropped an estimated 42 inches of snow in Maine while New York City and southern New England were heavily impacted. An estimated 94 people died and, for the first time in its history, Wall Street ceased trading due to the weather.

The most severe ice storm in Connecticut on record was Ice Storm Felix on December 18, 1973. This storm resulted in two deaths and widespread power outages throughout the state.

The Blizzard of February 1978 brought record snowfall amounts to several areas of Connecticut as heavy snow continued unabated for an unprecedented 33 straight hours. The State of Connecticut was essentially shut down for three days when all roads were ordered closed except for emergency travel. The storm was responsible for over 100 deaths, 4,500 injuries, and $520 million in damages (1978 USD). This storm is rated 5th overall by RSI as a "Major" storm.

Overall, a total of nine extreme, crippling, and major winter storms have occurred in Connecticut during the past 30 years. One is listed for each of the years 1993, 1996, 2003, 2007, 2010, 2013, and 2015. More alarmingly, two are listed in the calendar year 2010 along with two more significant storms, a significant storm in 2011, and a single major storm in 2013 and 2015. Considering nor'easters only, 11 major winter nor'easters have occurred in Connecticut during the past 30 years (in 1988, 1992, 1996, 2003, 2006, 2009, 2010, two in 2011, 2013 and 2015).

However, the most damaging winter storms are not always nor'easters. According to the NCDC, there have been 47 days with winter storms, 16 days with heavy snow, one day with an ice storm, and one day with a blizzard in Litchfield County since 1996. Additional examples of recent winter weather events to affect the New Milford area, taken from the NCDC database, include:

- March 13-14, 1993 – A massive, powerful storm dubbed the "Storm of the Century" caused "whiteout" blizzard conditions stretching from Jacksonville, Florida into eastern Canada and affected 26 states, producing 24 inches of snow in Hartford and up to 21 inches of snow in New Haven County. A total of 40,000 power outages and $550,000 in property damage was reported throughout Connecticut, and the state received a federal emergency declaration. The storm had a RSI rating of "Extreme" and is the 2nd highest ranking storm recorded by RSI.

- January 15-16, 1994 – A Siberian air mass brought record to near-record low temperatures across Connecticut. Strong northwest winds accompanied the cold and drove wind chill values to 30 to 50 degrees below zero.

- December 23, 1994 – An unusual snowless late December storm caused gale force winds across the state. The high winds caused widespread power outages affecting up to 130,000 customers statewide. Numerous trees and limbs were blown down, damaging property, vehicles, and power lines to a total of $5 million in damages. Peak wind gusts of up to 64 mph were reported.

- January 7-8, 1996 – Winter Storm Ginger caused heavy snow and shut down the state of Connecticut for an entire day. The state received a federal major disaster declaration. The storm had a RSI rating of "Extreme" and is the 3rd highest ranked storm by RSI.

- February 17, 2003 – A heavy snowstorm caused near-blizzard conditions and produced 24 inches of snow in areas of the state. The storm had a RSI rating of "Crippling" and is the 7th ranked winter storm by RSI. The State of Connecticut received a federal emergency declaration.

- January 18, 2006 – High winds of 60 kts brought down trees and power lines in New Milford.

- February 12-13, 2006 – This nor'easter is ranked 33rd overall as a "Significant" storm on the RSI scale. The storm produced 18 to 24 inches of snow across Connecticut, with ten to 16 inches of snow accumulating across southern Litchfield County. Five Connecticut counties received a federal emergency declaration.

- December 13, 2007 – A winter storm produced eight to 11 inches of snow in southern Litchfield County, creating treacherous travel conditions for the evening commute as many roads became impassable.

- February 12-13, 2008 – A winter storm produced a wintery mix of four to eight inches of snow and ice accretion of up to 0.25 inches across Litchfield County, creating treacherous travel conditions for the morning commute.

- December 11, 2008 – Freezing rain created treacherous travel conditions for the evening commute across portions of southern Litchfield County, with ice accretions up to 0.2 inches.

- Successive heavy snow storms from December 2010 through February 2011 caused more than 70 inches of snowfall in many areas of Connecticut and collapsed nearly 80 roofs across the state. These storms include the "Groundhog Day Blizzard of 2011" which was an ice storm that brought a mixture of snow, sleet, and freezing rain with a heavier second round of freezing rain and sleet. Using media reports, a list of roof/building collapses and damage due to buildup of snow was compiled. The list (Table 6-2, starting below this list) includes 76 locations that span over a month of time from January 12, 2011 to February 17, 2011. The storms resulted in a federal disaster declaration (FEMA-1958-DR) for the entire state.

The significant snow depths resulted in widespread shoveling efforts on roofs throughout New Milford, with Town staff clearing the flat roofs at the John Pettibone and Hill & Plain elementary schools and at the town library. Many barns and garages in New Milford experienced roof collapses, and the Canterbury School's ice arena roof also collapsed.

- October 29, 2011 – Winter Storm "Alfred" produced high winds and 12 to 18 inches of heavy wet snow across Connecticut. The combination of heavy snow on tree limbs and on fairly saturated ground caused widespread snapping and uprooting of trees and tree limbs. Over 830,000 customers were without power with some outages lasting 11 days or more. The storm resulted in ten deaths and caused over $3 billion in damage in Connecticut. Homes in New Milford were without electricity for approximately one week in outlying areas, with tree damage and power line damage being the biggest impact in the town. The Town of New Milford received assistance and reimbursements totaling approximately $800,000 from FEMA.

- January 31, 2013 – High winds of up to 60 mph downed trees and wires in New Milford, with power outages reported throughout southern Litchfield County.

- February 7-9, 2013 – A fierce nor'easter dubbed "Winter Storm Nemo" by the Weather Channel brought blizzard conditions to most of the Northeast, producing snowfall rates of five to six inches per hour in parts of Connecticut. RSI classified this storm as a "Major" storm. Many areas of the state received more than 40 inches of snowfall, with Litchfield County experiencing one to 2.5 feet. The storm caused more than 38,000 power outages statewide. Most roads in Connecticut were closed for two days. The Town of New Milford received a $103,000 reimbursement from FEMA for storm cleanup.

- February 14, 2014 – A winter storm brought widespread snowfall to southern Connecticut accompanied with some ice. Snowfalls ranged between 8 and 13" with freezing rain totaling three tenths of an inch. This was ranked "Significant" storm and listed 40th in the RSI storm rankings.

- January 26, 2015 – A strong nor'easter brought heavy snow and strong winds to Connecticut with blizzard conditions. Strong winds caused extreme cases of snow drifts and heavier accumulations in areas. This event was classified as a "Major" storm and listed 26th in the RSI ranking. This January storm resulted in a federal disaster declaration for the entire state.

Table 6-2
Reported Roof Collapse Damage, 2011

Address	Municipality	Date	Description
205 Wakelee Avenue	Ansonia	2/2/2011	Catholic Charities
Route 44	Barkhamsted	2/4/2011	Barkhamsted Highway Department Salt Shed
8 Railroad Avenue	Beacon Falls	2/2/2011	Manufacturing Corporation
20 Sargent Drive	Bethany	2/2/2011	Fairfield County Millworks
50 Hunters Trail	Bethany	2/2/2011	Sun Gold Stables
74 Griffin Road South	Bloomfield	2/14/2011	Home Depot Distribution Center
25 Blue Hill Road	Bozrah	1/27/2011	Kofkoff Egg Farm
135 Albany Turnpike	Canton	2/3/2011	Ethan Allen Design Center
520 South Main Street	Cheshire	1/12/2011	Cheshire Community Pool (Prior to recent ice storm)
1701 Highland Avenue	Cheshire	1/23/2011	Cox Communications
174 East Johnson Avenue	Cheshire	2/2/2011	First Calvary Life Family Worship Center
166 South Main Street	Cheshire	2/3/2011	George Keeler Stove Shop (Historic Building)
1755 Highland Avenue	Cheshire	2/7/2011	Nutmeg Utility Products
45 Shunpike Road (Route 372)	Cromwell	2/2/2011	K Mart (cracks inside and outside - no official collapse)
Cromwell Hills Drive	Cromwell	2/4/2011	Cromwell Gardens
98 West Street	Danbury	1/28/2011	Garage
142 N. Road (Route 140)	East Windsor	2/3/2011	Dawn Marie's Restaurant - Bassdale Plaza Shopping Center
3 Craftsman Road	East Windsor	2/4/2011	Info Shred
140 Mountain Road	Ellington	1/27/2011	Garage Collapse
100 Phoenix Avenue	Enfield	2/1/2011	Brooks Brothers
South Road	Enfield	2/2/2011	Bosco's Auto Garage
175 Warde Terrace	Fairfield	2/3/2011	Parish Court Senior Housing (Ceiling damage - 10 apartments)
19 Elm Tree Road	Glastonbury	2/6/2011	Residence
Unknown	Hampton	1/28/2011	Wood Hill Farm barn collapse - animals died
Gillette Street	Hartford	1/19/2011	Garage
West Street	Hebron	2/2/2011	Residential
Connecticut Route 101	Killingly	2/8/2011	Historic church converted to an office building
759 Boston Post Road	Madison	2/3/2011	Silver Moon, The Brandon Gallery, Madison Coffee Shop and Madison Cinemas (awning began to collapse)
478 Center Street	Manchester	1/28/2011	Lou's Auto Sales and Upholstery
1388 East Main Street	Meriden	1/28/2011	Jacoby's
260 Sherman Avenue	Meriden	2/6/2011	Engine 4 Fire Station
275 Research Parkway	Meriden	2/17/2011	Four Points by Sheraton Carport
1310 South Main Street	Middletown	1/30/2011	Passport Inn Building & Suites
505 Main Street	Middletown	2/2/2011	Accounting firm, converted, mixed use (3 story)
70 Robin Court	Middletown	2/3/2011	Madison at Northwoods Apartment

Table 6-2 (Continued)
Reported Roof Collapse Damage, 2011

80 North Main Street	Middletown	2/7/2011	Abandoned warehouse
Pepe's Farm Road	Milford	1/30/2011	Vacant manufacturing building
282 Woodmont Road	Milford	2/2/2011	Kip's Tractor Barn
150 Main St # 1	Monroe	2/2/2011	Monroe Paint & Hardware (Slumping roof, weld broke loose from structural beam)
Route 63	Naugatuck	1/21/2011	Former Plumbing Supply House
410 Rubber Avenue	Naugatuck	2/2/2011	Thurston Oil Company
1210 New Haven Road	Naugatuck	2/4/2011	Rainbowland Nursery School (structural damage)
1100 New Haven Road	Naugatuck	2/17/2011	Walmart (structural damage)
290 Goffe Street	New Haven	2/7/2011	New Haven Armory
201 South Main Street	Newtown	2/9/2011	Bluelinx Corp.
80 Comstock Hill Avenue	Norwalk	1/27/2011	Silvermine Stable
5 Town Line Road	Plainville	1/27/2011	Classic Auto Body
130 West Main Street	Plainville	2/2/2011	Congregational Church of Plainville
Terryville Section	Plymouth	1/12/2011	Public Works Garage (Terryville section) - taking plow trucks out
286 Airline Avenue	Portland	1/27/2011	Midstate Recovery Systems, LLC (waste transfer station)
680 Portland-Cobalt Road (Route 66)	Portland	1/27/2011	Vacant commercial property (next to Prehistoric Mini Golf - former True Value Hardware building)
Tryon Street	Portland	1/27/2011	Residential home (sunroof)
Main Street	Portland	1/28/2011	Middlesex Marina
93 Elm Street	Rocky Hill	2/6/2011	Residential garage
99 Bridgeport Avenue	Shelton	2/3/2011	Shell Gas Station
100 Maple Street	Somers	1/27/2011	Lindy Farms (barn)
68 Green Tree Lane	Somers	2/2/2011	Residential
95 John Fitch Boulevard	South Windsor	2/3/2011	South Windsor 10 Pin Bowling Alley
595 Nutmeg Road North	South Windsor	2/8/2011	Waldo Brothers Company
45 Newell Street	Southington	2/2/2011	Yarde Metals
Furnace Avenue	Stafford Springs	2/2/2011	Abandoned mill building
370 South Main Street	Terryville	2/8/2011	Former American Modular
46 Hartford Turnpike	Tolland	2/3/2011	Colonial Gardens
364 High Street	Tolland	2/9/2011	Horse barn
61 Monroe Turnpike	Trumbull	2/1/2011	Trumbull Tennis Center
5065 Main St # L1207	Trumbull	Unknown	Taco Bell
Route 83	Vernon	1/31/2011	Former Clyde Chevrolet
136 Dudley Avenue	Wallingford	1/27/2011	Tri State Tires
1074 South Colony Road	Wallingford	1/29/2011	Zandri's Stillwood Inn
121 N. Main Street	Waterbury	2/2/2011	Former bowling alley (Sena's Lanes)
456 New Park Avenue	West Hartford	2/8/2011	Shell gas station
Island Lane	West Haven	1/27/2011	Commercial building
Unknown	Wethersfield	2/2/2011	Automotive center roof collapse; 10 cars damaged
50 Sage Park Road	Windsor	2/2/2011	Windsor High School (auditorium roof collapse)
1001 Day Hill Road	Windsor	2/7/2011	Mototown USA
27 Lawnacre Road	Windsor Locks	2/7/2011	Long View RV

6.4 Existing Capabilities

Existing programs applicable to inland flooding and wind are the same as those discussed in Sections 3.0 and 4.0. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks, tree trimming to protect power lines, and other associated snow removal and response preparations. Other programs are aimed at warning residents about potential winter hazards, such as making educational pamphlets available at municipal buildings.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important for municipalities to budget fiscal resources toward snow management. In extreme years, such as the winter of 2010-2011, this budget can be quickly eclipsed and must be supplemented from other budget sources. In New Milford, the Public Works Department has an annual budget allotment for plowing town roads. The Building Official and the Public Works Department are available to assist town departments with snow removal and structural assessments of buildings, as occurred after the heavy snowfalls in January 2011.

Plowing is performed along 23 established plowing routes, although priority is given to plowing egresses to critical facilities. During emergencies, a plow vehicle can be temporarily rerouted to clear the route ahead of an emergency vehicle.

Connecticut DOT plows all state roads, while staff from the Public Works Department plows all 210 miles of town roads. The Public Works Department has 30 plow trucks with sanders that are either permanently attached or can be seasonally installed onto fleet vehicles. Homeowners, private associations, and businesses are responsible for plowing their own driveways, private roads, and sidewalks. The Public Works Department maintains a sand and salt pile that residents may use to sand their driveways and sidewalks during the winter.

Prior to a winter weather event, Town staff ensure that all warning/notification and communications systems are ready and ensure that appropriate equipment and supplies, especially snow removal equipment, are in place and in good working order. Pre-storm treatment is typically applied to roadways to reduce the accumulation of snow. The Town also prepares for the possible evacuation and sheltering of some populations that could be impacted by the upcoming storm (especially the elderly and special needs persons as identified in Section 2.6). The Public Works Director can also declare a “Snow Emergency and Parking Ban” which bans parking on certain designated streets in order to allow plowing to occur when snow is expected to accumulate. The ban is issued to the media via press release.

Overall, these programs are considered effective at mitigating the effects of winter storms. While additional budget could support these programs, the amount of experience that local personnel have in managing winter storm events makes it unlikely that a significant additional benefit could be achieved with additional funding.

6.5 Vulnerabilities and Risk Assessment

Description – Based on the historic record in Section 6.3, Connecticut experiences at least one major nor'easter every four years although a variety of minor and moderate snow and ice storms occur nearly every winter. According to the *2014 Connecticut Natural Hazards Mitigation Plan*, Connecticut residents can expect at least two or more severe winter weather events per season, including heavy snowstorms, potential blizzards, nor'easters, and potential ice storms. Fortunately, catastrophic ice storms are relatively less frequent in Connecticut than the rest of New England due to the close proximity of the warmer waters of the Atlantic Ocean and Long Island Sound.

According to the *2014 Connecticut Natural Hazards Mitigation Plan*, recent climate change studies predict a shorter winter season for Connecticut (by as much as two weeks) and less snow-covered days with a decreased overall snowpack. These models also predict that fewer, more intense precipitation events will occur with more precipitation falling as rain rather than snow. This trend suggests that future snowfalls will consist of heavier (denser) snow, and the potential for ice storms will increase. Such changes will have a large impact on how the state and its communities manage future winter storms and will affect the impact such storms have on the residents, roads, and utilities in the state.

The amount of snowfall and freezing precipitation in the town of New Milford can be elevation-dependent during winter storms. As the population of New Milford increases and more areas (particularly in the higher elevations in the southern portion of town) are developed, the vulnerability of New Milford residents to the effects of winter storms will increase. There is a high probability for traffic accidents and traffic jams during heavy snow and light icing events. Roads may become impassable, inhibiting the ability of emergency equipment to reach trouble spots and the accessibility of medical and shelter facilities.

After a storm, snow piled on the sides of roadways can inhibit sight lines and reflect a blinding amount of sunlight. When coupled with slippery road conditions, poor sightlines and heavy glare create dangerous driving conditions. Stranded motorists, especially senior and/or handicapped citizens, are at particularly high risk of injury or death from exposure during a blizzard. The elderly population in New Milford, in particular, are susceptible to the impacts created by winter storms due to resource needs (heat, electricity loss, safe access to food, etc.).

The structures and utilities in the town of New Milford are vulnerable to a variety of winter storm damage. Tree limbs and some building structures may not be suited to withstand high wind and snow loads. Ice can damage or collapse power lines, render steep gradients impassable for motorists, undermine foundations, and cause "flood" damage from freezing water pipes in basements. Drifting snow can occur after large storms, but the effects are generally mitigated through municipal plowing efforts. For example, the northern section of the town has traditionally experienced snow drift accumulation, especially along Merryall Road, Geiger Road, and Ridge Road. A few roads are narrow and require bucket loaders to plow effectively.

Icing causes difficult driving conditions throughout the hillier sections of the town. The Town's protocol of pretreating roads has been helpful in controlling ice in these problem areas. In addition, many of the historical icing problems in New Milford have been eliminated through drainage system improvements. However, icing remains an issue along Route 7 in the southern portion of town due to drainage issues.

Similar to the discussion for hurricanes and summer storms in the previous two sections, no critical facilities are believed to be more susceptible to winter storm damage than any other. Some critical facilities are more susceptible than others to flooding damage due to winter storms. Such facilities susceptible to flooding damage were discussed in Section 3.5. Critical facilities should be evaluated for the maximum snow load that can safely be maintained before clearing is required.

Loss Estimates – The *2014 Connecticut Natural Hazards Mitigation Plan* provides annual estimated losses on a countywide basis for several hazards. Based on the population of New Milford relative to Litchfield County, the annual estimated loss is $14,395 for severe winter storms. The Town's public assistance reimbursements for Winter Storm Alfred (October 2011) and Winter Storm Nemo (February 2013) were significant, as noted in the bullet list on page 6-5.

Summary – The entire town of New Milford is at relatively equal risk for experiencing damage from winter storms although some areas (such as icing trouble spots and neighborhoods with a high concentration of flat roofs) are more susceptible. Based on the historic record, it is difficult to determine if any winter storms have resulted in costly damages to the town as damage estimates for severe storms are generally spread over an entire county. Many damages are relatively site specific and occur to private property (and therefore are paid for by private insurance) while repairs for power outages are often widespread and difficult to quantify to any one municipality.

For municipal property, the Town budget for tree removal and minor repairs is generally adequate to handle winter storm damage although the plowing budget is often depleted. In particular, the heavy snowfalls associated with the winters of 2010-2011 and 2014-2015 drained the Town's plowing budgets and raised a high level of awareness of the danger that heavy snow poses to roofs.

6.6 Potential Mitigation Measures, Strategies, and Alternatives

Potential mitigation measures for flooding caused by winter storms include those appropriate for flooding and wind damage. These were presented in Section 3.6 and Section 4.6. Winter storm mitigation measures must also address blizzard, snow, and ice hazards. These are emphasized below. Natural resource protection measures include those for flooding as presented in Section 3.6.5.

6.6.1 Prevention

Cold air, wind, snow, and ice cannot be prevented from impacting any particular region. Thus, mitigation is typically focused on property protection and emergency services (discussed below) and prevention of damage related to wind and flooding hazards.

Previous recommendations for tree limb inspections and maintenance in Sections 4.0 and 5.0 are thus applicable to winter storm hazards as well. As mentioned previously, utilities in New Milford should be placed underground where possible. This can occur in connection with new development and also in connection with redevelopment or roadway reconstruction work. Underground utilities cannot be directly damaged by heavy snow, ice, and winter winds.

6.6.2 Property Protection

Property can be protected during winter storms through the use of structural measures such as shutters, storm doors, and storm windows. Pipes should be adequately insulated to protect against freezing and bursting. Compliance with the amended Connecticut Building Code for wind speeds is necessary. Finally, as recommended in previous sections, dead or dangerous tree limbs overhanging homes should be trimmed. All of these recommendations should apply to new construction although they may also be applied to existing buildings during renovations.

FEMA has produced a Snow Load Safety Guidance Document. A copy is presented in Appendix F.

When flat roofs are utilized on structures, snow removal is important as the heavy load from collecting snow may eventually exceed the bearing capacity of the structure. This can occur in both older buildings as well as newer buildings constructed in compliance with the most recent building codes. The Town should develop plans to prioritize the removal of snow from critical facilities and other municipal buildings and have funding available for this purpose. Heating coils may also be used to melt or evaporate snow from publicly and privately owned flat roofs.

6.6.3 Emergency Services

Emergency services personnel should continue to identify areas that may be difficult to access during winter storm events and devise contingency plans to continue servicing those areas when regular access is not feasible. The creation of through streets within new developments increases the amount of egress for residents and emergency personnel into neighborhoods and should be promoted when possible.

Standardized plowing routes that prioritize access to and from critical facilities should be utilized as these facilities are primarily located along state and primary local roads. Residents should be made aware of the plow routes in order to plan how to best access critical facilities, perhaps via posting of the general routes on the Town website. Such routes should also be posted in other municipal buildings such as the library and the post office. It is recognized that plowing critical facilities may not be a priority to all residents as people typically expect their own roads to be cleared as soon as possible.

Available shelters should continue to be advertised and their locations known to the public prior to a storm event. In addition, existing mutual aid agreements with surrounding municipalities should be reviewed and updated as necessary to ensure help will be available when needed.

6.6.4 Public Education and Awareness

The public is typically more aware of the hazardous effects of snow, ice, and cold weather than they are with regard to other hazards discussed in this HMP. Nevertheless, people are still stranded in automobiles, get caught outside their homes in adverse weather conditions, and suffer heart failure while shoveling during each winter. Public education should therefore focus on safety tips and reminders to individuals about how to prepare themselves and their homes for cold and icy weather, including stocking homes, preparing vehicles, and taking care of themselves during winter storms.

Traffic congestion and safe travel of people to and from work can be mitigated by the use of staggered timed releases from work, pre-storm closing of schools, and later start times for companies. Many employers and school districts employ such practices. The Town should consider the use of such staggered openings and closings to mitigate congestion during and after severe weather events if traffic conditions warrant.

6.6.5 Structural Projects

While structural projects to completely eliminate winter storm damage are not possible, structural projects related to the mitigation of wind (Section 4.6) or flooding damage (Section 3.6) to structures can be effective in the mitigation of winter storm damage. Additional types of structural projects can be designed to mitigate icing due to poor drainage and other factors as well as performing retrofits for flat-roofed buildings such as heating coils or insulating pipes.

6.7 Summary of Recommended Strategies and Actions

Most of the recommendations in Section 3.6 for mitigating flooding and in Section 4.6 for mitigating wind damage are suitable for reducing certain types of damage caused by winter storms. These are not repeated in this subsection. The recommended mitigation strategies for mitigating wind, snow, and ice in the town of New Milford are listed below.

- ❑ Evaluate critical facilities for acceptable snow loading and develop a response plan to clear roofs when necessary.

In addition, important recommendations that apply to all hazards are listed in Section 10.1.

7.0 EARTHQUAKES

7.1 Setting

The entire town of New Milford is susceptible to earthquake damage. However, even though earthquake damage has the potential to occur anywhere both in the town as well as in the northeastern United States, the effects may be felt differently in some areas based on the type of geology. In general, earthquakes are considered a hazard that may possibly occur and that may cause significant effects to a large area of the town (Table 1-3 and Table 1-4).

7.2 Hazard Assessment

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time without warning.

The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake are determined by the use of the Richter scale and the Mercalli scale, respectively.

The Richter scale defines the magnitude of an earthquake. Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of earthquake waves recorded on instruments that have a common calibration. The magnitude of an earthquake is thus represented by a single instrumentally determined value recorded by a seismograph, which records the varying amplitude of ground oscillations.

The magnitude of an earthquake is determined from the logarithm of the amplitude of recorded waves. Being logarithmic, each whole number increase in magnitude represents a tenfold increase in measured strength. Earthquakes with a magnitude of about 2.0 or less are usually called microearthquakes and are generally only recorded locally. Earthquakes with magnitudes of 4.5 or greater are strong enough to be recorded by seismographs all over the world.

The effect of an earthquake on the earth's surface is called the intensity. The Modified Mercalli Intensity Scale consists of a series of key responses such as people awakening, movement of furniture, damage to chimneys, and total destruction. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It is an arbitrary ranking based on observed effects. A comparison of Richter magnitude to typical Modified Mercalli intensity is presented in Table 7-1.

Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known faults. Instead, earthquakes with epicenters in Connecticut are referred to as intraplate activity. Bedrock in Connecticut and New England in general is highly capable of transmitting seismic energy; thus, the area impacted by an earthquake in Connecticut can be four to 40 times greater than that of California. For example, the relatively strong earthquake that occurred in Virginia in 2011 was felt in Connecticut because the energy was transmitted over a great distance through hard bedrock. In addition, population density is up to 3.5 times greater in Connecticut than in California, potentially putting a greater number of people at risk.

Table 7-1
Comparison of Earthquake Magnitude and Intensity

Richter Magnitude	Typical Maximum Modified Mercalli Intensity
1.0 to 3.0	I
3.0 to 3.9	II - III
4.0 to 4.9	IV - V
5.0 to 5.9	VI - VII
6.0 to 6.9	VII - IX
7.0 and above	VIII - XII

The following is a description of the 12 levels of Modified Mercalli intensity from the USGS:

I. Not felt except by a very few under especially favorable conditions.
II. Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III. Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to the passing of a truck. Duration estimated.
IV. Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V. Felt by nearly everyone; many awakened. Some dishes and windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI. Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII. Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
IX. Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
XII. Damage total. Lines of sight and level are distorted. Objects thrown in the air.

The built environment in Connecticut includes old non-reinforced masonry that is not seismically designed. Those who live or work in non-reinforced masonry buildings, especially those built on filled land or unstable soils, are at the highest risk for injury due to the occurrence of an earthquake.

7.3 Historic Record

According to the Weston Observatory at Boston College, there were 150 recorded earthquakes in Connecticut between 1678 and 2014. The vast majority of these earthquakes had a magnitude of less than 3.0. The most severe earthquake in Connecticut's history occurred at East Haddam on May 16, 1791. Stone walls and chimneys were toppled during this quake.

Additional instances of seismic activity occurring in and around Connecticut are provided below, based on information provided in USGS documents, the Weston Observatory, the 2010 *Connecticut Natural Hazard Mitigation Plan Update*, other municipal hazard mitigation plans, and newspaper articles.

- A devastating earthquake near Three Rivers, Quebec on February 5, 1663 caused moderate damage in parts of Connecticut.
- Strong earthquakes in Massachusetts in November 1727 and November 1755 were felt strongly in Connecticut.
- The May 16, 1791 East Haddam quake was estimated as a 4.4 magnitude by Weston Observatory.
- In April 1837, a moderate tremor occurred at Hartford, causing alarm but little damage.
- In August 1840, another moderate tremor with its epicenter 10 to 20 miles north of New Haven shook Hartford buildings but caused little damage.
- In October 1845, an Intensity V earthquake occurred in Bridgeport. An Intensity V earthquake would be approximately 4.3 on the Richter scale.
- On June 30, 1858, New Haven and Derby were shaken by a moderate tremor.
- On July 28, 1875, an early morning tremor caused Intensity V damage throughout Connecticut and Massachusetts.
- The second strongest earthquake to impact Connecticut occurred near Hebron on November 14, 1925. No significant damage was reported.
- The Timiskarning, Ontario earthquake of November 1935 caused minor damage as far south as Cornwall, Connecticut. This earthquake affected one million square miles of Canada and the United States.
- An earthquake near Massena, New York in September 1944 produced mild effects in Hartford, Marion, and New Haven, Connecticut.
- An Intensity V earthquake was reported in Stamford in March 1953, causing shaking but no damage.
- On November 3, 1968, another Intensity V earthquake in southern Connecticut caused minor damage in Madison and Chester.
- Recent earthquake activity has been recorded near New Haven in 1988, 1989, and 1990 (2.0, 2.8, and 2.8 in magnitude, respectively), in Greenwich in 1991 (3.0 magnitude), and on Long Island in East Hampton, New York in 1992.
- A noticeable earthquake occurred in Connecticut on March 11, 2008. It was a 2.0 magnitude with its epicenter three miles northwest of the center of Chester.
- A magnitude 5.0 earthquake struck at the Ontario-Quebec border region of Canada on June 23, 2010. This earthquake did not cause damage in Connecticut but was felt by residents in Hartford and New Haven Counties.
- A magnitude 3.9 earthquake occurred 117 miles southeast of Bridgeport, Connecticut on the morning of November 30, 2010. The quake did not cause damage in Connecticut but was felt by residents along Long Island Sound.

- A magnitude 2.1 quake occurred near Stamford, Connecticut on September 8, 2012. Dozens of residents reported feeling the ground move. No injuries were reported.
- An earthquake with a magnitude 2.1 was recorded near southeastern Connecticut on November 29, 2013. The earthquake did not cause damage but was felt by residents from Montville to Mystic.
- A magnitude 2.7 quake occurred beneath the Town of Deep River on August 14, 2014.
- A series of quakes hit Plainfield, Connecticut on January 8, 9, and 12, 2015. These events registered magnitudes of 2.0, 0.4, and 3.1, respectively. Residents in the Moosup section of Plainfield reported minor damage such as the tipping of shelves and fallen light fixtures.

An earthquake of special consideration was the magnitude 5.8 earthquake that occurred 38 miles from Richmond, Virginia on August 23, 2011. The quake was felt from Georgia to Maine and reportedly as far west as Chicago. Many residents of Connecticut experienced the swaying and shaking of buildings and furniture during the earthquake although widespread damage was constrained to an area from central Virginia to southern Maryland. According to Cornell University, the August 23 quake was the largest event to occur in the east central United States since instrumental recordings have been available to seismologists.

In the nearby town of Bethel, the earthquake event of August 23, 2011 caused the Bethel Municipal center to be evacuated for two hours to assess for possible damage. Although none was found, this experience demonstrates that earthquakes pose real risk to structures in Connecticut.

7.4 Existing Capabilities

The Connecticut Building Codes include design criteria for buildings specific to each municipality as adopted by the Building Officials and Code Administrators (BOCA). These include the seismic coefficients for building design in the town of New Milford. The Town has adopted these codes for new construction, and they are enforced by the Building Official. Due to the infrequent nature of damaging earthquakes, land use policies in the Town do not directly address earthquake hazards. However, various regulations do indirectly discuss areas susceptible to earthquake damage such as steep slopes.

In the event that a damaging earthquake occurs, the Town of New Milford will activate its EOP and initiate emergency response procedures as necessary.

7.5 Vulnerabilities and Risk Assessment

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. In addition, artificial fill material has the potential for liquefaction. When liquefaction occurs, the strength of the soil decreases, and the ability of soil to support building foundations and bridges is reduced. Increased shaking and liquefaction can cause greater damage to buildings and structures and a greater loss of life.

Liquefaction is a phenomenon in which the strength and stiffness of a soil are reduced by earthquake shaking or other rapid loading. It occurs in soils at or near saturation and especially in finer textured soils.

As explained in Section 2.3, several areas in the town of New Milford are underlain by sand and gravel, particularly within the valleys associated with the major streams. Figure 2-4 depicts surficial materials in the town. Structures in these areas are at increased risk from earthquakes due to amplification of seismic energy and/or collapse. The best mitigation for future development in areas of sandy material may be application of the most stringent building codes or possibly the prohibition of new construction. However, many of these areas occur in floodplains associated with the various streams in New Milford, so they are already regulated. The areas that are at the least risk during an earthquake due to unstable soils are the areas in Figure 2-4 underlain by glacial till, which includes most of the town.

Areas of steep slopes can collapse during an earthquake, creating landslides. Seismic activity can also break utility lines such as water mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMP, dam failure has been addressed separately in Section 9.0.

The AEL is the expected losses due to earthquakes each year. Note that this number represents a long-term average; thus, actual earthquake losses may be much greater or nonexistent for a particular year.

According to the FEMA HAZUS-MH Estimated Annualized Earthquake Losses for the United States (2008) document, FEMA used probabilistic curves developed by the USGS for the National Earthquakes Hazards Reduction Program to calculate Annualized Earthquake Losses (AEL) for the United States. Based on the results of this study, FEMA calculated the AEL for Connecticut to be $11,622,000. This value placed Connecticut 30th out of the 50 states in terms of AEL. The magnitude of this figure stems from the fact that Connecticut has a large building inventory that would be damaged in a severe earthquake.

According to the *2014 Connecticut Natural Hazards Mitigation Plan*, Connecticut is at a low to moderate risk for experiencing an earthquake of a magnitude greater than 3.5 and at a moderate risk of experiencing an earthquake of a magnitude less than 3.0 in the future. No earthquake with a magnitude greater than 3.5 has occurred in Connecticut within the last 30 years, and the USGS currently ranks Connecticut 43rd out of the 50 states for overall earthquake activity.

A series of earthquake probability maps was generated using the 2009 interactive web-based mapping tools hosted by the USGS. These maps were used to determine the probability of an earthquake of greater than magnitude 5.0 or greater than magnitude 6.0 damaging the town of New Milford. Results are presented in Table 7-2 below.

Table 7-2
Probability of a Damaging Earthquake in the Vicinity of New Milford

Time Frame (Years)	Probability of the Occurrence of an Earthquake Event > Magnitude 5.0	Probability of the Occurrence of an Earthquake Event > Magnitude 6.0
50	1% to 2%	< 1%
100	3% to 4%	< 1%
250	8% to 10%	1% to 3%
350	10% to 15%	2% to 4%

Based on the historic record and the probability maps generated from the USGS database, the state of Connecticut possesses areas of seismic activity. It is likely that Connecticut will continue to experience minor earthquakes (magnitude less than 3.0) in the future. While the risk of an earthquake affecting New Milford is relatively low over the short term, long-term probabilities suggest that a damaging earthquake (magnitude greater than 5.0) could occur within the vicinity of New Milford.

As a damaging earthquake would likely affect a large area beyond the town of New Milford, it is likely that the community may not be able to receive significant regional aid for a few days. It is important for municipal facilities and departments to have adequate contingency plans and supplies to ensure that restoration activities may proceed until outside assistance may be provided.

HAZUS-MH Simulations

The *2014 Connecticut Natural Hazards Mitigation Plan* identifies four "maximum plausible" earthquake scenarios (three historical, one potential) within HAZUS-MH to generate potential earthquake risk to the State of Connecticut. The same four scenarios were simulated within HAZUS-MH to generate potential damages in New Milford from those events using the default year 2000 building inventories and census data. The four events are as follows:

- ❑ Magnitude 5.7, epicenter in Portland, CT, based on historic event
- ❑ Magnitude 5.7, epicenter in Haddam, CT, based on historic event
- ❑ Magnitude 6.4, epicenter in East Haddam, CT, based on historic event
- ❑ Magnitude 5.7, epicenter in Stamford, CT, magnitude based on USGS probability mapping

The results for each HAZUS-MH earthquake simulation are presented in Appendix E and presented below. These results are believed conservative and considered appropriate for planning purposes in New Milford. Note that potentially greater impacts could also occur.

Table 7-3 presents the number of residential buildings (homes) damaged by the various earthquake scenarios, while Table 7-4 presents the total number of buildings damaged by each earthquake scenario. A significant percentage of building damage is to single-family residential buildings, while other building types include agriculture, commercial, education, government, industrial, other residential, and religious buildings. The exact definition of each damage state varies based on building construction. See Chapter 5 of the *HAZUS-MH Earthquake Model Technical Manual*, available on the FEMA website, for the definitions of each building damage state based on building construction.

Table 7-3
HAZUS-MH Earthquake Scenarios – Number of Residential Buildings Damaged

Epicenter Location and Magnitude	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage	Total
Haddam – 5.7	258	44	3	None	305
Portland – 5.7	296	52	5	None	353
Stamford – 5.7	587	123	11	None	721
East Haddam – 6.4	824	190	19	2	1,035

Table 7-4
HAZUS-MH Earthquake Scenarios – Total Number of Buildings Damaged

Epicenter Location and Magnitude	Slight Damage	Moderate Damage	Extensive Damage	Complete Damage	Total
Haddam – 5.7	293	55	5	None	353
Portland – 5.7	336	65	6	None	407
Stamford – 5.7	662	154	15	1	832
East Haddam – 6.4	928	238	26	2	1,194

The HAZUS simulations consider a subset of critical facilities termed "essential facilities" which are important during emergency situations. As shown in Table 7-5, minor damage to essential facilities is expected for each earthquake scenario.

Table 7-5
HAZUS-MH Earthquake Scenarios – Essential Facility Damage

Epicenter Location and Magnitude	Hospitals (1)	Fire Stations (2)	Police Stations (2)	Schools (7)
Haddam – 5.7	Minor damage (86% functionality); 53 out of 62 beds available	Minor damage (86% functionality)	Minor damage (86% functionality)	Minor damage (86% functionality)
Portland – 5.7	Minor damage (85% functionality); 52 out of 62 beds available	Minor damage (84% functionality)	Minor damage (85% functionality)	Minor damage (85% functionality)
Stamford – 5.7	Minor damage (76% functionality); 47 out of 62 beds available	Minor damage (78% functionality)	Minor damage (77% functionality)	Minor damage (76% functionality)
East Haddam – 6.4	Minor damage (71% functionality); 44 out of 62 beds available	Minor damage (71% functionality)	Minor damage (71% functionality)	Minor damage (71% functionality)

Table 7-6 presents potential damage to utilities and infrastructure based on the various earthquake scenarios. The HAZUS-MH software assumes that the New Milford transportation network and utility network includes the following:

- ❑ Highway: 37 major bridges and 11 major segments;
- ❑ Railway: 2 major segments;
- ❑ A potable water system consisting of 440 total kilometers of pipelines;
- ❑ A waste water system consisting of 264 total kilometers of pipeline and one facility; and
- ❑ A total of 176 kilometers of natural gas lines.

As shown in Table 7-6, highway bridges are simulated to experience minor damage under each earthquake scenario. Sewer and gas lines are expected to have leaks and breaks, but no loss of potable water or electrical service is expected. The software did not simulate any ignitions following the earthquake.

Table 7-6
HAZUS-MH Earthquake Scenarios – Utility, Infrastructure, and Fire Damage

Epicenter Location and Magnitude	Transportation Network	Utilities	Fire Damage
Haddam – 5.7	Minor damage to transportation infrastructure ($0.01 million to bridges)	1 leak in potable water system ($0.01 million) and 1 leak in waste water system (<$0.01 million). Damage to waste water system of $0.13 million. No loss of service expected. Total damage: Approximately $0.15 million.	No ignitions were simulated.
Portland – 5.7	Minor damage to transportation infrastructure ($0.01 million to bridges)	3 leaks and 1 major break in potable water system ($0.01 million) 1 leak in natural gas system and 1 leak in waste water system ($0.01 million). Damage to waste water facility of $0.20 million. No loss of service expected. Total damage: Approximately $0.22 million.	No ignitions were simulated.
Stamford – 5.7	Minor damage to transportation infrastructure ($0.03 million to bridges)	6 leaks and 2 major breaks in potable water system ($0.03million), 3 leaks and 1 major break in waste water system ($0.01 million) and 1 leak in natural gas system (<$0.01 million). Damage to waste water facility of $0.91 million. No loss of service expected. Total damage: Approximately $0.96 million.	No ignitions were simulated.
East Haddam – 6.4	Minor damage to transportation infrastructure ($0.26 million to bridges)	17 leaks and 4 major breaks in potable water system ($0.08 million), 8 leaks and 2 major breaks in waste water system ($0.04 million) and 3 leaks and 1 major break in natural gas system ($0.01 million). Damage to potable water facility of $0.80 million. No loss of service expected. Total damage: Approximately $0.93 million.	No ignitions were simulated.

Table 7-7 presents the estimated tonnage of debris that would be generated by earthquake damage during each HAZUS-MH scenario. As shown in Table 7-7, significant debris is simulated for each of the four earthquake scenarios, with the Stamford scenario generating the most debris for the town of New Milford.

Table 7-7
HAZUS-MH Earthquake Scenarios – Debris Generation (Tons)

Epicenter Location and Magnitude	Brick / Wood	Reinforced Concrete / Steel	Total	Estimated Cleanup Truckloads (25 Tons / Truck)
Haddam – 5.7	730	270	1,000	40
Portland – 5.7	720	280	1,000	40
Stamford – 5.7	2,680	1,320	4,000	160
East Haddam – 6.4	3,840	2,160	6,000	240

Table 7-8 presents the potential sheltering requirements based on the various earthquake events simulated by HAZUS-MH. The predicted sheltering requirements for earthquake damage (not including fire damage in Table 7-6) are relatively minimal even for the Stamford scenario. However, it is possible that an earthquake could also produce a dam failure (flooding) or be a contingent factor in another hazard event that could increase the overall sheltering need in the community.

Table 7-8
HAZUS-MH Earthquake Scenarios – Shelter Requirements

Epicenter Location and Magnitude	Number of Displaced Households	Short Term Sheltering Need (Number of People)
Haddam – 5.7	2	1
Portland – 5.7	3	1
Stamford – 5.7	7	4
East Haddam – 6.4	11	6

Table 7-9 presents the casualty estimates generated by HAZUS-MH for the various earthquake scenarios. Casualties are broken down into four severity levels that describe the extent of injuries. The levels are as follows:

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed;
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening;
- Severity Level 3: Injuries will require hospitalization and can become life-threatening if not promptly treated; and
- Severity Level 4: Victims are killed by the earthquake.

Table 7-9
HAZUS-MH Earthquake Scenarios – Casualty Estimates

Epicenter Location - Magnitude	2 AM Earthquake	2 PM Earthquake	5 PM Earthquake
Haddam – 5.7	1 (Level 1)	1 (Level 1)	1 (Level 1)
Portland – 5.7	1 (Level 1)	1 (Level 1)	1 (Level 1)
Stamford – 5.7	3 (Level 1)	3 (Level 1)	3 (Level 1)
East Haddam – 6.4	4 (Level 1)	4 (Level 1) 1 (Level 2)	4 (Level 1) 1 (Level 2)

Some casualties are expected due to earthquake damage in New Milford under each scenario, with the East Haddam scenario simulating the highest level of casualties including those requiring hospitalization. The casualty categories include commuters, educational, hotels, industrial, other residential, and single family residential, and are accounted for during the night, in the early afternoon, and during afternoon rush hour.

Table 7-10 presents the total estimated losses and direct economic impact that may result from the four earthquake scenarios created for New Milford as estimated by the HAZUS-MH software. Capital damage loss estimates include the subcategories of building, contents, and inventory damages. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building or its contents. Business interruption loss estimates include the subcategories of lost income, relocation expenses, and lost wages. The business interruption losses are associated with the inability to operate a business due to the damage sustained during an earthquake, and also include temporary living expenses for those people displaced from their home because of the storm. Note that these damages do not include transportation, utility, or fire damage in Table 7-6.

Table 7-10
HAZUS-MH Estimated Direct Losses from Earthquake Scenarios

Epicenter Location and Magnitude	Estimated Total Capital Losses	Estimated Total Income Losses	Estimated Total Losses
Haddam – 5.7	$4,240,000	$1,140,000	$5,380,000
Portland – 5.7	$5,240,000	$1,330,000	$6,570,000
Stamford – 5.7	$13,980,000	$3,220,000	$17,200,000
East Haddam – 6.4	$19,920,000	$5,170,000	$25,090,000

The maximum simulated damage considering direct losses and infrastructure losses is approximately $25.1 million for the East Haddam scenario. Note that the losses are presented in 2006 dollars, which implies that they will be greater in the future due to inflation. It is also believed that the next plan update will be able to utilize 2010 census data within HAZUS-MH, providing a more recent dataset for analysis.

Despite the low probability of occurrence of damaging earthquakes, earthquake damage presents a potentially significant hazard to the town of New Milford. Additional infrastructure not modeled by HAZUS-MH, such as water and sewer pumping stations, water storage tanks, the third fire station, and the emergency operations center could also be affected by an earthquake, so the results of this analysis for utility infrastructure may be low. However, it is very unlikely that the community would be at the epicenter of a damaging earthquake. Should a damaging earthquake occur in Connecticut, it is possible that some New Milford emergency personnel may be needed in other parts of the state that are harder hit by the earthquake.

7.6 Potential Mitigation Strategies and Actions

As earthquakes are relatively infrequent, difficult to predict, and can affect the entire community, potential mitigation can only include adherence to building codes, education of residents, and adequate planning. Natural resource mitigation to prevent earthquake damage is not possible.

7.6.1 Prevention

Communities may consider preventing new residential development in areas that are most at risk to collapse or liquefaction. Many Connecticut communities already have regulations restricting development on steep slopes and in floodplains. Additional regulations could be enacted to buffer development a certain distance from the bottom of steep slopes, or to prohibit development on fill materials and areas of fine sand and clay. The State Geologist indicates that such deposits have the highest risk for seismic wave amplification. Other regulations could specify a minimum level of compaction for filled areas before it is approvable for development.

7.6.2 Property Protection

Requiring adherence to current State building codes for new development and redevelopment is necessary to minimize the potential risk of earthquake damage.

7.6.3 Emergency Services

Departments providing emergency services should have backup plans and adequate backup facilities such as portable generators in place in case earthquake damage occurs to critical facilities, particularly public water and the waste water treatment infrastructure. The Public Works Department should also have adequate backup plans and facilities to ensure that roads can be opened as soon as possible after a major earthquake.

7.6.4 Public Education and Awareness

The fact that damaging earthquakes are rare occurrences in Connecticut heightens the need to educate the public about this potential hazard. An annual pamphlet outlining steps each family can take to be prepared for disaster is recommended. Also, because earthquakes generally provide little or no warning time, municipal personal and students should be instructed on what to do during an earthquake in a manner similar to fire drills.

7.6.5 Structural Projects

Critical facilities may be retrofitted to reduce potential damage from seismic events. Potential mitigation activities may include bracing of critical equipment such as generators, identifying and hardening critical lifeline systems, utilizing flexible piping where possible, and installing shutoff valves and emergency connector hoses where utilities cross fault lines. Potential seismic mitigation measures for all buildings include strengthening and retrofitting non-reinforced masonry buildings and non-ductile concrete facilities that are particularly vulnerable to ground shaking, retrofitting building veneers to prevent failure, installing window films to prevent injuries from shattered glass, anchoring rooftop-mounted equipment, and reinforcing masonry chimneys with steel bracing.

7.7 Summary of Recommended Strategies and Actions

The following potential mitigation measures have been identified:

- ❑ Enact regulations preventing new residential development in areas prone to collapse such as at the bottom of steep slopes.
- ❑ Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs to municipal buildings.

In addition, important recommendations that apply to all hazards are listed in Section 10.1

8.0 DAM FAILURE

8.1 Setting

Dam failures can be triggered suddenly, with little or no warning, and often from other natural disasters such as floods and earthquakes. Dam failures often occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. With numerous inventoried dams and potentially several other minor dams in the community, in addition to several significant dams located upstream in Kent, the effects of a dam failure could occur along almost any stream system in New Milford. While flooding from a dam failure generally has a moderate geographic extent, the effects are potentially catastrophic. Fortunately, a major dam failure is considered only a possible hazard event in New Milford in any given year (Table 1-3 and Table 1-4).

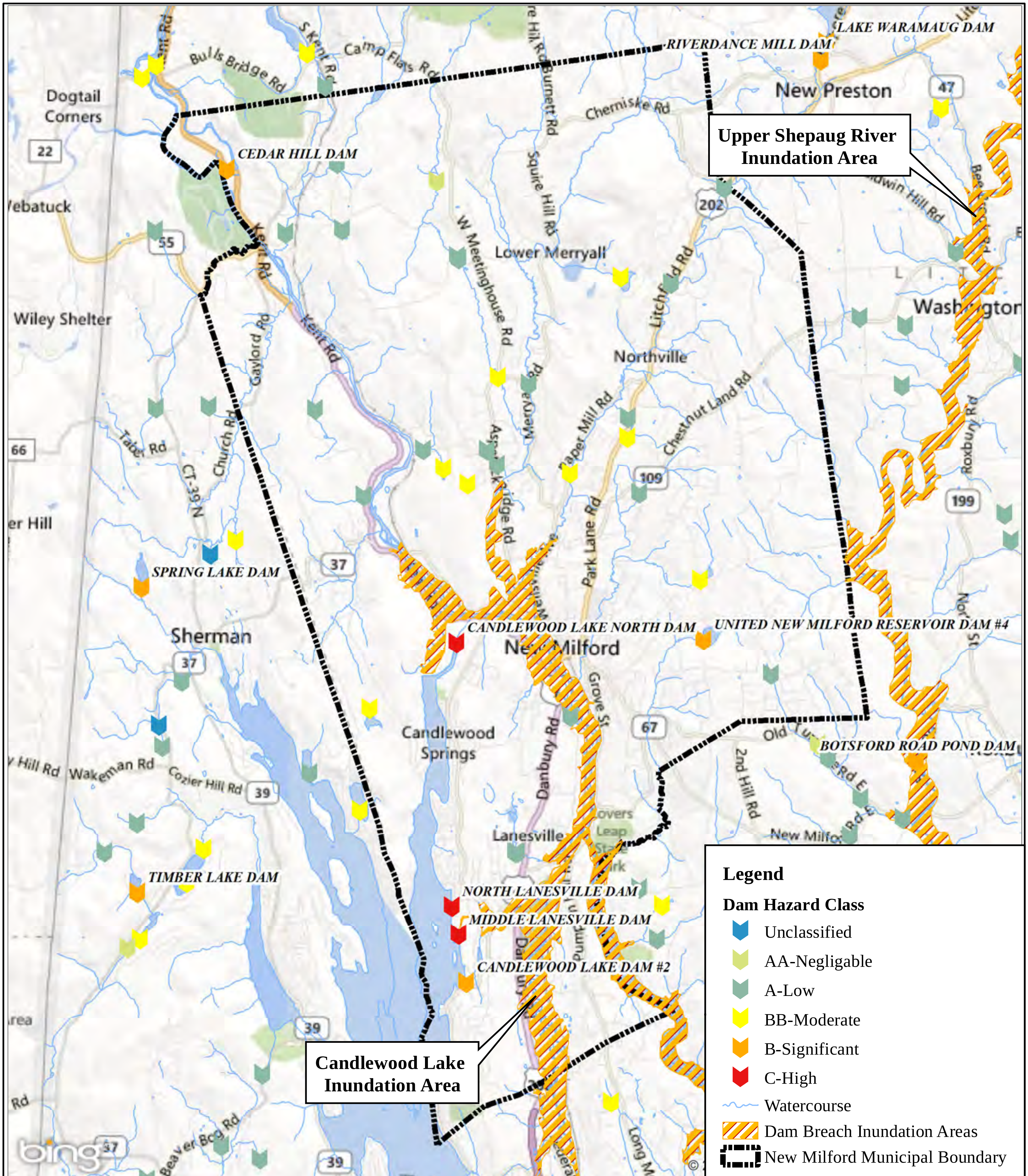
8.2 Hazard Assessment

The Connecticut DEEP administers the statewide Dam Safety Program and designates a classification to each state-inventoried dam based on its potential hazard.

- *Class AA* dams are negligible hazard potential dams that upon failure would result in no measurable damage to roadways and structures, and negligible economic loss.
- *Class A* dams are low hazard potential dams that upon failure would result in damage to agricultural land and unimproved roadways, with minimal economic loss.
- *Class BB* dams are moderate hazard potential dams that upon failure would result in damage to normally unoccupied storage structures, damage to low volume roadways, and moderate economic loss.
- *Class B* dams are significant hazard potential dams that upon failure would result in possible loss of life; minor damage to habitable structures, residences, hospitals, convalescent homes, schools, and the like; damage or interruption of service of utilities; damage to primary roadways; and significant economic loss.
- *Class C* dams are high potential hazard dams that upon failure would result in loss of life and major damage to habitable structures, residences, hospitals, convalescent homes, schools, and main highways with great economic loss.

As of October 1, 2013, there were 50 DEEP-inventoried dams within the town of New Milford. Three of these dams are considered high hazard (Class C), and three are considered to be significant hazard (Class B). Two additional significant hazard dams that could affect New Milford are located upstream in Washington, and one high hazard dam that could affect New Milford is located upstream in Danbury. These dams could cause flooding conditions in New Milford if a failure occurred (see Section 8.5). Dams in New Milford are shown on Figure 8-1.

This section primarily discusses the possible effects of failure of significant or high hazard (Class B and Class C) dams. Failure of a Class C dam has a high potential for loss of life and extensive property and infrastructure damage. As shown in Table 8-1, the high hazard dams in that may impact New Milford are owned by First Light Power Resources, a utility company.



SOURCE(S):
"Dams" "Dam Failure Inundation"
2013 CT DEEP
"Roads Base" Microsoft

Figure 8-1: Dam Location and Hazard Classifications

LOCATION:
New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure 8-1 New Milford Dam Locations and Hazard Classification.mxd

Map By: scottb
MMI#: 3101-14
Original: 01/31/2014
Revision: 7/21/2014
Scale: 1 in = 8,000 ft

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Table 8-1
High and Significant Hazard Dams with Potential to Affect New Milford

Number	Name	Location	Class	Owner
3404	Candlewood Lake South Dam	Candlewood Lake, Danbury	C	First Light Power Resources
9602	Candlewood Lake North Dam	Candlewood Lake, New Milford	C	First Light Power Resources
9604	United New Milford Reservoir #4 Dam	Town Farm Brook, New Milford	B	Town of New Milford
9609	Cedar Hill Dam	Housatonic River, New Milford	B	First Light Power Resources
9634	Candlewood Lake Dam #2	Candlewood Lake, New Milford	B	First Light Power Resources
9639	North Lanesville Dam	Candlewood Lake, New Milford	C	First Light Power Resources
9640	Middle Lanesville Dam	Candlewood Lake, New Milford	C	First Light Power Resources
15008	Lake Waramaug Dam	Lake Waramaug, Washington	B	Town of Washington

8.3 Historic Record

Approximately 200 notable dam and reservoir failures occurred worldwide in the 20th century. More than 8,000 people died in these disasters. The following is a listing of some of the more catastrophic dam failures in Connecticut's recent history:

- 1938 and 1955: Exact numbers of dam failures caused by these floods are unavailable, but the Connecticut DEEP believes that more dams were damaged in these events than in the 1982 event listed below or the 2005 dam failure events listed below.
- 1961: Crystal Lake Dam in Middletown failed, injuring three and severely damaging 11 homes.
- 1963: Failure of the Spaulding Pond Dam in Norwich caused six deaths and $6 million in damage.
- June 5-6, 1982: Connecticut experienced a severe flood that caused 17 dams to fail and seriously damaged 31 others. Failure of the Bushy Hill Pond Dam in Deep River caused $50 million in damages, and the remaining dam failures caused nearly $20 million in damages.

The Connecticut DEEP reported that the sustained heavy rainfall from October 7 to 15, 2005 caused 14 complete or partial dam failures and damage to 30 other dams throughout the state. A sample of damaged dams is summarized in Table 8-2.

The Association of State Dam Safety Officials states that no one knows precisely how many dam failures have occurred, but they have been documented in every state. From January 1, 2005 through June 2013, state dam safety programs reported 173 dam failures and 587 incidents requiring intervention to prevent failure.

Table 8-2
Dams Damaged Due to Flooding From October 2005 Storms

Number	Name	Location	Class	Damage Type	Ownership
-----	Somerville Pond Dam	Somers	--	Partial Breach	DEEP
4701	Windsorville Dam	East Windsor	BB	Minor Damage	Private
10503	Mile Creek Dam	Old Lyme	B	Full Breach	Private
-----	Staffordville Reservoir #3	Union	--	Partial Breach	CT Water Co.
8003	Hanover Pond Dam	Meriden	C	Partial Breach	City of Meriden
-----	ABB Pond Dam	Bloomfield	--	Minor Damage	Private
4905	Springborn Dam	Enfield	BB	Minor Damage	DEEP
13904	Cains Pond Dam	Suffield	A	Full Breach	Private
13906	Schwartz Pond Dam	Suffield	BB	Partial Breach	Private
14519	Sessions Meadow Dam	Union	BB	Minor Damage	DEEP

Town personnel could not recall any significant dam failures occurring in or affecting New Milford.

8.4 Existing Capabilities

The Dam Safety Section of the Connecticut DEEP Inland Water Resources Division is charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. The existing statutes require that permits be obtained to construct, repair, or alter dams and that existing dams be inventoried and periodically inspected to assure that their continued operation does not constitute a hazard to life, health, or property.

Dams permitted by the Connecticut DEEP must be designed to pass the 1% annual chance rainfall event with one foot of freeboard, a factor of safety against overtopping.

Significant and high hazard dams are required to meet a design standard greater than the 1% annual chance rainfall event.

The dam safety requirements are codified in Sections 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies have been enacted and set requirements for the registration, classification, and inspection of dams. Connecticut Public Act 83-38 (incorporated into 22a-401 through 22a-411) required that the owner of a dam or similar structure provide information to the Commissioner of DEEP by registering their dam by July 1, 1984.

Important dam safety program changes now effective in Connecticut. Public Act No. 13-197, *An Act Concerning the Dam Safety Program and Mosquito Control*, passed in June 2013 and describes new requirements for dams related to registration, maintenance, and EOPs, which will be called emergency action plans (EAPs) moving forward. This Act requires owners of certain unregistered dams or similar structures to register them by October 1, 2015. The Act generally shifts regularly scheduled inspection and reporting requirements from the DEEP to the owners of dams. The Act also makes owners generally responsible for supervising and inspecting construction work and establishes new reporting requirements for owners when the work is completed.

First Light Power Resources owns each of the dams that impound Candlewood Lake. The utility regularly monitors water levels at several locations in Candlewood Lake as well as on the Housatonic River. First Light Power Resources conducts a formal regulatory inspection of its high hazard dams a minimum of every two years in compliance with the Act, and also performs quarterly inspections at a minimum as required. The Town of New Milford and the Town of Washington perform formal regulatory inspections of their Class B dams every five years, and also perform quarterly inspections as required.

Dams found to be unsafe under the inspection program must be repaired by the owner. Depending on the severity of the identified deficiency, an owner is allowed reasonable time to make the required repairs or remove the dam. If a dam owner fails to make necessary repairs to the subject structure, the Connecticut DEEP may issue an administrative order requiring the owner to restore the structure to a safe condition and may refer noncompliance with such an order to the Attorney General's office for enforcement. As a means of last resort, the Connecticut DEEP Commissioner is empowered by statute to remove or correct, at the expense of the owner, any unsafe structures that present a clear and present danger to public safety.

Effective October 1, 2013, the owner of any high or significant hazard dam (Class B and C) must develop and implement an EAP after the Commissioner of DEEP adopts regulations. The EAP shall be updated every two years, and copies shall be filed with DEEP and the chief executive officer of any municipality that would potentially be affected in the event of an emergency. New regulations shall establish the requirements for such EAPs, including but not limited to (1) criteria and standards for inundation studies and inundation zone mapping; (2) procedures for monitoring the dam or structure during periods of heavy rainfall and runoff, including personnel assignments and features of the dam to be inspected at given intervals during such periods; and (3) a formal notification system to alert appropriate local officials who are responsible for the warning and evacuation of residents in the inundation zone in the event of an emergency.

Guidelines for dam EAPs were published by DEEP in 2012, creating a uniform approach for development of EAPs. As dam owners develop EAPs using the new guidance, DEEP anticipates that the quality of EOPs will improve, which will ultimately help reduce vulnerability to dam failures. The Town of New Milford has drafted an EAP for the United New Milford Reservoir #4. First Light Power Resources maintains EAPs for its Candlewood Lake Dams. The Town of Washington maintains an EOP for the Lake Waramaug Dam.

The CT DEEP also administers the Flood and Erosion Control Board program, which can provide noncompetitive state funding for repair of municipality-owned dams. Funding is limited by the State Bond Commission. State statute Section 25-84 allows municipalities to form Flood and Erosion Control Boards, but municipalities must take action to create the board within the context of the local government such as by revising the municipal charter.

The Town of New Milford subscribes to the CT Alert emergency notification system to provide warnings to Town residents. Residents must sign up for notification through the CT Alert website. The dam failure inundation mapping discussed in the next section can be used to ensure that contact information is available in potentially affected areas if the failure of a major dam is imminent. The Town of New Milford also regularly conducts emergency drills related to dam failure in cooperation with First Light Power Resources. Most recently, an exercise was held simulating the failure of Candlewood Lake South Dam in Danbury.

Overall, the Town of New Milford's capability to mitigate for dam failure and prevent loss of life and property has improved in recent years as the result of the recent statewide legislative actions described above. Over the next few years, it is anticipated that dam safety programs will continue to strengthen in Connecticut.

8.5 Vulnerabilities and Risk Assessment

A dam failure event would likely occur as part of a large flood event. The Town of New Milford believes that the town is vulnerable to dam failure with the potential for a large amount of damage particularly if one of the dams along Candlewood Lake were to fail. Fortunately, the dams maintained by First Light Power Resources are in good condition. In general, the Town believes that most of the dam failure concern lies with smaller public and private dams that may be poorly maintained.

In addition to the high and significant hazard dams with the potential to impact the town of New Milford identified in Table 8-1, the following dams were identified by the Town of New Milford of being of concern to the community. These dams are also discussed in this chapter:

- The United Water New Milford Reservoir #3 Dam in New Milford;
- The Bulls Bridge Dam in Kent; and
- The Bleachery Dam in New Milford.

Dam failure analyses have been prepared for many of the high hazard dams, and these are included in the EAPs. The inundation limits portrayed in the dam failure analysis maps represent *a highly unlikely, worst-case scenario (1,000-year) flood event and should be used for emergency action planning only*. As such, they are appropriate to identify properties from which contact information should be included in the Town's emergency notification database. These analyses should not be interpreted to imply that the dams evaluated are not stable, that the routine operation of the dams presents a safety concern to the public, or that any particular structure downstream of the dam is at imminent risk of being affected by a dam failure.

Candlewood Lake Dams

Five high and significant hazard dams are owned by First Light Power Resources on Candlewood Lake. Candlewood Lake is a seasonally pumped storage facility used to impound water for hydropower. Candlewood Lake has a maximum storage volume of 577,000 acre-feet and has a surface area of 5,610 acres at normal maximum water levels. The powerhouse is located seven miles downstream of the Bulls Bridge Dam near the confluence of the Rocky River in New Milford.

Electronic monitors have been installed in the weirs downstream of all dams and dikes impounding Candlewood Lake which trigger audio and visual alarms in the event of a leak at any location. This information is continually relayed to the Rocky River Plant in New Milford which is staffed 24 hours a day, 7-days a week. Thus, First Light Power Resources has the capability to immediately become aware of any potential problems at its dams and dikes on Lake Candlewood.

- *Candlewood Lake North Dam*

  The main dam (Candlewood Lake North Dam) impounds the lake upstream of the Rocky River approximately one mile upstream of the confluence of the Rocky River with the Housatonic River and impounds Candlewood Lake. This is the upper reservoir of the development with a contributing watershed of 40.4 square miles. The Candlewood Lake North Dam is an earth-filled structure with a 952 foot long core wall. It has a maximum height of 107 feet.

  A Dam Breach Analysis was prepared for the Danbury Dike in 1990. A breach model was prepared using the National Weather Service's DAMBREAK program, with the model extending downstream on the Housatonic River. A breach under "sunny day" non-flood conditions was performed. It was assumed that the breach would form within 60 minutes, and the simulation found that outflow from the breach would continue for several days. Inundation would reach the Shepaug Dam in approximately 72 minutes under either scenario.

  Failure of the Main Dam would cause extensive flooding downstream in New Milford in areas adjacent to the Housatonic River and along the Still River. Water levels would begin to rise in the Housatonic River 18 minutes after failure occurred. All low-lying areas along the Housatonic River and the Still River would need to be evacuated, as water levels could rise nearly 28 feet near the Rocky River power station and nearly 17 feet near Lovers Leap Gorge. Fortunately, given the continuous monitoring of the dam by First Light staff, it is unlikely that a dam breach would take the town completely by surprise.

  The Town of New Milford has concerns about the penstock that transfers water between Candlewood Lake and the Rocky River power station. Failure of the penstock could result in downstream flooding that could affect the downtown area in as few as 11 minutes. The wooden portion of the penstock reportedly has leaks in several places. First Light Power Resources has begun replacing sections of the penstock, so this problem should be alleviated within the next few years.

- *Middle Lanesville Dam*

  Three dikes were constructed in Lanesville at low points along the middle of the eastern shoreline of Candlewood Lake. The North Lanesville Dam (Class C) is a concrete structure 185 feet in length. The Candlewood Lake Dam #2 (Class B) is the southernmost structure and is a concrete gravity structure 520 feet in length. The Middle Lanesville Dam (Class C) lies between the other two structures and is an earth fill structure 260 feet in length. The crest elevation of these structures is each approximately 437 to 438 feet NGVD.

  A Dam Breach Analysis was prepared for the Middle Lanesville Dam in 1999. A breach model was prepared using the National Weather Service's DAMBREAK program, with the model extending downstream to the Shepaug Dam on the Housatonic River. Two analyses were performed, one under "sunny day" low flow conditions and another during the 1% annual chance flood on the Still River and the Housatonic River. It was assumed that the breach would form within 30 minutes, and models found that outflow from the breach would continue for several days under both scenarios. Inundation would reach the Shepaug Dam in approximately one hour under either scenario.

Failure of the Middle Lanesville Dam would cause extensive flooding downstream in New Milford. Portions of Skyview Drive, Sullivan Road, Larson Road, Route 7, Lanesville Road, Still River Drive, and Pumpkin Hill Road would likely be flooded with evacuations necessary, as some areas could experience an increase in water level of ten to 31 feet. Fortunately, given the continuous monitoring of the dam by First Light staff, it is unlikely that a dam breach would take the town completely by surprise. Based on the simulation, the breach wave will take less than 30 minutes to reach populated areas in New Milford.

- *Candlewood Lake South Dam*

The Candlewood Lake South Dam (Class C) impounds the southern end of Candlewood Lake in Danbury upstream of Beaver Brook, a tributary to the Still River. The dam consists of two earth-fill sections (the Main Dike and the Wing Dike) divided by a rock outcrop. The overall length of the dike is about 1,000 feet with a crest elevation of 440 feet NGVD.

A Dam Breach Analysis was prepared for the Danbury Dike in 1999. A breach model was prepared using the National Weather Service's DAMBREAK program, with the model extending from the Danbury dike downstream to the Shepaug Dam on the Housatonic River. Two analyses were performed, one under "sunny day" low flow conditions and another during the 100-year flood on the Still River and the Housatonic River. It was assumed that the breach would form within 30 minutes, and models found that outflow from the breach would continue for several days under both scenarios. Inundation would reach the Shepaug Dam in four hours under the 1% annual chance flood scenario, and in five hours under the "sunny day" scenario.

Failure of the Candlewood Lake South Dam would cause extensive flooding along the Still River Corridor in New Milford. Portions of Route 7, Aldrich Road, Cross Road, Erickson Road, Lanesville Road, Still River Drive, Pickett District Road, and Pumpkin Hill Road would likely be flooded with evacuations necessary, as some areas could experience an increase in water level of six to 22 feet. Fortunately, given the continuous monitoring of the dam by First Light staff, it is unlikely that a dam breach would take the town completely by surprise. Based on the simulation, the breach wave will take approximately four hours to reach New Milford.

United New Milford Reservoir #4

The United New Milford Reservoir #4 Dam is a Class B dam is located at the western end of the reservoir and impounds a storage volume of 54 acre-feet from a contributing watershed of 0.78 square miles. It is owned by the Town of New Milford and used for recreation. The earthen dam was constructed in 1900 and is 17 feet in height and 325 feet in length. The dam discharges to Town Farm Brook, which flows in a westerly direction through a predominantly forested and undeveloped region. The brook is conveyed beneath McMahon Road and Halpine Road. Floodwaters resulting from dam failure could potentially affect these roadway crossings and two residences on the east side of McMahon Road. A draft EAP has been prepared for this dam.

Cedar Hill Dam

The Cedar Hill Dam (Class B) is located at the western end of the seven-acre Cedar Hill Pond and impounds a storage volume of 445 acre-feet from a contributing watershed of 993 square miles.

It is owned by First Light Power Resources and used to impound a reservoir for hydropower. The earthen dam is 24 feet in height and 800 feet in length. Water is diverted at the Bulls Bridge Dam upstream on the Housatonic River into watercourse that flows nearly parallel to the Housatonic River on the east side of Kent Road that flows into the pond. The dam discharges to the Housatonic River through 400-foot long pipes that cross under Route 7 and through the power generating facility. Floodwaters from a structure failure would most likely inundate and damage a portion of Route 7. Floodwaters from a failure of the mountainside spillway would also likely inundate and damage a portion of Route 7.

<u>Lake Waramaug Dam</u>

The Lake Waramaug Dam (Class B) is located at the southern end of Lake Waramaug and impounds a 642-acre reservoir (the lake) from a contributing watershed of 14.4 square miles. It is owned by the Town of Washington and used for recreation. The masonry dam is three feet in height and 50 feet in length, and includes a spillway constructed of large cut stone blocks with stone training walls and gate house. The walls tie into West Shore Road embankments. Water passes under West Shore Road and travels 50 feet to the spillway crest, discharging to the East Aspetuck River. While buildings downstream of the dam in Washington along East Shore Road and its connectors are most likely to be impacted by flooding from failure of this dam, flooding conditions could also persist downstream along the East Aspetuck River into New Milford. Low-lying homes and roads are the most likely areas to be affected by flooding.

<u>United New Milford Reservoir #3 Dam</u>

The United New Milford Reservoir #3 Dam (Class BB) is located immediately upstream of Upper Reservoir Road and impounds a 8-acre pond from a contributing watershed of 0.59 square miles. It is owned privately owned and used for recreation. The earthen dam is 21 feet in height and 585 feet in length. Both the DEEP and Town personnel indicate that the dam is in poor condition, with the spillway butting up against the road. Failure of the dam would likely cause flooding of Upper Reservoir Road and Heacock-Crossbrook Road.

<u>Bulls Bridge Dam</u>

The Bulls Bridge Dam (Class BB) impounds the Housatonic River in the Bulls Bridge section of Kent. A portion of the impounded water is diverted downstream to produce hydropower at Cedar Hill Dam. The dam is owned and operated by First Light Power Resources. The concrete dam is 24 feet high above bedrock and 225 feet in length, with a spillway width of 195 feet. The drainage area upstream of the dam is approximately 784 square miles. Failure of the Bulls Bridge Dam would likely cause flooding downstream along the Housatonic River into Gaylordsville, with areas along Route 7 most likely to be affected by flooding.

<u>Bleachery Dam</u>

The Bleachery Dam (Class A) impounds the Housatonic River near the southern terminus of West Street. The dam is a run-of-the-river dam that is owned by the Town of New Milford. While its original purpose was likely industrial, the dam is now classified as being used for recreation. The dam is 19 feet high (primarily underwater) and 800 feet in length. The drainage area upstream of the dam is approximately 993 square miles. As a low hazard dam, failure of the Bleachery Dam is unlikely to have a significant downstream flooding effect.

According to Town staff, the dam was scoured by the 1955 floods and was never repaired by the previous owner. As a result, the downstream face of the dam is now too steep. Since acquiring the dam, the Town has tried unsuccessfully many times over the years to secure funding to repair the dam.

The Town's primary concern regarding the dam is that the failure of the dam would lower water levels along the Housatonic River throughout most of Town to unacceptable levels during the summer. The low water levels could potentially allow for contaminants in the riverbed to be scoured. A proposal for repairing and modifying the dam to that will mitigate flooding is presented in Section 3.5.

<u>*Loss Estimates*</u>

HAZUS-MH was utilized to determine the effect of dam failure for the main dam (Candlewood Lake North Dam) that crosses the Rocky River approximately one mile upstream from its confluence with the Housatonic River. This dam was selected for HAZUS analysis because it would cause the most catastrophic flooding in New Milford relative to the other dams located within or upstream of the town.

The Emergency Operations Plan for the main dam was utilized for this analysis. Cross-sectional data and flooding areas from the dam failure analyses for a "sunny day" breach were imported into the *HAZUS-MH* flood module. The *HAZUS-MH* simulation estimates that approximately 194 buildings will be at least moderately damaged and approximately 191 buildings are expected to be substantially damaged or completely destroyed in New Milford. No schools, fire stations, hospitals, or police stations are expected to experience moderate or higher damage.

The *HAZUS-MH* simulation estimated the following tons of debris would be generated by flood damage from the dam failure scenario. The simulation also estimates the number of truckloads (at approximately 25 tons per truck) that will be required to remove the debris. The breakdown of debris generation is as follows:

Table 8-3
***HAZUS-MH* Flood Scenario – Debris Generation (Tons)**

Stream	Finishes	Structural	Foundations	Total	Truckloads
Failure of Main Dam	4,442	16,741	12,983	34,166	1,367

HAZUS-MH calculated the potential sheltering requirement for the dam failure scenario. Displacement includes households evacuated from within or very near to the inundated areas.

Table 8-4
***HAZUS-MH* Flood Scenario – Sheltering Requirements**

Stream	Displaced Households	Population Using Public Shelters
Failure of Main Dam	275	698

HAZUS-MH also calculated the predicted economic losses due the dam failure scenario. Economic losses are categorized between building-related losses and business interruption losses. The total loss for a sunny day scenario dam failure event is estimated by *HAZUS-MH* to be approximately $146 million.

Table 8-5
***HAZUS-MH* Flood Scenario – Building Loss Estimates**

Stream	Residential	Commercial	Industrial	Others	Total
Failure of Main Dam	$63,920,000	$47,830,000	$27,380,000	$6,510,000	$145,630,000

Table 8-6
***HAZUS-MH* Flood Scenario – Business Interruption Estimates**

Stream	Residential	Commercial	Industrial	Others	Total
Failure of Main Dam	$50,000	$290,000	$0	$30,000	$370,000

The *HAZUS-MH* results do not provide casualty estimates. However, it is assumed that casualties would occur under this flood scenario.

8.6 Potential Mitigation Strategies and Actions

Typical mitigation measures for preventing dam failure include many of those for preventing flooding in addition to the ones presented below. Natural resource protection measures are similar to those for flooding as presented in Section 3.6.5.

8.3.1 Prevention

Preventative measures for preventing dam failure include quarterly or less frequent inspections of each dam. Regulatory-level dam inspections in the State of Connecticut are required to be conducted by a registered professional engineer. In addition, local communities should maintain a dialogue with Connecticut DEEP regarding the development of Emergency Action Plans and Dam Failure Analysis for dams not owned by the municipality, and encourage Connecticut DEEP to approach dam owners of Class B and Class C dams to develop or update such plans as needed.

8.3.2 Property Protection

Property protection measures for preventing flooding from dam failure are similar to those presented for reducing flooding damage as presented in Section 3.

8.3.3 Emergency Services

Communities containing or located downstream from high and significant hazard dams should maximize their emergency preparedness for a potential dam failure. This can be done by having copies of the EOP/EAP for each dam on file with the local emergency manager and the local engineering department, and by ensuring that contacts are available for each property in the potential inundation areas within an emergency notification database. It is important to maintain up to date dam failure inundation mapping in order to properly direct notifications into potentially affected areas. Dam failure inundation areas should be mapped for all community-owned significant and high hazard dams. For dams without a mapped failure inundation area, the 1% and 0.2% annual chance floodplains described in Section 3 could be utilized, with an appropriate buffer, to provide approximate failure inundation areas to determine property contacts for the emergency notification database.

8.3.4 Public Education and Awareness

> **FEMA and the Association of Dam Safety Officials have a variety of resources available for dam owners. More information can be found at http://www.fema.gov and at http://www.damsafety.org/resources/downloads/**

Public education and awareness should be directed at dam owners in the community in order to keep them up to date on maintenance resources, repair resources, funding sources, and regulatory changes. Public education for residents will be similar to those for flooding, but should also be directed to residents in potential inundation areas. Such residents should be given information regarding preparing evacuation kits and potential evacuation procedures.

8.3.5 Structural Projects

Structural projects for preventing dam failure are typically focused on maintaining and repairing subject dams to be in good condition, resizing spillways to pass a larger flood event without causing damage to the dam, and maintaining upstream dams such that sequential failures do not occur.

8.7 Summary of Recommended Strategies and Actions

Potential mitigation strategies related to mitigating dam failure in New Milford include:

- ❑ Prepare inundation mapping and EAPs for Town-owned significant hazard dams.
- ❑ Utilize dam failure inundation mapping to identify properties that could be affected and conduct outreach to ensure contact information is added to the emergency notification system database.
- ❑ Enact a Flood and Erosion Control Board in order to be eligible for funding to repair municipally-owned dams.

In addition, there are several suggested potential mitigation strategies that are applicable to all hazards in this plan. These are outlined in the Section 10.1.

9.0 WILDFIRES

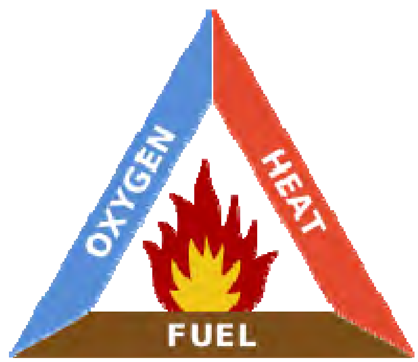
9.1 Setting

The ensuing discussion about wildfires is generally focused on the undeveloped wooded and shrubby areas of New Milford, along with low-density suburban/rural type development found at the margins of these areas known as the wildland interface. Structural fires in higher-density areas of the community are not considered.

The town of New Milford is generally considered a low-risk area for wildfires. Wildfires are of particular concern in outlying areas without public water service and other areas with poor access for fire-fighting equipment. Such areas in New Milford generally lie in the northern section of town as presented on Figure 9-1. Hazards associated with wildfires include property damage and loss of habitat. Wildfires are considered a likely event each year but are generally contained to a small range with limited damage to non-forested areas (Table 1-3 and Table 1-4).

9.2 Hazard Assessment

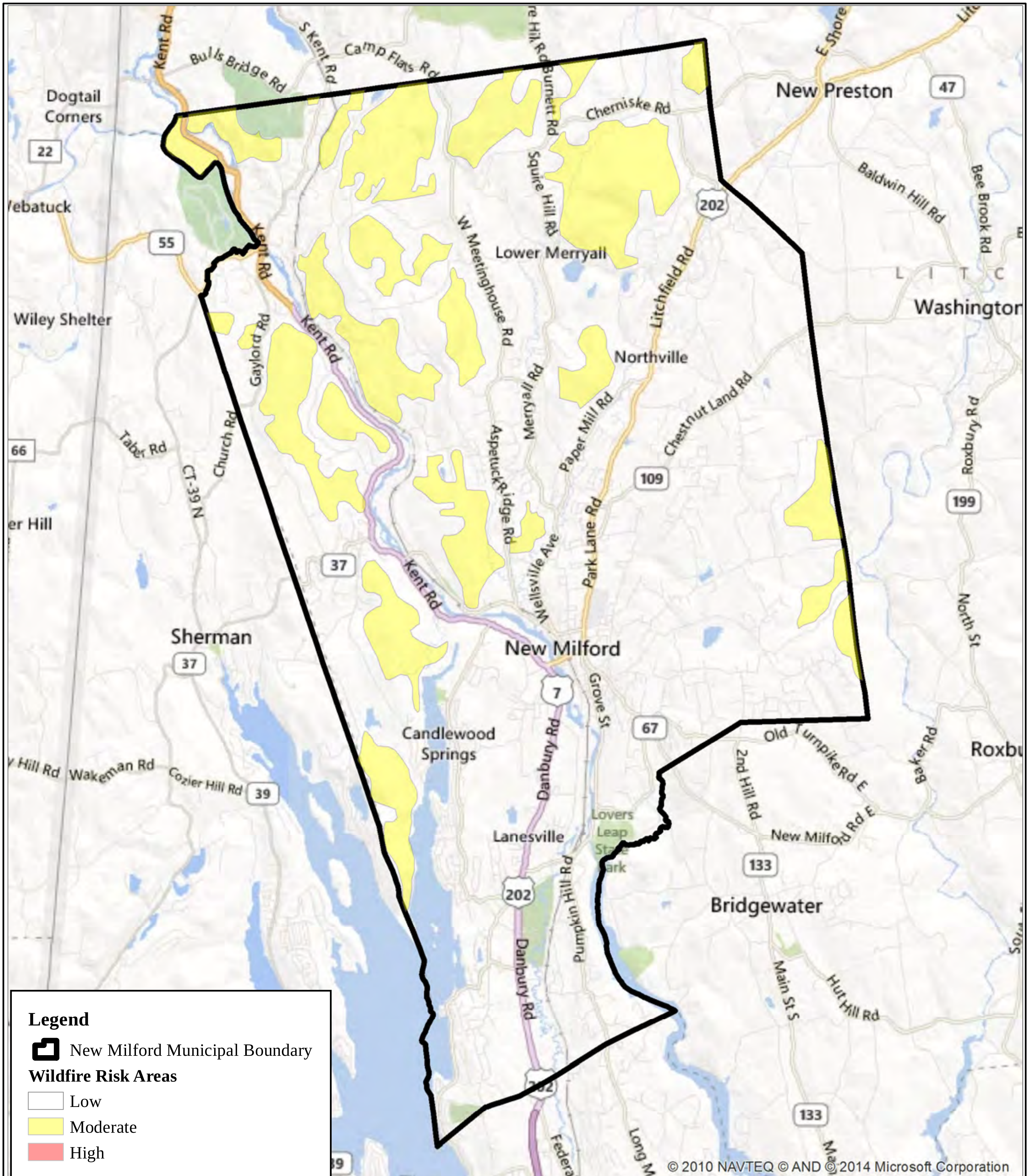
Wildfires are any non-structure fire, other than a prescribed burn, that occurs in undeveloped areas. They are considered to be highly destructive, uncontrollable fires. Although the term brings to mind images of tall trees engulfed in flames, wildfires can occur as brush and shrub fires, especially under dry conditions. Wildfires are also known as "wildland fires." Areas within New Milford vulnerable to wildfire are shown in Figure 9-1. According to the U.S. Bureau of Land Management, each of three elements (known as the fire triangle) must be present in order to have any type of fire:



The Fire Triangle. Public Domain Image Hosted by Wikimedia Commons.

- Fuel – Without fuel, a fire will stop. Fuel can be removed naturally (when the fire has consumed all burnable fuel) or manually by mechanically or chemically removing fuel from the fire. In structure fires, removal of fuel is not typically a viable method of fire suppression. Fuel separation is important in wildfire suppression and is the basis for controlling prescribed burns and suppressing other wildfires. The type of fuel present in an area can help determine overall susceptibility to wildfires. According to the Forest Encyclopedia Network, four types of fuel are present in wildfires:
  - Ground Fuels, consisting of organic soils, forest floor duff, stumps, dead roots, and buried fuels;
  - Surface Fuels, consisting of the litter layer, downed woody materials, and dead and live plants to two meters in height;
  - Ladder Fuels, consisting of vine and draped foliage fuels; and
  - Canopy Fuels, consisting of tree crowns.

- Heat – Without sufficient heat, a fire cannot begin or continue. Heat can be removed through the application of a substance, such as water, powder, or certain gases, that reduces the amount of heat available to the fire. Scraping embers from a burning structure also removes the heat source.



SOURCE(S):
"Roads" Microsoft
"Town Boundary" CT DEEP

Figure 9-1: Wildfire Risk Areas

LOCATION:

New Milford, CT

N

Town of New Milford
Hazard Mitigation Plan

MXD: P:\3101-14\Design\GIS\Fairfield County\New Milford\Maps\Figure9-1.mxd

Map By: scottb
MMI#: 3101-14
Original: 1/14/2014
Revision: 7/22/2014
Scale: 1 in = 8,000 ft

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- Oxygen – Without oxygen, a fire cannot begin or continue. In most wildland fires, this is commonly the most abundant element of the fire triangle and is therefore not a major factor in suppressing wildfires.

Nationwide, humans have caused approximately 90% of all wildfires in the last decade. Accidental and negligent acts include unattended campfires, sparks, burning debris, and irresponsibly discarded cigarettes. The remaining 10% of fires are caused primarily by lightning. According to the USGS, wildfires can increase the potential for flooding, debris flows, or landslides; increase pollutants in the air; temporarily destroy timber, foliage, habitats, scenic vistas, and watershed areas; and have long-term impacts such as reduced access to recreational areas, destruction of community infrastructure, and reduction of cultural and economic resources.

Nevertheless, wildfires are also a natural process, and their suppression is now recognized to have created a larger fire hazard as live and dead vegetation accumulates in areas where fire has been prevented. In addition, the absence of fire has altered or disrupted the cycle of natural plant succession and wildlife habitat in many areas. Consequently, federal, state, and local agencies are committed to finding ways such as prescribed burning to reintroduce fire into natural ecosystems while recognizing that firefighting and suppression are still important.

Connecticut has a particular vulnerability to fire hazards where urban development and wildland areas are in close proximity. The "wildland/urban interface" is where many such fires are fought. Wildland areas are subject to fires because of weather conditions and fuel supply. An isolated wildland fire may not be a threat, but the combined effect of having residences, businesses, and lifelines near a wildland area causes increased risk to life and property. Thus, a fire that might have been allowed to burn itself out with a minimum of fire-fighting or containment in the past is now fought to prevent fire damage to surrounding homes and commercial areas as well as smoke threats to health and safety in these areas.

9.3 Historic Record

According to the Connecticut DEEP Forestry Division, much of Connecticut was deforested by settlers and turned into farmland during the colonial period. A variety of factors in the 19th century caused the decline of farming in the state, and forests reclaimed abandoned farm fields. In the early 20th century, deforestation again occurred in Connecticut, this time for raw materials needed to ship goods throughout the world. Following this deforestation, shipping industries in Connecticut began to look to other states for raw materials, and the deciduous forests of today began to grow in the State.

During the early 20th century, wildfires regularly burned throughout Connecticut. Many of these fires began accidentally by sparks from railroads and industry while others were deliberately set to clear underbrush in the forest and provide pasture for livestock. A total of 15,000 to 100,000 acres of land was burned annually during this period. This destruction of resources led to the creation of the position of the State Forest Fire Warden and led to a variety of improved coordination measures described in Section 9.4.

According to the USDA Forest Service Annual Wildfire Summary Report for 1994 through 2003, an average of 600 acres per year in Connecticut was burned by wildfires. The National Interagency Fire Center (NIFC) reports that a total of 3,686 acres of land burned in Connecticut from 2002 through 2013 due to 2,410 non-prescribed wildfires, an average of 1.5 acres per fire and 307 acres per year (Table 9-1).

Table 9-1
Wildland Fire Statistics for Connecticut

Year	Number of Wildland Fires	Acres Burned	Number of Prescribed Burns	Acres Burned	Total Acres Burned
2013	76	238	4	37	275
2012	180	417	4	42	459
2011	196	244	7	42	286
2010	93	262	6	52	314
2009	264	246	6	76	322
2008	330	893	6	68	961
2007	361	288	7	60	348
2006	322	419	6	56	475
2005	316	263	10	130	393
2004	74	94	12	185	279
2003	97	138	8	96	234
2002	101	184	13	106	290
Total	**2,410**	**3,686**	**89**	**950**	**4,636**

Source: National Interagency Fire Center

The Connecticut DEEP Forestry Division estimates the average acreage burned per year statewide to be much higher (1,300 acres per year) in the *2014 Connecticut Natural Hazards Mitigation Plan.* The Connecticut DEEP also states that the primary cause of wildland fires in seven of the eight counties is undetermined, with the secondary cause being arson or debris burning. In general, the wildland fires in Connecticut are small and detected quickly, with most of the largest wildfires being contained to less than 10 acres in size.

Traditionally, the highest forest fire danger in Connecticut occurs in the spring from mid-March to mid-May. The worst wildfire year for Connecticut in the recent past occurred during the extremely hot and dry summer of 1999. Over 1,733 acres of Connecticut burned in 345 separate wildfires, an average of about five acres per fire. Only one wildfire occurred between 1994 and 2003 that burned over 300 acres. That fire was the Schaghticoke Mountain fire that occurred in Kent in 2001 that burned approximately 570 acres. Another large historical wildfire occurred in 1986 in the Mattatuck State Forest in the town of Watertown, Connecticut burned 300 acres.

Town staff indicate only a few small fires have occurred in the northwestern section of New Milford over the past few years. The largest recent fire to occur happened off North Kent Road on the New Milford/Kent border in March 2011. This uncontrolled grass fire burned five acres before it could be contained and spread so quickly that it consumed one of fire trucks owned by the Town of Kent.

9.4 Existing Programs, Policies, and Mitigation Measures

Connecticut enacted its first statewide forest fire control system in 1905, when the state was largely rural with very little secondary growth forest. By 1927, the state had most of the statutory foundations for today's forest fire control programs and policies in place such as the State Forest Fire Warden system, a network of fire lookout towers and patrols, and regulations regarding open burning. The severe fire weather in the 1940s prompted the state legislature to join the Northeastern Interstate Forest Fire Protection Compact with its neighbors in 1949.

The technology used to combat wildfires has significantly improved since the early 20th century. An improved transportation network, coupled with advances in firefighting equipment, communication technology, and training, has improved the ability of firefighters to minimize damage due to wildfires in the state. For example, radio and cellular technologies have greatly improved firefighting command capabilities. Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. Firefighters are typically focused on training for either structural fires or wildland fires and maintain a secondary focus on the opposite category.

The Connecticut DEEP Division of Forestry monitors the weather each day during non-winter months as it relates to fire danger. The Division utilizes precipitation and soil moisture data to compile and broadcast daily forest fire probability forecasts. Forest fire danger levels are classified as low, moderate, high, very high, or extreme. In addition, the National Weather Service issues a Red Flag warning when winds will be sustained or there will be frequent gusts above a certain threshold (usually 25 mph), the relative humidity is below 30%, and precipitation for the previous five days has been less than one-quarter inch. Such conditions can cause wildfires to quickly spread from their source area.

The Connecticut DEEP has recently changed its Open Burning Program. It now requires individuals to be nominated and designated by the Chief Executive Officer in each municipality that allows open burning to take an online training course and exam to become certified as an "Open Burning Official." Permit template forms were also revised that provides permit requirements so that the applicant/permittee is made aware of the requirements prior to, during and post burn activity. The regulated activity is then overseen by the Town through the Fire Marshall's office. According to Town staff, the burning permit requirement has reportedly helped to reduce uncontrolled fires in New Milford.

Regulations regarding fire protection are outlined in the *Zoning Regulations* and the *Subdivision Regulation*s as presented below. As noted in the 2010 POCD, access for fire fighting vehicles is believed important and therefore is prioritized in the regulations.

<u>Zoning Regulations</u>

- ❑ Section 025-040(2) and Section 165-030(2) require that residential rear lots be connected via a separate, unobstructed right of way that is at least 20 feet in width and connecting to a street that is adequate to accommodate fire apparatus or other emergency equipment.
- ❑ Section 040-030(5) presents a similar requirement for commercial rear lots in the B-1 business zone except that the right of way must be at least 30 feet in width.
- ❑ Section 070-020(1)(g) bans outside burning of motor vehicle parts or bodies in the motor vehicle junkyard district.
- ❑ Section 080-030(5)(g) authorizes the Zoning Commission to consider problems of fire protection in considering applications for approval in the Village Center District.
- ❑ Section 105-040(1) requires that water supply systems in Planned Residential Districts be designed as to provide adequate fire protection with hydrants or fire ponds.

- Section 117-040(12) requires fire hydrants or other fire suppression devices be installed in locations approved by the Fire Marshall in Major Planned Residential Development Districts.

Subdivision Regulations

- Section 2.2.1b(6) of the *Subdivision Regulations* requires common driveways that serve two lots to install a hammerhead-type turnaround that is adequate to accommodate fire apparatus and other emergency equipment.
- Section 2.5.3 of the *Subdivision Regulations* requires the installation of fire suppression systems or hydrants within subdivisions to provide adequate fire protection.

The 2010 POCD notes that continued cooperation between land use boards and the Fire Marshall is important. The Fire Marshall reviews new developments for fire protection requirements and provides recommendations to the Planning Commission and Zoning Commission. The Fire Marshall and Fire Departments also regularly conduct public outreach and education on fire safety and safe practices throughout the community.

Public water service is provided throughout much of the southern and central portions of town, but alternative water sources are needed in outlying areas. A dry hydrant program has been implemented, but maintenance of the hydrants has proven difficult particularly for those hydrants installed in tanks. Unlike the west coast of the United States where the fires are allowed to burn toward development and then stopped, the New Milford Fire Department goes to the fires whenever possible. This proactive approach is believed to be effective for controlling wildfires. As noted in the 2010 POCD, the Northville and Gaylordsville Fire Departments prefer to fight fires in outlying areas by using those hydrants installed in ponds, or utilizing a direct connection to a pond as public water is not available in their areas of coverage. The Town first utilizes its pumpers and tanker trucks to fight fires before drawing water from surface water sources, although the water carrying capacity of the pumpers is limited.

The Town of New Milford has an all-terrain vehicle to assist with fighting fires in outlying areas. The Town also has mutual aid agreements with all its neighbors, and works with the Connecticut DEEP regarding fire protection on state-owned lands. In particular, DEMHS Region 5 has a tanker brigade that can assist New Milford fire personnel in fighting wildfires. Fire protection needs and potential problem areas are reviewed at least annually. Finally, the DEEP Forestry Division uses rainfall data from a variety of sources to compile forest fire probability forecasts. This allows the DEEP and the Town to monitor the drier areas of the state to be prepared for forest fire conditions. Overall, the level of preparedness in New Milford is considered suitable for the level of wildfire risk in the community.

9.5 Vulnerabilities and Risk Assessment

Description – Today, most of Connecticut's forested areas are secondary growth forests. According to the Connecticut DEEP, forest has reclaimed over 500,000 acres of land that was used for agriculture in 1914. However, that new forest has been fragmented in the past few decades by residential development. The urban/wildland interface is increasing each year as sprawl extends further out from Connecticut's cities. It is at this interface that the most damage to buildings and infrastructure occurs.

The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas. The extensive forests and fields covering the state are prime locations for a wildfire. In many areas, structures and subdivisions are built abutting forest borders, creating areas of particular vulnerability.

Wildfires are more common in rural areas than in developed areas as most fires in populated areas are quickly noticed and contained. The likelihood of a severe wildfire developing is lessened by the vast network of water features in the state, which create natural breaks likely to stop the spread of a fire. During long periods of drought, these natural features may dry up, increasing the vulnerability of the state to wildfires.

According to the Connecticut DEEP, the actual forest fire risk in Connecticut is low due to several factors. First, the overall incidence of forest fires is very low (an average of 201 fires per year occurred in Connecticut from 2002 to 2014, which is a rate slightly higher than one per municipality per year). Secondly, as the wildfire/forest fire prone areas become fragmented due to development, the local fire departments have increased access to those neighborhoods for fire-fighting equipment. Third, the problematic interface areas such as driveways too narrow to permit emergency vehicles are site specific. Finally, trained firefighters at the local and state level are readily available to fight fires in the state, and inter-municipal cooperation on such instances is common.

As suggested by the historic record presented in Section 9.3, most wildfires in Connecticut are relatively small. In the drought year of 1999, the average wildfire burned five acres in comparison to the large 570-acre wildfire in Kent in 2001. The largest recent wildfire in March 2011 burned five acres. Given the availability of firefighting water in the town – including the use of nearby water bodies – and the historic record, it is believed that the average size of a wildfire in a drought year would be between one and five acres, with the larger values occurring in outlying areas of the community.

Town staff have identified weaknesses in their fire-fighting capability. First, the 2010 POCD indicates **that improved communication equipment is necessary for the Fire Departments to properly coordinate among themselves and other emergency officials during emergencies.** Second, accessibility in parts of the northern, western, and eastern sections of town is limited in many areas and particularly difficult for larger fire apparatus to access. These areas are in outlying areas away from the public water system where access may be limited and fire protection water is not immediately available. Town staff have identified these areas as being of the greatest risk for wildfire damage in the community, although the size of the fires that could be experienced in these areas would likely be in line with the estimated values above. **The Fire Departments should identify and implement projects to increase fire access into these areas where possible.**

<u>Loss Estimates</u> – The *2014 Connecticut Natural Hazards Mitigation Plan* provides annual estimated losses on a countywide basis for several hazards. Based on the population of Bethel relative to Litchfield County, the annual estimated loss is $8,305for wildfires.

In summary, the town of New Milford is generally a low-risk area for wildfires and wildfire damage. The areas with the greatest potential for a significant wildfire are shown on Figure 9-1 and discussed above. These areas are both located in the outlying areas of town that are considered to be of moderate risk due to poor access and lack of public water supply for fire-fighting.

9.6 Potential Mitigation Strategies and Actions

Typical mitigation measures for preventing wildfires include the following measures presented below:

9.6.1 Prevention

Preventative measures for wildfire damage includes placing utilities underground in new developments and instituting regulations that encourage fire breaks, emergency access, and the availability of fire protection water. Utilities that are located underground cannot be harmed by wildfires. The Fire Department or the Fire Marshall typically reviews zoning and subdivision applications for emergency access and fire protection requirements. The inclusion of open area buffer requirements around new construction can eliminate fuel that would otherwise allow wildfires to spread near buildings. In addition, the installation of sprinkler systems can help to abate the effects of wildfires on nearby structures.

9.6.2 Property Protection

Residents along the woodland-urban interface should be encouraged to remove deadfall in wooded areas of their property. In addition, homeowners should be encouraged to trim back overgrowth that is encroaching on the structure that could encourage a structure fire spreading from a wildfire. Property owners should also be encouraged to widen access roads into private property such that fire trucks and other emergency vehicles can access remote locations.

9.6.3 Emergency Services

Most wildfire prevention and response activities in a community are performed by the various emergency services departments. Communities should continue to promote inter-municipal cooperation in firefighting efforts, enforce regulations and permits for open burning, and patrol community-owned open space and parks to prevent unauthorized campfires. Maintaining proper equipment and training in wildfire response is also important.

9.6.4 Public Education and Awareness

Education of homeowners on methods of protecting their homes is far more effective than trying to steer growth away from potential wildfire areas, especially given that the available land that is environmentally appropriate for development may be forested. Educational materials and programs are typically available through local Fire Departments, such has fire extinguisher use and how to properly manage burning and campfires on private property. Educational materials are often available at other municipal offices as well. Booklets such as *Is Your Home Protected from Wildfire Disaster? – A Homeowner's Guide to Wildfire Retrofit* can be made available in permit offices when developers and homeowners pick up or drop off applications;

9.6.5 Natural Resource Protection

Communities that control large areas of forests and brush land should consider conducting controlled burns to minimize the amount of low-lying combustible materials that could lead to dangerous wildfires during dry conditions. Such burns could be performed with the assistance of the State and regional fire departments as they can be excellent training exercises for area fire fighters. Clearing and maintaining fire access roads into isolated areas is also important.

9.6.6 Structural Projects

Water system improvements are an important class of potential mitigation for wildfires. Communities are encouraged to add additional supplies of firefighting water where adequate water supplies do not currently exist. Such measures can include extension of public water supply, the use of dry hydrants, or the use of storage tanks.

9.7 Summary of Recommended Strategies and Actions

The following recommendation could be implemented to further mitigate wildfire risk:

- ❑ Identify and implement projects to increase fire-fighting access to areas at increased risk for wildfire.

In addition, specific recommendations that apply to all hazards are listed in Section 10.1.

10.0 HAZARD MITIGATION STRATEGIES AND ACTIONS

Recommendations that are applicable to two, three, or four hazards were discussed in the applicable subsections of Sections 3.0 through 9.0 although not necessarily repeated in each subsection. For example, placing utilities underground is a recommendation for hurricane, summer storm, winter storm, and wildfire mitigation. Public education and awareness is a type of mitigation applicable to all hazards because it includes recommendations for improving public safety and planning for emergency response. Instead of repeating these recommendations in section after section of this HMP, these are described below.

10.1 Additional Strategies and Actions

Due to the importance of having shelters and standby power available to critical facilities during storm events and following disasters, as well as emergency communications and supplies to respond to emergencies, these considerations are priority strategies for the plan. One specific action has been identified for the Town of New Milford related to emergency capabilities:

- ❑ Acquire a generator for the Town Hall and then relocate the EOC to the Town Hall.

In addition, one additional strategy is required by FEMA regarding plan maintenance and incorporation. This is discussed in Section 11.1 and summarized below:

- ❑ Incorporate the identified strategies of this HMP into local planning activities within five years from the date of adoption or when other plans are updated, whichever is sooner.

10.2 Summary of Proposed Strategies and Actions

Strategies and potential actions have been presented throughout this document in individual sections as related to each hazard. This section lists specific strategies and actions of the HMP without any priority ranking that will build upon the existing capabilities of the community. Strategies and potential actions that span multiple hazards are only reprinted once in this section under the heading “multiple hazards”. Refer to the matrix in Appendix A for recommendations with scores based on the STAPLEE methodology described in Section 1.4.

Multiple Hazards

- ❑ Incorporate the identified strategies of this HMP into local planning activities within five years from the date of adoption or when other plans are updated, whichever is sooner.
- ❑ Acquire a generator for the Town Hall and then relocate the EOC to the Town Hall.

Flooding

- ❑ Adopt a standardized drainage policy to ensure consistency between developments.
- ❑ Adopt low-impact development standards into the Zoning regulations and Subdivision regulations.
- ❑ Adopt a regulation requiring the use of the FEMA Elevation Certificate to formally record building floor and floodproofing elevations for compliance with the Zoning Regulations.
- ❑ Adopt a freeboard requirement of one foot for all new development or substantial improvement within the SFHA.

- Encourage town practices to employ measures to reduce stormwater flow.
- Educate residents and property owners on ways that they can reduce stormwater runoff, and possibly adopt regulatory incentives over the long term.
- Create an Open Space Plan to prioritize future open space acquisition that encourages the creation of recreational open space within SFHAs.
- Assist residential property owners interested in obtaining grant funding to elevate properties within SFHAs.
- Encourage property owners within the SFHA to purchase flood insurance through the NFIP and complete FEMA Elevation Certificates for their structures.
- Relocate the Public Works Garage out of the SFHA.
- Elevate one or more roads leading to the Ambulance facility to ensure that egress is available during the 1% annual chance flood.
- Elevate portions of West Street to ensure that egress is maintained to the Water Pollution Control Facility during floods.
- Elevate portions of West Street or develop an emergency mode of egress to the Bleachery commercial development.
- Widen portions of the side roads that are used to detour traffic when flooding occurs along Route 7 between Bridge Street and Sunny Valley Road.
- Elevate one of the three bridges over the Housatonic River to be unaffected by the 0.2% annual chance flood event.
- Evaluate the potential flood mitigation effects of installing inflatable flashboards at the Bleachery Dam.
- Perform a drainage study along the Housatonic River to identify drainage systems that should be outfitted to prevent floodwater from flowing back up through storm drains on Route 7.
- Check the conveyance of all bridges and culverts based on more recent rainfall data statistics.
- Construct a slope stabilization project to prevent mudslides along Grove Street.

Wind

- Update the Zoning Regulations to require underground utilities for all new buildings regardless of zone unless such installation is deemed infeasible by the utility.
- Encourage the use of structural techniques related to mitigation of wind damage in new structures to protect new buildings to a standard greater than the minimum building code requirements.
- Require the use of structural mitigation techniques to harden new municipal critical facilities against wind damage.
- Consider locations where a micro-grid could be installed in New Milford.

Winter Storms

- Evaluate critical facilities for acceptable snow loading and develop a response plan to clear roofs when necessary.

Earthquakes

- Enact regulations preventing new residential development in areas prone to collapse such as at the bottom of steep slopes.
- Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs to municipal buildings.

Dam Failure

- ❑ Prepare inundation mapping and EAPs for Town-owned significant hazard dams.
- ❑ Utilize dam failure inundation mapping to identify properties that could be affected and conduct outreach to ensure contact information is added to the emergency notification system database.
- ❑ Enact a Flood and Erosion Control Board in order to be eligible for funding to repair municipally-owned dams.

Wildfires

- ❑ Identify and implement projects to increase fire-fighting access to areas at increased risk for wildfire.

10.3 Priority Strategies and Actions

As discussed in Section 1.4, the STAPLEE method was used to score mitigation activities. The STAPLEE matrix in Appendix A ranks the mitigation activities proposed in Section 10.2 and also lists possible funding sources. The town's top six priority strategies and actions are the following:

- ❑ Adopt a standardized drainage policy to ensure consistency between developments (8.5).
- ❑ Adopt a regulation requiring the use of the FEMA Elevation Certificate to formally record building floor and floodproofing elevations for compliance with the Zoning Regulations (8.0).
- ❑ Create an Open Space Plan to prioritize future open space acquisition that encourages the creation of recreational open space within SFHAs (8.0).
- ❑ Update the Zoning Regulations to require underground utilities for all new buildings regardless of zone unless such installation is deemed infeasible by the utility (8.0).
- ❑ Encourage the use of structural techniques related to mitigation of wind damage in new structures to protect new buildings to a standard greater than the minimum building code requirements (8.0).
- ❑ Require the use of structural mitigation techniques to harden new municipal critical facilities against wind damage (8.0).

10.4 Sources of Funding

The following sources of funding and technical assistance may be available for the priority projects listed above. This information comes from the FEMA website (http://www.fema.gov/government/grant/index.shtm). Funding requirements and contact information is given in Section 11.4.

Community Disaster Loan Program
http://www.fema.gov/government/grant/fs_cdl.shtm

This program provides funds to any eligible jurisdiction in a designated disaster area that has suffered a substantial loss of tax and other revenue. The assistance is in the form of loans not to exceed twenty-five percent of the local government's annual operating budget for the fiscal year in which the major disaster occurs, up to a maximum of five million dollars.

Continuing Training Grants (CTG)
http://www.grants.gov/web/grants/search-grants.html

This program provides funds to develop and deliver innovative training programs that are national in scope and meet emerging training needs in local communities.

Emergency Food and Shelter Program
http://www.fema.gov/government/grant/efs.shtm

This program was created in 1983 to supplement the work of local social service organizations, both private and governmental, to help people in need of emergency assistance.

Emergency Management Institute
http://training.fema.gov/

Provides training and education to the floodplain managers, fire service, emergency management officials, its allied professions, and the general public.

Emergency Management Performance Grants
http://www.fema.gov/emergency/empg/empg.shtm

The Emergency Management Performance Grant (EMPG) is designed to assist local and state governments in maintaining and strengthening the existing all-hazards, natural and man-made, emergency management capabilities. Allocations if this fund is authorized by the 9/11 Commission Act of 2007, and grant amount is determined demographically at the state and local level.

Flood Mitigation Assistance (FMA) Program
http://www.fema.gov/government/grant/fma/index.shtm

The FMA was created as part of the National Flood Insurance Reform Act of 1994 with the goal of reducing or eliminating claims under the NFIP. FEMA provides funds in the form of planning grants for Flood Mitigation Plans and project grants to implement measures to reduce flood losses, including elevation, acquisition, or relocation of NFIP-insured structures. Repetitive loss properties are prioritized under this program. This grant program is administered through the DEMHS.

Hazard Mitigation Grant Program (HMGP)
http://www.fema.gov/government/grant/hmgp/index.shtm

The HMGP provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. This grant program is administered through the DEMHS.

Homeland Security Grant Program (HSGP)
http://www.fema.gov/government/grant/hsgp/index.shtm

The objective of the HSGP is to enhance the response, preparedness, and recovery of local, State, and tribal governments in the event of a disaster or terrorist attack. Eligible applicants include all 50 states, the District of Columbia, Puerto Rico, American Samoa, Guam, Northern Mariana Islands, and the Virgin Islands. Risk and effectiveness, along with a peer review, determine the amount allocated to each applicant.

Intercity Passenger Rail (IPR) Program
http://www.fema.gov/fy-2013-intercity-passenger-rail-ipr-amtrak-0

This program provides funding to the National Passenger Railroad Corporation (Amtrak) to protect critical surface transportation infrastructure and the traveling public from acts of terrorism, and to increase the resilience of the Amtrak rail system.

National Flood Insurance Program (NFIP)
http://www.fema.gov/library/viewRecord.do?id=3005

This program enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages. Municipalities that join the associated Community Rating System can gain discounts of flood insurance for their residents.

Nonprofit Security Grant Program (NSGP)
http://www.fema.gov/fy-2014-urban-areas-security-initiative-uasi-nonprofit-security-grant-program-nsgp

This program provides funding support for hardening and other physical security enhancements to nonprofit organizations that are at high risk of terrorist attack and located within one of the specific Urban Areas Security Initiative (UASI)-eligible Urban Areas. The program seeks to integrate the preparedness activities of nonprofit organizations that are at high risk of terrorist attack with broader state and local preparedness efforts, and serve to promote coordination and collaboration in emergency preparedness activities among public and private community representatives and state and local government agencies.

Pre-Disaster Mitigation (PDM) Grant Program
http://www.fema.gov/government/grant/pdm/index.shtm

The purpose of the PDM program is to fund communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. PDM grants are provided to states, territories, Indian tribal governments, communities, and universities, which, in turn, provide sub-grants to local governments. PDM grants are awarded on a competitive basis. This grant program is administered through the DEMHS.

Public Assistance Grant Program
http://www.fema.gov/government/grant/pa/index.shtm

The Public Assistance Grant Program (PA) is designed to assist State, Tribal and local governments, and certain types of private non-profit organizations in recovering from major disasters or emergencies. Along with helping to recover, this grant also encourages prevention against potential future disasters by strengthening hazard mitigation during the recovery process. The first grantee to apply and receive the PA would usually be the State, and the State could then allocate the granted funds to the sub-grantees in need of assistance.

Small Town Economic Assistance Program
http://www.ct.gov/opm/cwp/view.asp?Q=382970&opmNav

The Small Town Economic Assistance Program (STEAP) funds economic development, community conservation and quality of life projects for localities that are ineligible to receive Urban Action bonds. This program is administered by the Connecticut Office of Policy and Management (OPM). Connecticut municipalities may receive up to $500,000 per year if (1) they are not designated as a distressed municipality or a public investment community, and (2) the State Plan of Conservation and Development does not show them as having a regional center. Public Act 05-194 allows an Urban Act Town that is not designated as a regional center under the State Plan of Conservation and Development to opt out of the Urban Action program and become a STEAP town for a period of four years.

Transit Security Grant Program (TSGP)
http://www.fema.gov/government/grant/tsgp/index.shtm

The purpose of TSGP is to bolster security and safety for public transit infrastructure within Urban Areas throughout the United States. Applicable grantees include only the state Governor and the designated State Administrative Agency (SAA) appointed to obligate program funds to the appropriate transit agencies.

<u>U.S. Fire Administration</u>

Assistance to Firefighters Grant Program (AFGP)
http://www.firegrantsupport.com/afg/
http://www.usfa.dhs.gov/fireservice/grants/

The primary goal of the Assistance to Firefighters Grants (AFG) is to meet the firefighting and emergency response needs of fire departments and nonaffiliated emergency medical services organizations. Since 2001, AFG has helped firefighters and other first responders to obtain critically needed equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards. The Grant Programs Directorate of the Federal Emergency Management Agency administers the grants in cooperation with the U.S. Fire Administration.

Fire Prevention & Safety Grants (FP&S)
http://www.firegrantsupport.com/fps/

The Fire Prevention and Safety Grants (FP&S) are part of the Assistance to Firefighters Grants (AFG) and are under the purview of the Grant Programs Directorate in the Federal Emergency Management Agency. FP&S grants support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to target high-risk populations and mitigate high incidences of death and injury. Examples of the types of projects supported by FP&S include fire prevention and public safety education campaigns, juvenile firesetter interventions, media campaigns, and arson prevention and awareness programs.

National Fire Academy Education and Training
http://www.usfa.dhs.gov/nfa/

Provides training to increase the professional level of the fire service and others responsible for fire prevention and control.

Reimbursement for Firefighting on Federal Property
http://www.usfa.dhs.gov/fireservice/grants/rfff/

Reimbursement may be made to fire departments for fighting fires on property owned by the federal government for firefighting costs over and above normal operating costs. Claims are submitted directed to the U.S. Fire Administration.

Staffing for Adequate Fire & Emergency Response (SAFER)
http://www.firegrantsupport.com/safer/

The goal of SAFER is to enhance the local fire departments' abilities to comply with staffing, response and operational standards established by NFPA and OSHA (NFPA 1710 and/or NFPA 1720 and OSHA 1910.134 - see http://www.nfpa.org/SAFERActGrant for more details). Specifically, SAFER funds should assist local fire departments to increase their staffing and deployment capabilities in order to respond to emergencies whenever they may occur. As a result of the enhanced staffing, response times should be sufficiently reduced with an appropriate number of personnel assembled at the incident scene. Also, the enhanced staffing should provide that all front-line/first-due apparatus of SAFER grantees have a minimum of four trained personnel to meet the OSHA standards referenced above. Ultimately, a faster, safer and more efficient incident scene will be established and communities will have more adequate protection from fire and fire-related hazards.

Other Grant Programs

Flood Mitigation

- U.S. Army Corps of Engineers – *50/50 match funding for floodproofing and flood preparedness projects.*
- U.S. Department of Agriculture – *financial assistance to reduce flood damage in small watersheds and to improve water quality.*
- CT Department of Energy and Environmental Protection – *assistance to municipalities to solve flooding and dam repair problems through the Flood and Erosion Control Board Program.*

Erosion Control and Wetland Protection

- U.S. Department of Agriculture – *technical assistance for erosion control.*

- ❑ North American Wetlands Conservation Act Grants Program – *funding for projects that support long term wetlands acquisition, restoration, and/or enhancement. Requires a 1-to-1 funds match.*

11.0 PLAN IMPLEMENTATION

11.1 Implementation Strategy and Schedule

The Town of New Milford will be responsible for ensuring adoption of this HMP. A record of adoption is presented in Appendix B. Upon adoption at the local level, this HMP will be made available to all local departments as a planning tool to be used in conjunction with existing documents and regulations. It is expected that revisions to other community plans and regulations such as the POCD, department annual budgets, the Zoning Regulations, and the Subdivision Regulations may reference this plan and its updates. Table 11-1 cross-references those plans and regulations that may be most important for updating relative to the HMP, and provides a summary of how those plans and regulations could be updated based on the information in this HMP.

Table 11-1
Plans and Regulations to be Potentially Updated

Regulation or Plan	Potential Revisions Based on HMP	Status Relative to HMP Update	Responsible Party
Emergency Operations Plan (Annual)	Vulnerable areas of the community can be specified in the plan.	The next revision of this plan will incorporate elements of the HMP.	Emergency Management Director
Plan of Conservation and Development (2010)	General strategies and concerns of the HMP may be incorporated into the plan.	The next POCD update (~2020?) will incorporate elements of this HMP.	Planning Commission
Water Supply Plans	None. The emergency response protocols in these plans typically inform the HMP process.	No changes needed at the present time.	Not Applicable
New Milford Health Department Plans	None. The emergency response protocols and critical populations in these plans typically inform the HMP process.	No changes needed at the present time.	Not Applicable
Zoning Regulations, Subdivision Regulations	Potential for recommendations of HMP Update to be incorporated.	The Planning / Zoning Department will present potential strategies to the Planning Commission and Zoning Commission	Planning / Zoning Department; Planning and Zoning Commission
Inland Wetland Regulations	None.	No changes needed at present time.	Not applicable

The STAPLEE matrix in Appendix A of this plan presents potential mitigation strategies for the Town of New Milford to consider. An implementation strategy and schedule is also identified for each action, detailing the responsible department and anticipated time frame for completing the mitigation action if funding is available. **The Local Coordinator (Emergency Management Director) will be responsible for ensuring that the strategies identified are incorporated into local planning activities within five years from the date of adoption or when other plans are updated, whichever is sooner.** The exception will be the POCD, where the planning process is not expected to commence until the time of the HMP update. It is expected that this HMP and the HMP update will help to inform the POCD update process.

The Mayor will be responsible for assigning appropriate Town officials to update portions of the plans and regulations in Table 11-1 if it is determined that such updates are appropriate. Should a general revision be too cumbersome or cost prohibitive, simple addendums to these documents will be added that include the provisions of this HMP within the five-year timeframe. The Plan of Conservation and Development is most likely to benefit from the inclusion of mitigation-related goals and recommendations, as it already includes discussion of important demographic information pertinent to long-range planning.

The Planning Commission and the Zoning Commission are listed multiple times in Table 11-1 and on the implementation table (Appendix A). These commissions have demonstrated relatively rapid action in the past as a result of receiving recommendations from a plan. The Town of New Milford anticipates that these commissions will continue to be able to actively implement certain recommendations of this HMP in a reasonable timeframe.

Finally, the Local Coordinator (Emergency Management Director) will be responsible for ensuring that information and projects in this planning document will be included in the annual budget and capital improvement plans as part of implementing the projects recommended herein. This will primarily include the annual budget and capital improvement project lists maintained by the Department of Public Works.

11.2 Progress Monitoring and Public Participation

The following instructions shall be followed by the Local Coordinator. The Local Coordinator will be responsible for monitoring the successful implementation of this HMP update, and will provide the linkage between the multiple departments involved in hazard mitigation at the local level relative to communication and participation. As the plans will be adopted by the local government, coordination is expected to be able to occur without significant barriers.

Site reconnaissance for Specific Suggested Actions – The Local Coordinator, with the assistance of appropriate department personnel, will annually perform reconnaissance-level inspections of sites that are subject to specific actions. This will ensure that the suggested actions remain viable and appropriate. Examples include home acquisitions or elevations, structural projects such as culvert replacements, roadway elevations, and water main extensions for increased fire suppression capabilities. The worksheets in Appendix C will be filled out for specific project-related actions as appropriate. These worksheets are taken from the *Local Mitigation Planning Handbook.*

The local coordinator will be responsible for obtaining a current list of RLPs in the community each year. This list is available from the State Hazard Mitigation Officer or State NFIP Coordinator. The RLPs shall be subject to a windshield survey at least once every two years to ensure that the list is reasonably accurate relative to addresses and other basic information. Some of the reconnaissance-level inspections could occur incidentally during events such as flooding when response is underway.

Annual Reporting and Meeting – The Local Coordinator will be responsible for having an annual meeting to review the plan. Matters to be reviewed on an annual basis include the goals and objectives of the HMP, hazards or disasters that occurred during the preceding year, mitigation activities that have been accomplished to date, a discussion of reasons that implementation may be behind schedule, and suggested actions for new projects and revised activities. Results of site reconnaissance efforts will also be reviewed. A meeting should be conducted at least two months before the annual application cycle for grants under the HMA program[4]. This will enable a list of possible projects to be circulated to applicable local departments to review and provide sufficient time to develop a grant application. The Local Coordinator shall prepare and maintain documentation and minutes of this annual review meeting, as this information will assist the next HMP update.

Post-Disaster Reporting and Metering – Subsequent to federally-declared disasters in the State of Connecticut for Litchfield County, a meeting shall be conducted by the Local Coordinator with representatives of appropriate departments to develop a list of possible projects for developing an HMGP application. The Local Coordinator shall prepare a report of the recent events and ongoing or recent mitigation activities for discussion and review at the HMGP meeting. Public outreach may be solicited for HMGP applications at a *separate* public meeting.

Continued Public Involvement – Continued public involvement will be sought regarding the monitoring, evaluating, and updating of the HMP. Public input can be solicited through community meetings, presentations on local cable access channels, and input to web-based information gathering tools. Public comment on changes to the HMP may be sought through posting of public notices and notifications posted on local websites and the eventual WCCOG website.

11.3 Updating the Plan

Updates to this HMP will be coordinated by the Local Coordinator with the anticipated assistance of the WCCOG. The Town of New Milford understands that this HMP will be considered current for a period of five years from the date of approval, with the expiration date reported by FEMA via the final approval letter. The Local Coordinator will be responsible for compiling the funding required to update the HMP in a timely manner such that the current plan will not expire while the HMP update is being developed. This will ensure that the opportunity to apply for funding is available should an untimely disaster occur.

Table 11-2 presents a schedule to guide the preparation and adoption of the HMP update. The schedule assumes that the current version of this plan was adopted in December 2015 and will therefore expire in December 2020.

Table 11-2
Schedule for Hazard Mitigation Plan Update

Month and Year	Tasks
December 2016	Annual meeting to review plan content and progress
December 2017	Annual meeting to review plan content and progress
December 2018	Annual meeting to review plan content and progress
June 2019	Ensure that funding for the plan update is included in the

[4] PDM and FMA applications were due to the State in July 2015. The month with the application deadline changes from year to year.

Month and Year	Tasks
	fiscal year 2019-2020 budget
July 2019	Secure consultant to begin updating the plan, or begin updating in-house
December 2019	Annual meeting to review plan content and progress
June 2020	Forward draft updated plan to State for review
July-October 2020	Process edits from State and FEMA and obtain the Approval Pending Adoption (APA)
December 2020	Adopt updated plan

To update the Plan:

- The Local Coordinator will coordinate the appropriate group of local officials consisting of representatives of many of the same departments solicited for input to this HMP. In addition, commission chairs from the Planning and Zoning Commission and other commissions will be invited to participate.

- Aside from municipal officials and commission members, New Milford will invite local business leaders, community and neighborhood group leaders, relevant private and nonprofit interest groups, and the neighboring municipalities (Kent, Washington, Roxbury, Bridgewater, Brookfield, New Fairfield, and Sherman) to provide input for the update.

- Finally, the Town of New Milford will consider developing an internet-based survey for the plan update, understanding that this has worked well for some of the Naugatuck Valley municipalities as they updated their hazard mitigation plans.

The project action worksheets prepared by the Local Coordinator and annual reports described in Section 11.2 above for New Milford will be reviewed. In addition, the following questions will be asked:

- Do the mitigation goals and objectives still reflect the concerns of local residents, business owners, and officials?
- Have local conditions changed so that findings of the risk and vulnerability assessments should be updated?
- Are new sources of information available that will improve the risk assessment?
- If risks and vulnerabilities have changed, do the mitigation goals and objectives still reflect the risk assessment?
- What hazards have caused damage locally since the last edition of the HMP was developed? Were these anticipated and evaluated in the HMP or should these hazards be added to the plan?
- Are current personnel and financial resources at the local level sufficient for implementing mitigation actions?
- For each mitigation action that has not been completed, what are the obstacles to implementation? What are potential solutions for overcoming these obstacles?
- For each mitigation action that has been completed, was the action effective in reducing risk?
- What mitigation actions should be added to the plan and proposed for implementation?
- If any proposed mitigation actions should be deleted from the plan, what is the rationale?

Future HMP updates may include deleting suggested actions as projects are completed or as potential strategies become capabilities, adding suggested actions as new hazard effects arise, or modifying hazard vulnerabilities as land use changes.

11.4 Technical and Financial Resources

This Section is comprised of a list of resources to be considered for technical assistance and potentially financial assistance for completion of the actions outlined in this Plan. This list is not all-inclusive and is intended to be updated as necessary.

Federal Resources

Federal Emergency Management Agency
Region I
99 High Street, 6th floor
Boston, MA 02110
(617) 956-7506
http://www.fema.gov/

Mitigation Division

The Mitigation Division is comprised of three branches that administer all of FEMA's hazard mitigation programs. The **Risk Analysis Branch** applies planning and engineering principles to identify hazards, assess vulnerabilities, and develop strategies to manage the risks associated with natural hazards. The **Risk Reduction Branch** promotes the use of land use controls and building practices to manage and assess risk in both the existing built developments and future development areas in both pre- and post-disaster environments. The **Risk Insurance Branch** mitigates flood losses by providing affordable flood insurance for property owners and by encouraging communities to adopt and enforce floodplain management regulations.

FEMA Programs administered by the Risk Analysis Branch include:

- *Flood Hazard Mapping Program*, which maintains and updates National Flood Insurance Program maps
- *National Dam Safety Program*, which provides state assistance funds, research, and training in dam safety procedures
- *National Hurricane Program*, which conducts and supports projects and activities that help protect communities from hurricane hazards
- *Mitigation Planning*, a process for states and communities to identify policies, activities, and tools that can reduce or eliminate long-term risk to life and property from a hazard event

FEMA Programs administered by the Risk Reduction Branch include:

- *Hazard Mitigation Grant Program (HMGP)*, which provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration

- *Flood Mitigation Assistance Program (FMA)*, which provides funds to assist states and communities to implement measures that reduce or eliminate long-term risk of flood damage to structures insurable under the National Flood Insurance Program
- *Pre-Disaster Mitigation Grant Program (PDM)*, which provides program funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event
- *Community Rating System (CRS)*, a voluntary incentive program under the National Flood Insurance Program that recognizes and encourages community floodplain management activities
- *National Earthquake Hazards Reduction Program (NEHRP)*, which in conjunction with state and regional organizations supports state and local programs designed to protect citizens from earthquake hazard

The Risk Insurance Branch oversees the *National Flood Insurance Program (NFIP)*, which enables property owners in participating communities to purchase flood insurance. The NFIP assists communities in complying with the requirements of the program and publishes flood hazard maps and flood insurance studies to determine areas of risk.

FEMA also can provide information on past and current acquisition, relocation, and retrofitting programs, and has expertise in many natural and technological hazards. FEMA also provides funding for training state and local officials at Emergency Management Institute in Emmitsburg, Maryland.

The Mitigation Directorate also has *Technical Assistance Contracts (TAC)* in place that support FEMA, states, territories, and local governments with activities to enhance the effectiveness of natural hazard reduction program efforts. The TACs support FEMA's responsibilities and legislative authorities for implementing the earthquake, hurricane, dam safety, and floodplain management programs. The range of technical assistance services provided through the TACs varies based on the needs of the eligible contract users and the natural hazard programs. Contracts and services include:

- *The Hazard Mitigation Technical Assistance Program (HMTAP) Contract*- supporting post-disaster program needs in cases of large, unusual, or complex projects; situations where resources are not available; or where outside technical assistance is determined to be needed. Services include environmental and biological assessments, benefit/cost analyses, historic preservation assessments, hazard identification, community planning, training, and more.

<u>Response & Recovery Division</u>

As part of the National Response Plan, this division provides information on dollar amounts of past disaster assistance including Public Assistance, Individual Assistance, and Temporary Housing, as well as information on retrofitting and acquisition/ relocation initiatives. The Response & Recovery Division also provides mobile emergency response support to disaster areas, supports the National Disaster Medical System, and provides urban search and rescue teams for disaster victims in confined spaces.

The division also coordinates federal disaster assistance programs. The Public Assistance Grant Program (PA) that provides 75% grants for mitigation projects to protect eligible damaged public and private non-profit facilities from future damage. "Minimization" grants at 100% are available through the Individuals and Family Grant Program. The Hazard Mitigation Grant Program and the Fire Management Assistance Grant Program are also administered by this division.

Computer Sciences Corporation
New England Regional Insurance Manager
Bureau and Statistical Office
(781) 848-1908

Corporate Headquarters
3170 Fairview Park Drive
Falls Church, VA 22042
(703) 876-1000
http://www.csc.com/

A private company contracted by the Federal Insurance Administration as the National Flood Insurance Program Bureau and Statistical Agent, CSC provides information and assistance on flood insurance, including handling policy and claims questions, and providing workshops to leaders, insurance agents, and communities.

Small Business Administration
Region I
10 Causeway Street, Suite 812
Boston, MA 02222-1093
(617) 565-8416
http://www.sba.gov/

SBA has the authority to "declare" disaster areas following disasters that affect a significant number of homes and businesses, but that would not need additional assistance through FEMA. (SBA is triggered by a FEMA declaration, however.) SBA can provide additional low-interest funds (up to 20% above what an eligible applicant would "normally" qualify for) to install mitigation measures. They can also loan the cost of bringing a damaged property up to state or local code requirements. These loans can be used in combination with the new "mitigation insurance" under the NFIP, or in lieu of that coverage.

Environmental Protection Agency
Region I
1 Congress Street, Suite 1100
Boston, MA 02114-2023
(888) 372-7341

Provides grants for restoration and repair, and educational activities, including:

- *Capitalization Grants for Clean Water State Revolving Funds*: Low interest loans to governments to repair, replace, or relocate wastewater treatment plans damaged in floods. Does not apply to drinking water or other utilities.

- *Clean Water Act Section 319 Grants*: Cost-share grants to state agencies that can be used for funding watershed resource restoration activities, including wetlands and other aquatic habitat (riparian zones). Only those activities that control non-point pollution are eligible. Grants are administered through the CT DEEP.

U.S. Department of Housing and Urban Development
20 Church Street, 19th Floor
Hartford, CT 06103-3220
(860) 240-4800
http://www.hud.gov/

The U.S. Department of Housing and Urban Development offers *Community Development Block Grants (CDBG)* to communities with populations greater than 50,000, who may contact HUD directly regarding CDGB. One program objective is to improve housing conditions for low and moderate income families. Projects can include acquiring floodprone homes or protecting them from flood damage. Funding is a 100% grant; can be used as a source of local matching funds for other funding programs such as FEMA's "404" Hazard Mitigation Grant Program. Funds can also be applied toward "blighted" conditions, which is often the post-flood condition. A separate set of funds exists for conditions that create an "imminent threat." The funds have been used in the past to replace (and redesign) bridges where flood damage eliminates police and fire access to the other side of the waterway. Funds are also available for smaller municipalities through the state-administered CDBG program participated in by the State of Connecticut.

U.S. Army Corps of Engineers
Institute for Water Resources
7701 Telegraph Road
Alexandria, VA 22315
(703) 428-8015
http://www.iwr.usace.army.mil/

The Corps provides 100% funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services Program (FPMS). Specific programs used by the Corps for mitigation are listed below.

- *Section 205 – Small Flood Damage Reduction Projects*: This section of the 1948 Flood Control Act authorizes the Corps to study, design, and construct small flood control projects in partnership with non-Federal government agencies. Feasibility studies are 100 percent federally-funded up to $100,000, with additional costs shared equally. Costs for preparation of plans and construction are funded 65 percent with a 35 percent non-federal match. In certain cases, the non-Federal share for construction could be as high as 50 percent. The maximum federal expenditure for any project is $7 million.

- *Section 14 – Emergency Streambank and Shoreline Protection:* This section of the 1946 Flood Control Act authorizes the Corps to construct emergency shoreline and streambank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and non-profit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $1.5 million.

- *Section 103 – Hurricane and Storm Damage Reduction Projects:* This section of the 1962 River and Harbor Act authorizes the Corps to study, design, and construct small coastal storm damage reduction projects in partnership with non-Federal government agencies. Beach nourishment (structural) and floodproofing (non-structural) are examples of storm damage reduction projects constructed under this authority. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $5 million.

- *Section 208 – Clearing and Snagging Projects:* This section of the 1954 Flood Control Act authorizes the Corps to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $500,000.

- *Section 206 – Floodplain Management Services:* This section of the 1960 Flood Control Act, as amended, authorizes the Corps to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of floodprone structures. When funding is available, this work is 100 percent federally funded.

In addition, the Corps also provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and post-flood response. Corps assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, the Corps can loan or issue supplies and equipment once local sources are exhausted during emergencies.

U.S. Department of Commerce

National Weather Service
Northeast River Forecast Center
445 Myles Standish Blvd.
Taunton, MA 02780
(508) 824-5116
http://www.nws.noaa.gov/

The National Weather Service prepares and issues flood, severe weather, and coastal storm warnings. Staff hydrologists can work with communities on flood warning issues and can give technical assistance in preparing flood warning plans.

U.S. Department of the Interior
National Park Service
Steve Golden, Program Leader
Rivers, Trails, & Conservation Assistance
15 State Street
Boston, MA 02109
(617) 223-5123
http://www.nps.gov/rtca/

The National Park Service provides technical assistance to community groups and local, state, and federal government agencies to conserve rivers, preserve open space, and develop trails and greenways as well as identify nonstructural options for floodplain development.

U.S. Fish and Wildlife Service
New England Field Office
70 Commercial Street, Suite 300
Concord, NH 03301-5087
(603) 223-2541
http://www.fws.gov/

The U.S. Fish and Wildlife Service provides technical and financial assistance to restore wetlands and riparian habitats through the North American Wetland Conservation Fund and Partners for Wildlife programs. It also administers the *North American Wetlands Conservation Act Grants Program*, which provides matching grants to organizations and individuals who have developed partnerships to carry out wetlands projects in the United States, Canada, and Mexico. Funds are available for projects focusing on protecting, restoring, and/or enhancing critical habitat.

U.S. Department of Agriculture
Natural Resources Conservation Service
Connecticut Office
344 Merrow Road, Suite A
Tolland, CT 06084-3917
(860) 871-4011

The Natural Resources Conservation Service provides technical assistance to individual landowners, groups of landowners, communities, and soil and water conservation districts on land use and conservation planning, resource development, stormwater management, flood prevention, erosion control and sediment reduction, detailed soil surveys, watershed/river basin planning and recreation, and fish and wildlife management. Financial assistance is available to reduce flood damage in small watersheds and to improve water quality. Financial assistance is available under the Emergency Watershed Protection Program, the Cooperative River Basin Program, and the Small Watershed Protection Program.

Regional Resources

Northeast States Emergency Consortium
1 West Water Street, Suite 205
Wakefield, MA 01880
(781) 224-9876
http://www.serve.com/NESEC/

The Northeast States Emergency Consortium (NESEC) develops, promotes, and coordinates "all-hazards" emergency management activities throughout the northeast. NESEC works in partnership with public and private organizations to reduce losses of life and property. They provide support in areas including interstate coordination and public awareness and education, along with reinforcing interactions between all levels of government, academia, nonprofit organizations, and the private sector.

State Resources

Connecticut Department of Administrative Services, Division of Construction Services
165 Capitol Avenue
Hartford, CT 06106
(860) 713-5850
http://www.ct.gov/dcs/site/default.asp

Office of the State Building Inspector - The Office of the State Building Inspector is responsible for administering and enforcing the Connecticut State Building Code and is also responsible for the municipal Building Inspector Training Program.

Connecticut Department of Economic and Community Development
505 Hudson Street
Hartford, CT 06106-7106
(860) 270-8000
http://www.ct.gov/ecd/

The Connecticut Department of Economic and Community Development administers HUD's State CDBG Program, awarding smaller communities and rural areas grants for use in revitalizing neighborhoods, expanding affordable housing and economic opportunities, and improving community facilities and services.

Connecticut Department of Energy and Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3000
http://www.dep.state.ct.us/

The Department includes several divisions with various functions related to hazard mitigation:

Bureau of Water Management, Inland Water Resources Division - This division is generally responsible for flood hazard mitigation in Connecticut, including administration of the National Flood Insurance Program. Other programs within the division include:

- *National Flood Insurance Program State Coordinator*: Provides flood insurance and floodplain management technical assistance, floodplain management ordinance review, substantial damage/improvement requirements, community assistance visits, and other general flood hazard mitigation planning including the delineation of floodways.

- *Flood & Erosion Control Board Program*: Provides assistance to municipalities to solve flooding, beach erosion, and dam repair problems. Have the power to construct and repair flood and erosion management systems. Certain nonstructural measures that mitigate flood damages are also eligible. Funding is provided to communities that apply for assistance through a Flood & Erosion Control Board on a noncompetitive basis.

- *Inland Wetlands and Watercourses Management Program*: Provides training, technical, and planning assistance to local Inland Wetlands Commissions, reviews and approves municipal regulations for localities. Also controls flood management and natural disaster mitigations.

- *Dam Safety Program*: Charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. Regulates the operation and maintenance of dams in the state. Permits the construction, repair or alteration of dams, dikes or similar structures and maintains a registration database of all known dams statewide. This program also operates a statewide inspection program.

Planning and Standards Division - Administers the Clean Water Fund and many other programs directly and indirectly related to hazard mitigation including the Section 319 nonpoint source pollution reduction grants and municipal facilities program which deals with mitigating pollution from wastewater treatment plants.

Office of Long Island Sound Programs (OLISP) - Administers the Coastal Area Management Act (CAM) program and Long Island Sound License Plate Program.

Connecticut Department of Emergency Services and Public Protection
1111 Country Club Road
Middletown, CT 06457
(860) 685-8190
http://www.ct.gov/dps/

Connecticut Division of Emergency Management and Homeland Security
25 Sigourney Street, 6th Floor
Hartford, CT 06106-5042
(860) 256-0800
http://www.ct.gov/demhs/

DEMHS is the lead division responsible for emergency management. Specifically, responsibilities include emergency preparedness, response and recovery, mitigation, and an extensive training program. DEMHS is the state point of contact for most FEMA grant and assistance programs and oversees hazard mitigation planning and policy; administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program; and the responsibility for making certain that the State Natural Hazard

Mitigation Plan is updated every five years. DEMHS administers the Earthquake and Hurricane programs described above under the FEMA resource section. Additionally, DEMHS operates a mitigation program to coordinate mitigation throughout the state with other government agencies. Additionally, the agency is available to provide technical assistance to sub-applicants during the planning process.

DEMHS operates and maintains the CT "Alert" emergency notification system powered by Everbridge. This system uses the state's Enhanced 911 database for location-based notifications to the public for life-threatening emergencies. The database includes traditional wire-line telephone numbers and residents have the option to register other numbers on-line in addition to the land line.

DEMHS employs the *State Hazard Mitigation Officer*, who is in charge of hazard mitigation planning and policy; oversight of administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program, and has the responsibility of making certain that the State Natural Hazard Mitigation Plan is updated every five years.

Connecticut Department of Transportation
2800 Berlin Turnpike
Newington, CT 06131-7546
(860) 594-2000
http://www.ct.gov/dot/

The Department of Transportation administers the federal Intermodal Surface Transportation Efficiency Act (ISTEA) that includes grants for projects that promote alternative or improved methods of transportation. Funding through grants can often be used for projects with mitigation benefits such as preservation of open space in the form of bicycling and walking trails. CT DOT is also involved in traffic improvements and bridge repairs that could be mitigation related.

Connecticut Office of Policy and Management
450 Capitol Avenue
Hartford, CT 06106
(860) 418-6200
http://www.ct.gov.opm

Small Town Economic Assistance Program

The Small Town Economic Assistance Program (STEAP) funds economic development, community conservation and quality of life projects for localities that are ineligible to receive Urban Action bonds. This program is administered by the Connecticut Office of Policy and Management (OPM). Connecticut municipalities may receive up to $500,000 per year if (1) they are not designated as a distressed municipality or a public investment community, and (2) the State Plan of Conservation and Development does not show them as having a regional center. Public Act 05-194 allows an Urban Act Town that is not designated as a regional center under the State Plan of Conservation and Development to opt out of the Urban Action program and become a STEAP town for a period of four years. Projects eligible for STEAP funds include:

1) Economic development projects such as (a) constructing or rehabilitating commercial, industrial, or mixed-use structures and (b) constructing, reconstructing, or repairing roads, access ways, and other site improvements;
2) Recreation and solid waste disposal projects;
3) Social service-related projects, including day care centers, elderly centers, domestic violence and emergency homeless shelters, multi-purpose human resource centers, and food distribution facilities;
4) Housing projects;
5) Pilot historic preservation and redevelopment programs that leverage private funds; and
6) Other kinds of development projects involving economic and community development, transportation, environmental protection, public safety, children and families and social service programs.

In recent years, STEAP grants have been used to help fund many types of projects that are consistent with the goals of hazard mitigation. Projects funded in 2013 and 2014 include streambank stabilization, dam removal, construction of several emergency operations centers (EOCs) in the state, conversion of a building to a shelter, public works garage construction and renovations, design and construct a public safety communication system, culvert replacements, drainage improvements, bridge replacements, generators, and open space acquisition.

Private and Other Resources

Association of State Dam Safety Officials (ASDSO)
450 Old Vine Street
Lexington, KY 40507
(859) 257-5140
http://www.damsafety.org

ASDSO is a non-profit organization of state and federal dam safety regulators, dam owners/operators, dam designers, manufacturers/suppliers, academia, contractors and others interested in dam safety. The mission is to advance and improve the safety of dams by supporting the dam safety community and state dam safety programs, raising awareness, facilitating cooperation, providing a forum for the exchange of information, representing dam safety interests before governments, providing outreach programs, and creating an unified community of dam safety advocates.

The Association of State Floodplain Managers (ASFPM)
2809 Fish Hatchery Road, Suite 204
Madison, WI 53713
(608) 274-0123
http://www.floods.org/

ASFPM is a professional association of state employees that assist communities with the NFIP with a membership of over 1,000. ASFMP has developed a series of technical and topical research papers and a series of Proceedings from their annual conferences. Many "mitigation success stories" have been documented through these resources and provide a good starting point for planning.

Connecticut Association of Flood Managers (CAFM)
P.O. Box 960
Cheshire, CT 06410
ContactCAFM@gmail.com

CAFM is a professional association of private consultants and local floodplain managers that provides training and outreach regarding flood management techniques. CAFM is the local state chapter of ASFPM.

Institute for Business & Home Safety
4775 East Fowler Avenue
Tampa, FL 33617
(813) 286-3400
http://www.ibhs.org/

A nonprofit organization put together by the insurance industry to research ways of reducing the social and economic impacts of natural hazards. The Institute advocates the development and implementation of building codes and standards nationwide and may be a good source of model code language.

Multidisciplinary Center for Earthquake Engineering and Research (MCEER)
University at Buffalo
State University of New York
Red Jacket Quadrangle
Buffalo, New York 14261
(716) 645-3391
http://mceer.buffalo.edu/

A source for earthquake statistics, research, and for engineering and planning advice.

The National Association of Flood & Stormwater Management Agencies (NAFSMA)
1301 K Street, NW, Suite 800 East
Washington, DC 20005
(202) 218-4122
http://www.nafsma.org

NAFSMA is an organization of public agencies who strive to protect lives, property, and economic activity from the adverse impacts of stormwater by advocating public policy, encouraging technology, and conducting educational programs. NAFSMA is a voice in national politics on water resources management issues concerning stormwater management, disaster assistance, flood insurance, and federal flood management policy.

National Emergency Management Association (NEMA)
P.O. Box 11910
Lexington, KY 40578
(859)-244-8000
http://www.nemaweb.org/

A national association of state emergency management directors and other emergency management officials, the NEMA Mitigation Committee is a strong voice to FEMA in shaping all-hazard mitigation policy in the nation. NEMA is also an excellent source of technical assistance.

<u>**Natural Hazards Center**</u>
University of Colorado at Boulder
482 UCB
Boulder, CO 80309-0482
(303) 492-6818
http://www.colorado.edu/hazards/

The Natural Hazards Center includes the Floodplain Management Resource Center, a free library and referral service of the ASFPM for floodplain management publications. The Natural Hazards Center is located at the University of Colorado in Boulder. Staff can use keywords to identify useful publications from the more than 900 documents in the library.

Volunteer Organizations **-** Volunteer organizations including the American Red Cross, the Salvation Army, Habitat for Humanity, and the Mennonite Disaster Service are often available to help after disasters. Service Organizations such as the Lions Club, Elks Club, and the Veterans of Foreign Wars are also available. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings while incorporating mitigation or floodproofing concepts. The office of individual organizations can be contacted directly or the FEMA Regional Office may be able to assist.

Flood Relief Funds **-** After a disaster, local businesses, residents, and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches, or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance, allowing the funds to be used for mitigation and other projects that cannot be funded elsewhere.

Americorps **-** Americorps is the National Community Service Organization. It is a network of local, state, and national service programs that connects volunteers with nonprofits, public agencies, and faith-based and community organizations to help meet our country's critical needs in education, public safety, health, and the environment. Through their service and the volunteers they mobilize, AmeriCorps members address critical needs in communities throughout America, including helping communities respond to disasters. Some states have trained Americorps members to help during flood-fight situations such as by filling and placing sandbags.

12.0 REFERENCES

Association of State Dam Safety Officials, 2010, "Dam Failures, Dam Incidents (Near Failures)," http://www.damsafety.org/media/Documents/PRESS/US_FailuresIncidents.pdf

___, 2010, *Connecticut Dam Safety Program*, http://www.damsafety.org/map/state.aspx?s=7

Blake, E. S., Jarrell, J. D., Rappaport, E. N., Landsea, C. W., 2006, *The Deadliest, Costliest, and Most Intense United States Tropical Cyclones from 1851 to 2005 (and Other Frequently Requested Hurricane Facts)*, Miami, FL: NOAA Technical Memorandum NWS TPC-4, http://www.nhc.noaa.gov/Deadliest_Costliest.shtml

Brumbach, Joseph J., 1965, *The Climate of Connecticut*, State Geological and Natural History Survey of Connecticut, Bulletin No. 99

Buck, Rinker, 2010, "Earthquake Reported off Long Island Sound", *Hartford Courant*, http://articles.courant.com/2010-11-30/news/hc-earthquake-1201-20101130_1_small-quake-minor-earthquake-minor-temblor

Butler, David A., "Geological History of Jamestown, Rhode Island – Building the Northern Appalachian Mountains and New England," http://www.jamestown-ri.info/northern_appalachians.htm, last accessed 12/30/2010

Center for Land Use Education and Research (CLEAR), "Your Town: Land Cover" http://clear.uconn.edu/projects/landscape/your/town.asp?townname=9&Go=Go, University of Connecticut College of Agriculture and Natural Resources.

Connecticut Department of Economic and Community Development, 2011, "Construction Reports: Housing Production and Permits" 2000 – 2013, http://www.ct.gov/ecd/cwp/view.asp?a=1105&q=251248.

Connecticut Department of Energy & Environmental Protection, 2014, *Connecticut's Natural Hazard Mitigation Plan Update*

___, 2013, Connecticut DEEP Dam Safety Inventory.

___, GIS *Data for Connecticut - DEP Bulletin Number 40, rev. 2014*

Connecticut Department of Public Health, 2010, Connecticut Emergency Medical Service Regional Councils, http://www.ct.gov/dph/cwp/view.asp?a=3127&Q=387372&dphNav_GID=1827&dphNav=|, last accessed 1/28/2010

Connecticut Department of Transportation & U.S. Department of Transportation Federal Transit Administration, 2013, *FTA Environmental Assessment: Danbury Branch Improvement Program Technical Summary Report*, State Project 302-008.

Connecticut Flood Recovery Committee, 1955, *Report of the Connecticut Flood Recovery Committee, November 3, 1955*, Connecticut State Library, http://www.cslib.org/floodrecov.pdf

Connecticut Geological & Natural History Survey, 1990, *Generalized Bedrock Geologic Map of Connecticut*, Department of Environmental Protection, http://www.wesleyan.edu/ctgeology/images/CtGeoMap_big.jpg, accessed 12/30/2010

Connecticut State Data Center at the University of Connecticut Libraries Map and Geographic Information Center - MAGIC. (2012). 2015-*2025 Population Projections for Connecticut at State, County, Regional Planning Organization, and Town levels - November 1, 2012 edition*. Retrieved from http://ctsdc.uconn.edu/projections.html.

Federal Emergency Management Agency, 2013, *Flood Insurance Study, Fairfield County, Connecticut* (All Jurisdictions) revised October 16, 2013

___, 2015, *Hazard Mitigation Assistance Unified Guidance.*

___, 2013, "Connecticut Disaster History," http://www.fema.gov/news/disasters_state.fema?id=9

___, 2010, "Wind Zones in the United States," http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm

___, 2009, "FEMA BCA Toolkit v.4.5.5.0."

___, April 2008, *HAZUS®-MH Estimated Annualized Earthquake Losses for the United States*, FEMA document 366

___, 2007, "Connecticut Receives More Than $6.4 Million in Federal Disaster Aid," http://www.fema.gov/news/newsrelease.fema?id=38763

___, 2007, Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000, March 2004, Revised November 2006 and June 2007

___, 2007, *Using Benefit-Cost Review in Mitigation Planning*, State and Local Mitigation Planning How-To Guide Number Five, FEMA document 386-5

___, 2005, *Reducing Damage from Localized Flooding: A Guide for Communities*, FEMA document 511

___, 2003, *Developing the Mitigation Plan – Identifying Mitigation Actions and Implementation Strategies*, State and Local Mitigation Planning How-To Guide Number Three, FEMA document 386-3

___, 1987, *Reducing Losses in High Risk Flood Hazard Areas: A Guidebook for Local Officials*, The Association of State Floodplain Managers

___, Hazards, *Tornadoes*, http://www.fema.gov/hazard/tornado/index.shtm

___, *Multi-Hazard Loss Estimation Methodology – Earthquake Model: Hazus-MH MR5 Technical Manual*

___, *Multi-Hazard Loss Estimation Methodology – Flood Model: Hazus-MH MR5 Technical Manual*

___, *Multi-Hazard Loss Estimation Methodology – Hurricane Model: Hazus-MH MR5 Technical Manual*

First Light Power Resources Services, LLC, 2013, *Emergency Action Plan: Housatonic Project – Bulls Bridge Development*, FERC Project No. 2576, First Light Hydro Generating Company

____, 2010, *Emergency Action Plan: Housatonic Project – Rocky River Development*, FERC Project No. 2576, First Light Hydro Generating Company

Flounders, Helene T., 2004, *Connecticut Statewide Forest Resource Plan, 2004 – 2013*, Connecticut Department of Environmental Protection

Fox News.com, 2008, Rare *Earthquake Strikes Connecticut*, http://www.foxnews.com/story/0,2933,336973,00.html, accessed 8/11/2010

Glowacki, D. 2005. *Heavy Rains & Flooding of Sub-Regional Drainage Basins*, reviewed draft, Connecticut Department of Environmental Protection, Inland Water Resources Division

Hershfield, David M., 1961, *Rainfall Frequency Atlas of the United States*, Technical Paper No. 40, U. S. Department of Commerce, Weather Bureau

Kafka, Alan L., 2008, Why *Does the Earth Quake in New England?* Boston College, Weston Observatory, Department of Geology and Geophysics, http://www2.bc.edu/~kafka/Why_Quakes/why_quakes.html, accessed 8/11/2010

Kennard, D., 2008, "Fuel Categories", Forest Encyclopedia Network, http://www.forestencyclopedia.net/p/p4/p140/p353/p506

Map and Geographic Information Center, 2013, "Connecticut GIS Data," University of Connecticut, Storrs, Connecticut, http://magic.lib.uconn.edu/connecticut_data.html

Milone & MacBroom, Inc., 2012, *City of Danbury Natural Hazard Mitigation Plan*.

____, 2012, "Memorandum: Grove Street Slope Failures Investigation"

____, 2011, *Town of Sherman Natural Hazard Mitigation Plan*, Housatonic Valley Council of Elected Officials, Brookfield, Connecticut

____, 2011, *Town of New Fairfield Natural Hazard Mitigation Plan.*

Miller, D.R., G.S. Warner, F.L. Ogden, A.T. DeGaetano, 1997, *Precipitation in Connecticut*, University of Connecticut College of Agriculture and Natural Resources., Connecticut Institute of Water Resources, Storrs, CT

Muckel, G.B. (editor)., 2004, Understanding Soil Risks and Hazards: Using Soil Survey to Identify Areas with Risks and Hazards to Human Life and Property, United States Department of Agriculture, Natural Resource Conservation Service, National Soil Survey Center, Lincoln, NE

National Interagency Fire Center, 2014, *Fire Information – Wildland Fire Statistics*, http://www.nifc.gov/fire_info/fire_stats.htm

National Oceanic and Atmospheric Administration, Coastal Services Center, 2014, "Hurricane Historical Tracks," http://csc.noaa.gov/hurricanes/

___, National Climatic Data Center, 2011, "Station Snow Climatology – Danbury, Connecticut," http://www.ncdc.noaa.gov/ussc/USSCAppController#GEN

____, National Hurricane Center, 2011, "Return Periods," http://www.nhc.noaa.gov/HAW2/english/basics/return.shtml

National Oceanic and Atmospheric Administration (NOAA), Enhanced *F-scale for Tornado Damage*, http://www.spc.noaa.gov/efscale/

___, *Severe Weather*, http://www.noaawatch.gov/themes/severe.php

___, National Severe Storms Laboratory, 2009, "Tornado Basics," http://www.nssl.noaa.gov/primer/tornado/tor_basics.html

___, 2008, "Lightning Basics," http://www.nssl.noaa.gov/primer/lightning/ltg_basics.html

___, 2006, "Damaging Winds Basics," http://www.nssl.noaa.gov/primer/wind/wind_basics.html

___, 2006, "Hail Basics," http://www.nssl.noaa.gov/primer/hail/hail_basics.html

___, 2004, "Climatography of the United States, No. 20, 1971-2000: Danbury, CT," http://cdo.ncdc.noaa.gov/climatenormals/clim20/ct/061762.pdf

___, 2001, *Winter Storms: The Deceptive Killers – A Preparedness Guide*, http://www.nws.noaa.gov/om/winter/resources/winterstorm.pdf

___, 1995, *A Preparedness Guide*

___, Weekend *Snowstorm in Northeast Corridor Classified as a Category 3 "Major" Storm*, http://www.noaanews.noaa.gov/stories2006/s2580.htm

___, National Climatic Data Center (NCDC), 2014, *Extreme Weather and Climate Events*, http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwEvent~Storms

___, 2014, *Regional Snowfall Index*, http://www.ncdc.noaa.gov/snow-and-ice/rsi/?nesis

___, 2011, *The Northeast Snowfall Impact Scale (NESIS)*, http://www.ncdc.noaa.gov/snow-and-ice/nesis.php

___, National Weather Service, Office of Climate, Water, and Weather Services, 2010, *NEW Weather Fatality, Injury, and Damage Statistics*, http://www.nws.noaa.gov/om/hazstats.shtml

___, National Weather Service Columbia, SC Forecast Office, 2010, *Downbursts…*, http://www.erh.noaa.gov/cae/svrwx/downburst.htm

___, 2010, *Hail…*, http://www.erh.noaa.gov/er/cae/svrwx/hail.htm

___, National Weather Service Louisville, KY Weather Forecast Office, 2005, *Tornado Classifications*, http://www.crh.noaa.gov/lmk/preparedness/tornado_small/classify.php

NBC Connecticut, 2014, "Tornado Did Not Touch Down in New Milford: NWS", http://www.nbcconnecticut.com/weather/stories/Storms-Likely-This-Afternoon-and-Evening-260751171.html

New England Seismic Network, 2014, "NESN Recent Earthquakes," Weston Observatory – Boston College, http://aki.bc.edu/cgi-bin/NESN/recent_events.pl

Northeast States Emergency Consortium, *Earthquakes, http*://www.nesec.org/hazards/Earthquakes.cfm, accessed 8/11/2010

The Paleontological Research Institution, "Geologic History – Mountain Building Part 1: The Grenville Mountains," http://www.priweb.org/ed/TFGuide/NE/geo_history/history_files2/history_pdfs/ne_geohistory1.pdf

Partnership for Strong Communities, 2011, *2011 HOPE Regional Housing Forums Town Housing Profile – New Milford,, CT*, http://www.hvceo.org/tables/psc_factsheet_hvceotowns.pdf

Robinson, G. R. Jr., Kapo, K. E., 2003. *Generalized Lithology and Lithogeochemical Character of Near-Surface Bedrock in the New England Region*, U.S. Geological Survey Open-File Report 03-225, U.S. Geological Survey, Reston, VA, http://pubs.usgs.gov/of/2003/of03-225/

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture, Soil Series Classification Database [Online WWW], Available URL: http://soils.usda.gov/soils/technical/classification/scfile/index.html [accessed 10 February 2004], USDA-NRCS, Lincoln, NE

Tornado Project Online. http://www.tornadoproject.com/

___, 1979-1980, National Program for Inspection of Non-Federal Dams, Phase I Inspection Reports, http://oai.dtic.mil/oai/

Town of New Milford, *Inland Wetland Regulations*, as amended through June 10, 2013

____, 2010, *Plan of Conservation and Development*

____, 2002, *Subdivision Regulations*, effective June 2, 2001 as revised through March 7, 2002

____, 2013, *Zoning Regulations*, effective 1971 as amended through June 10, 2013

United States Census Bureau, 2008-2012 American Community Survey, http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_12_5YR_DP02&prodType=table

United States Geological Survey, Earthquake Hazards Program, Connecticut *Earthquake History*, Abridged from Earthquake Information Bulletin, January – February 1971, http://earthquake.usgs.gov/regional/states/connecticut/history.php, accessed 8/11/2010

___, 2010, "2009 Earthquake Probability Mapping," https://geohazards.usgs.gov/eqprob/2009/index.php

___, 2010, "Magnitude / Intensity Comparison," http://earthquake.usgs.gov/learn/topics/mag_vs_int.php

___, 2009, *Seismic Hazard Map of Connecticut,* http://earthquake.usgs.gov/regional/states/connecticut/hazards.php, accessed 8/11/2010

___, 2009, *The Severity of an Earthquake*, http://pubs.usgs.gov/gip/earthq4/severitygip.html, accessed 8/11/2010

___, 2009, "Top Earthquake States," http://earthquake.usgs.gov/earthquakes/states/top_states.php

___, 2006, *Wildfire Hazards – A National Threat*, http://pubs.usgs.gov/fs/2006/3015/2006-3015.pdf

Wfsb, 2010, "Residents Report Feeling Canadian Earthquake," http://www.wfsb.com/news/24007970/detail.html

Wikipedia, 2014, “New Milford, Connecticut”, http://en.wikipedia.org/wiki/New_Milford,_Connecticut

___, 2014, *List of Connecticut Tornadoes,* http://en.wikipedia.org/wiki/List_of_Connecticut_tornadoes

___, 2011, "1993 Storm of the Century," http://en.wikipedia.org/wiki/1993_Storm_of_the_Century

___, 2011, "Great Blizzard of 1888," http://en.wikipedia.org/wiki/Great_Blizzard_of_1888

___, 2011, "Northeastern United States Blizzard of 1978," http://en.wikipedia.org/wiki/Northeastern_United_States_blizzard_of_1978

___, 2010, "Fire Triangle," http://en.wikipedia.org/wiki/Fire_triangle

APPENDIX A
STAPLEE MATRIX

	Strategies and Actions for the Town of New Milford	Report Sections							Categories[1]	Responsible Department[2]	Timeframe	Cost[3]	Potential Funding Sources[4]	Weighted STAPLEE Criteria[5]																Total STAPLEE Score
														Benefits								*Costs*								
		Flooding	Hurricanes and Tropical Storms	Summer Storms and Tornadoes	Winter Storms	Earthquakes	Dam Failure	Wildfires						Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	**STAPLEE Subtotal**	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	**STAPLEE Subtotal**	
	MULTIPLE HAZARDS																													
1	Incorporate the identified strategies of this HMP into local planning activities	X	X	X	X	X	X	X	1,4	MA, LC	9/2015-9/2020	Minimal	Municipal	1	1	1	0.5	1	1	0.5	**8.0**	0	0	-0.5	0	0	0	0	**-0.5**	**7.5**
2	Acquire a generator for the Town Hall and then relocate the Emergency Operations Center to the Town Hall	X	X	X	X	X	X	X	3	EMD	9/2015-12/2016	Moderate	Municipal, EOC, STEAP, HMA	1	1	1	1	1	0.5	0	**7.0**	0	0	-0.5	0	0	-0.5	0	**-1.5**	**5.5**
	FLOODING																													
3	Adopt a standardized drainage policy to ensure consistency between developments	X	X	X	X		X		1	PC, ZC	1/2016-12/2016	Minimal	Municipal	1	1	1	1	1	1	1	**9.0**	0	0	-0.5	0	0	0	0	**-0.5**	**8.5**
4	Adopt low-impact development standards into the Zoning Regulations and Subdivision Regulations	X	X	X	X		X		1	PC, ZC	1/2016-12/2016	Minimal	Municipal	0.5	0.5	1	0.5	1	1	1	**7.0**	0	0	-0.5	0	0	0	0	**-0.5**	**6.5**
5	Adopt a freeboard requirement of one foot for all new development or substantial improvement within the SFHA	X	X	X	X		X		1	PC, ZC	1/2016-12/2016	Minimal	Municipal	1	1	1	0	1	0.5	1	**7.0**	0	0	-0.5	0	0	-0.5	0	**-1.5**	**5.5**
6	Require the use of the FEMA Elevation Certificate to formally record elevations for compliance with the Zoning Regulations	X	X	X	X		X		1, 2	ZC	9/2015-9/2020	Minimal	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	0	0	0	0	0	**0.0**	**8.0**
7	Encourage town practices to employ measures to reduce stormwater flow	X	X	X	X		X		2, 4	MA, PZ	9/2015-9/2020	Minimal	Municipal	1	0.5	0.5	1	1	1	1	**7.5**	0	0	-0.5	0	0	0	0	**-0.5**	**7.0**
8	Educate residents and property owners on ways that they can reduce stormwater runoff, and possibly adopt regulatory incentives over the long term	X	X	X	X		X		4	PZ, PW	7/2016-6/2017	Low	Municipal	1	1	0.5	0.5	1	0.5	0.5	**6.5**	0	0	-0.5	0	0	0	0	**-0.5**	**6.0**
9	Create an Open Space Plan to prioritize future open space acquisition that encourages the creation of recreational open space within SFHAs	X	X	X	X		X		5	PC, PZ	7/2016-6/2017	Low	Municipal, Weantinoge Heritage Land Trust	1	1	1	1	1	1	1	**9.0**	-0.5	0	-0.5	0	0	0	0	**-1.0**	**8.0**
10	Assist residential property owners interested in obtaining grant funding to elevate properties within SFHAs	X	X	X	X		X		2	MA	7/2016-6/2018		HMA	1	1	0	1	1	1	1	**8.0**	0	0	-0.5	0	0	0	0	**-0.5**	**7.5**
11	Encourage property owners within the SFHA to purchase flood insurance through the NFIP and complete FEMA elevation certificates for their structures	X	X	X	X		X		2	PZ	7/2016-6/2017	Minimal	Municipal	1	1	1	1	1	1	0	**8.0**	-0.5	0	-0.5	0	0	0	0	**-1.0**	**7.0**
12	Relocate the Public Works Garage out of the SFHA	X	X	X	X		X		2, 3	PW	7/2017-6/2019	High	Municipal, HMA, EOC	1	1	1	1	1	1	1	**9.0**	0	0	0	0	0	-1	0	**-2.0**	**7.0**
13	Elevate one or more roads leading to the Ambulance facility to ensure that egress is available during the 1% annual chance flood	X	X	X	X		X		3, 6	PW	7/2017-6/2019	High	Municipal	1	1	1	1	1	0.5	0	**7.0**	0	0	-0.5	0	0	-1	0	**-2.5**	**4.5**
14	Elevate portions of West Street to ensure that egress is maintained to the Water Pollution Control Facility during floods	X	X	X	X		X		6	PW	7/2017-6/2019	High	Municipal	0.5	1	0.5	0.5	1	0.5	0	**5.5**	0	0	-0.5	0	0	-1	0	**-2.5**	**3.0**
15	Elevate portions of West Street or develop an emergency mode of egress to the Bleachery commercial development	X	X	X	X		X		3, 6	PW	7/2017-6/2019	High	Municipal	0.5	1	0.5	0.5	1	0.5	0	**5.5**	-1	-0.5	-0.5	0	-0.5	-1	0	**-5.0**	**0.5**
16	Widen portions of the side roads that are used to detour traffic when flooding occurs along Route 7 between Bridge Street and Sunny Valley Road	X	X	X	X		X		6	PW	7/2017-6/2019	Moderate	Municipal	0.5	0.5	1	0.5	1	0	0	**4.0**	-1	-1	-0.5	0	0	-0.5	0	**-4.5**	**-0.5**
17	Elevate one of the three bridges over the Housatonic River to be unaffected by the 0.2% annual chance flood event	X	X	X	X		X		6	PW, MA	7/2018-6/2020	High	Municipal, HMA, CT DOT	1	1	1	1	1	1	0	**8.0**	0	0	-0.5	0	0	-1	0	**-2.5**	**5.5**
18	Evaluate the potential flood mitigation effects of installing inflatable flashboards at the Bleachery Dam	X	X	X	X				2, 6	PW, MA	7/2016-6/2017	Low	Municipal, STEAP	1	0.5	1	1	1	0.5	0	**6.0**	0	0	0	0	0	0	0	**0.0**	**6.0**
19	Perform a drainage study along the Housatonic River to identify drainage systems that should be outfitted to prevent floodwater from flooding Route 7	X	X	X	X		X		6	PW	7/2017-6/2018	Moderate	Municipal, STEAP	1	1	1	1	1	1	0.5	**8.5**	0	0	-0.5	0	0	-0.5	0	**-1.5**	**7.0**
20	Check the conveyance of all bridges and culverts based on more recent rainfall data statistics	X	X	X	X		X		6	PW	7/2017-6/2018	Low	Municipal	1	1	1	0.5	1	0.5	0	**6.5**	0	0	-0.5	0	0	0	0	**-0.5**	**6.0**
21	Construct a slope stabilization project to prevent mudslides along Grove Street	X	X	X	X				6	PW	7/2017-6/2018	High	Municipal, HMA*	1	1	1	1	1	0.5	0.5	**7.5**	-0.5	0	-0.5	0	0	-1	0	**-3.0**	**4.5**
	WIND																													
22	Update the Zoning Regulations to require underground utilities for all new buildings regardless of zone unless such installation is deemed infeasible		X	X	X			X	1	ZC	1/2016-12/2016	Minimal	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	0	0	0	0	0	**0.0**	**8.0**
23	Encourage the use of structural techniques related to wind damage mitigation in new structures		X	X	X				4	PZ	9/2015-9/2020	Minimal	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	0	0	0	0	0	**0.0**	**8.0**
24	Require the use of structural mitigation techniques to harden new municipal critical facilities		X	X	X				6	ZC	1/2016-9/2020	Minimal	Municipal, HMA, EOC	1	1	1	1	1	1	0	**8.0**	0	0	0	0	0	0	0	**0.0**	**8.0**
25	Consider locations where a micro-grid could be installed		X	X	X	X			6	EMD	1/2016-12/2016	Low	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	-0.5	0	0	0	0	**-0.5**	**7.5**
	WINTER STORMS																													
26	Evaluate critical facilities for acceptable snow loading and develop a response plan to clear roofs when necessary				X				2	BD, PW	1/2016-12/2016	Low	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	-1	0	0	0	0	**-1.0**	**7.0**
	EARTHQUAKES																													
27	Enact regulations preventing new residential development in areas prone to collapse such as at the bottom of steep slopes					X			1	PC, ZC	1/2017-12/2017	Minimal	Municipal	0.5	1	1	0.5	1	1	0.5	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**
28	Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs to municipal buildings					X			3	EMD	1/2018-12/2019	High	Municipal, EOC, STEAP	1	1	1	0.5	1	0	0	**5.5**	0	0	-0.5	0	0	-1	0	**-2.5**	**3.0**
	DAM FAILURE																													
29	Prepare inundation mapping and EAPs for Town-owned significant hazard dams						X		3, 4	PW	1/2016-12/2016	Moderate	Municipal	1	1	1	1	1	0.5	0	**7.0**	0	0	-0.5	0	0	-0.5	0	**-1.5**	**5.5**
30	Utilize inundation mapping to identify properties that may be affected and conduct outreach to ensure contact information is in Everbridge system						X		3	EMD, PZ	1/2016-12/2016	Low	Municipal	1	1	1	1	1	1	0	**8.0**	0	0	-0.5	0	0	0	0	**-0.5**	**7.5**
31	Enact a Flood and Erosion Control Board in order to be eligible for funding to repair municipally-owned dams	X					X		1	MA	1/2016-12/2016	Minimal	Municipal	1	1	1	0.5	1	1	0	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**
	WILDFIRES																													
32	Identify and implement projects to increase fire-fighting access to areas at increased risk for wildfire							X	5,6	EMD	9/2015-9/2020	High	Municipal, STEAP	1	1	1	0.5	1	0	0.5	**6.0**	-0.5	-0.5	-0.5	-0.5	-0.5	-1	0	**-5.0**	**1.0**

NOTES

1. Categories: 1: Prevention. 2: Property Protection. 3: Emergency Services. 4: Public Information. 5: Natural Resource Protection. 6: Structural Projects.
2. Responsible Departments: BD = Building Department; EMD = Emergency Management Director; LC = Local Coordinator; MA = Mayor; PW = Public Works; PC = Planning Commission; PZ = Planning/Zoning Department; ZC = Zoning Commission
3. Costs: Minimal = To be completed by staff or volunteers where costs are primarily printing, copying, or meetings; Low = Costs are less than $10,000; Moderate = Costs are less than $100,000; High = Costs are > than $100,000.
4. Funding Sources: HMA = Hazard Mitigation Assistance Grants (PDM, FMA, HMGP), a * indicates that the project has the potential to be cost effective; EOC = Emergency Operations Center grant (not currently active); STEAP = Small Town Economic Assistance Program
5. A beneficial or favorable rating = 1; an unfavorable rating = -1. Technical and Financial benefits and costs are double-weighted (i.e. their values are counted twice in each subtotal)

APPENDIX B
RECORD OF MUNICIPAL ADOPTION

CERTIFICATE OF ADOPTION
TOWN OF NEW MILFORD TOWN COUNCIL

**A RESOLUTION ADOPTING
THE TOWN OF NEW MILFORD HAZARD MITIGATION PLAN**

WHEREAS, the town of New Milford has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of those natural hazards profiled in the plan (e.g. *flooding, high wind, thunderstorms, winter storms, earthquakes, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

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

WHEREAS, public and committee meetings were held between January 2014 and May 2014 regarding the development and review of the Hazard Mitigation Plan; and

WHEREAS, the Hazard Mitigation Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of New Milford; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the town of New Milford, 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 New Milford eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Town Council:

1. The Plan is hereby adopted as an official plan of the Town of New Milford;
2. The respective officials identified in the mitigation strategy 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 a part of this resolution for a period of five (5) years from the date of this resolution; and
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Town Council by the Emergency Management Director.

Adopted this ______ day of _______, 2015 by the Town Council of New Milford, Connecticut

____

Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of New Milford this _____ day of _______, 2015.

____

Town Clerk

APPENDIX C
MITIGATION PROJECT STATUS WORKSHEET

Mitigation Action Progress Report Form

Progress Report Period	From Date:	To Date:
Action/Project Title		
Responsible Agency		
Contact Name		
Contact Phone/Email		
Project Status	❏ Project completed ❏ Project canceled ❏ Project on schedule ❏ Anticipated completion date:__________ ❏ Project delayed Explain __________	

Summary of Project Progress for this Report Period

1. What was accomplished for this project during this reporting period?

2. What obstacles, problems, or delays did the project encounter?

3. If uncompleted, is the project still relevant? Should the project be changed or revised?

4. Other comments

APPENDIX D
DOCUMENTATION OF PLAN DEVELOPMENT

APPENDIX D
PREFACE

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the town of New Milford as well as to identify areas that should be prioritized for hazard mitigation. Documentation of this process is provided within the following sets of meeting minutes and field reports.

Meeting Agenda
HAZARD MITIGATION PLAN FOR TOWN OF NEW MILFORD
January 15, 2014

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1. Purpose and Need for Hazard Mitigation Plan
2. Natural Hazards and Hazard Mitigation
3. Update on Hazard Mitigation Grant Programs (PDM, HMGP)
4. Hazards to Include in Plan
5. Hazard Mitigation Planning Process
6. Project Scope and Schedule
7. Data Collection and Review of Hazards and Events from 2007-2014
8. Hazard Mitigation Strategies
9. Outreach and Public Involvement
10. Next Steps

Development of Hazard Mitigation Plan for the Town of New Milford

PDM

PRE-DISASTER MITIGATION

Presented by:
Scott Bighinatti, CFM
Craig Southern, CFM
Milone & MacBroom, Inc.
January 15, 2014

HMGP

HAZARD MITIGATION GRANT PROGRAM

MILONE & MACBROOM®

Purpose and Need for a Hazard Mitigation Plan

- **Authority**
  - Disaster Mitigation Act of 2000 (amendments to Stafford Act of 1988)
- **Goal of Disaster Mitigation Act**
  - Encourage disaster preparedness
  - Encourage hazard mitigation measures to reduce losses of life and property
- **Status of Plans in Connecticut**
  - Most initial plans developed 2005-2010
  - A few areas of the State remain
  - The State hazard mitigation plan is updated every three years; local plans are updated every five years

FEDERAL EMERGENCY MANAGEMENT AGENCY

MILONE & MACBROOM®

What is a Natural Hazard?

- An extreme natural event that poses a risk to people, infrastructure, and resources

MILONE & MACBROOM®

What is Hazard Mitigation?

- Actions that reduce or eliminate long-term risk to people, property, and resources from natural hazards and their effects

MILONE & MACBROOM®

Long-Term Goals of Hazard Mitigation

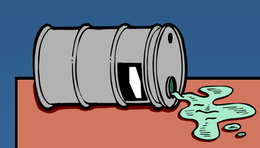
- Reduce loss of life and damage to property and infrastructure
- Reduce the costs to residents and businesses (taxes, insurance, repair costs, etc.)
- Educate residents and policy-makers about natural hazard risk and vulnerability
- Connect hazard mitigation planning to other community planning efforts
- Enhance and preserve natural resource systems in the community

MILONE & MACBROOM®

What a Hazard Mitigation Plan Does Not Address

- Terrorism and Sabotage

- Disaster Response and Recovery
- Human Induced Emergencies (some fires, hazardous spills and contamination, disease, etc.)



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Update on Hazard Mitigation Grant Programs

- Local communities must have a FEMA-approved Hazard Mitigation Plan in place to receive Federal Grant Funds for Hazard Mitigation Projects
  - PDM (Pre-Disaster Mitigation)
  - HMGP (Hazard Mitigation Grant Program)
  - FMA (Flood Mitigation Assistance)
- Connecticut has >$20M to distribute under HMGP

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How Can the Plan be Used?

- Grants can be used for:
  - Building acquisitions or elevations
  - Culvert replacements
  - Drainage projects
  - Riverbank stabilization
  - Landslide stabilization
  - Wind retrofits
  - Seismic retrofits
  - Snow load retrofits
  - **Standby power supplies for critical facilities**

FEMA's new cost effectiveness guidelines will make acquisitions and elevations easier

This home in Trumbull was acquired and demolished using a FEMA grant

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How Can the Plan be Used?

Culvert Replacement to
be funded by HMGP

Floyd
1999

Irene
2011

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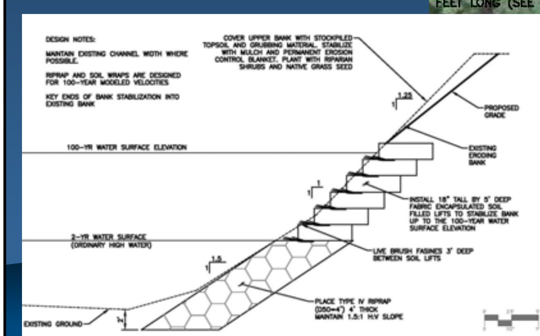
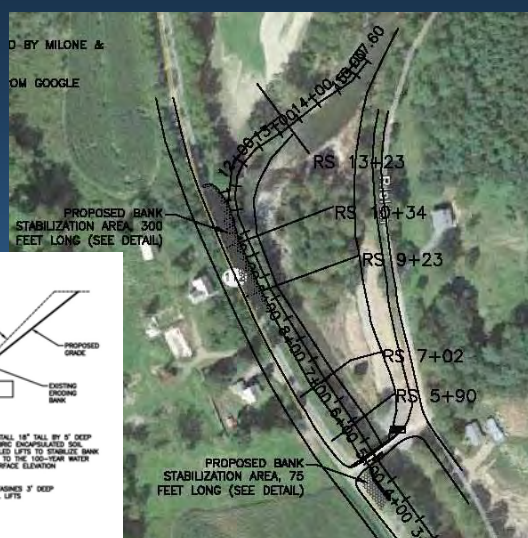
How Can the Plan be Used?

Riverbank Stabilization
to be funded by HMGP





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Hazards Proposed to Include in the Plan

- Floods
- Hurricanes and tropical storms
- Summer storms and tornadoes

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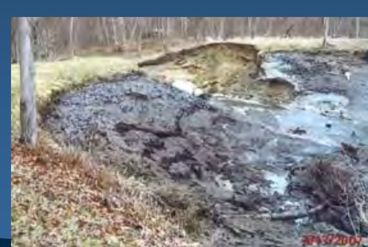
Hazards Proposed to Include in the Plan

- Winter storms and nor'easters
- Earthquakes
- Wildfires
- Dam failure
- Landslides (optional)



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Components of Hazard Mitigation Plan Process

- Review natural hazards that could occur in New Milford
- Review the vulnerability of structures and populations and identify critical facilities and areas of concern
- Incorporate effects of federally declared disasters that have occurred in the last few years:
  - ✓ March 2010 floods
  - ✓ Winter snow loads/collapsing roofs in January 2011
  - ✓ Tropical Storm Irene in August 2011 (and T.S. Lee afterward)
  - ✓ Winter Storm Alfred in October 2011
  - ✓ Hurricane Sandy in October 2012
  - ✓ Winter Storm Nemo in February 2013

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Components of Hazard Mitigation Plan Process

- Assess adequacy of mitigation measures currently in place such as regulations and drainage projects
- Develop mitigation goals, strategies, and actions
- Outreach to stakeholders and neighboring towns
- HAZUS vulnerability/risk analysis
- Public participation
- Develop plan document
- State and FEMA approvals
- Local adoption

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Scope of Services and Schedule

- Task 1 – Project Initiation and Data Collection: January 2014
- Task 2 – Risk and Vulnerability Assessment: HAZUS already completed; additional analysis February 2014
- Task 3 – Strategy and Plan Development: February-March 2014
- Task 4 – DEMHS and FEMA Review and Plan Adoption: April 2014 and continuing as needed

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Data Collection and Discussion

- What are New Milford's critical facilities?
- Shelters and evacuation routes
- Standby power supplies
- Discussion of recent storms (Irene, Alfred, Sandy)
- Development and redevelopment trends
- Utilities above/below ground?
- Areas of flooding
- How are drainage and flooding complaints received and tracked?
- Repetitive loss properties (15)

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Data Collection and Discussion

- Have any bridges, culverts, or stormwater systems been replaced or upgraded recently?
- Areas prone to wind damage or increased wind damage risk
- Tree maintenance and tree warden budget
- Snow and ice removal routes and capabilities
- Areas prone to icing or drifts in winter
- Dams and effects of dam failure
- Areas without fire protection and use of dry hydrants and cisterns
- Areas prone to wildfires, fire department capabilities, coordination with nearby municipalities

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Hazard Mitigation Strategies

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Typical Hazard Mitigation Strategies

- Elevate or remove flood-prone buildings
- Wet and dry floodproofing
- Move critical facilities from flood zones
- Strengthen or reinforce shelters
- Remove and replace undersized and/or failing bridges and culverts
- Replace overhead utilities with underground utilities
- Organize tree maintenance priorities and scheduling
- Enhance fire suppression capabilities
- Public education programs – dissemination of public safety information

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Hazard Mitigation Strategies for New Milford

- Goals?
- Strategies and actions?
- What one or two things can be done in New Milford with current budgets?
- What one or two things would be done in New Milford if money was not a concern?

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Next Steps

- Outreach and public involvement
  - Coordination with other HVCEO municipalities
  - Public information meeting in February 2014
- Materials needed or resulting from this meeting
  - Are POCD, Regulations, and zoning map on town web site?
  - Are any specific ordinances related to hazard mitigation?
  - NFIP regulations: Is flood damage prevention included in the municipal code, zoning, or both?

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MINUTES OF MEETING

PROJECT NO.: MMI #3101-14-1

PROJECT NAME: Hazard Mitigation Plan – New Milford

DATE OF MEETING: January 15, 2014

SUBJECT OF MEETING: Data Collection

LOCATION OF MEETING: New Milford Town Hall

ATTENDEES:
Patricia Murphy, Mayor
Shawn Boyne, Chief of Police
Mark Buckley, Deputy Chief of Police
James Ferlow, Inland Wetlands Enforcement Officer and Chief, Water Witch Hose Co. #2
Michael Zarba, P.E., Director of Public Works
Laurene Beattie, Public Works Department
James Rotohdo, Public Works Department
Marla Scribner, Emergency Management Director
David Hannon, Housatonic Valley Council of Elected Officials (HVCEO)
Scott Bighinatti, CFM, Milone & MacBroom, Inc. (MMI)
Craig Southern, Milone & MacBroom, Inc. (MMI)

A. *Welcome and Introductions*

The individuals attending the data collection meeting were welcomed and introduced.

B. *Description and Need for Hazard Mitigation Plans/Disaster Mitigation Act of 2000*

Mr. Bighinatti briefly described the basis for the natural hazard planning process and possible outcomes, including the role of the subject plan in grant application support for the community. Mr. Bighinatti noted that with several declared disasters in the past few years there are opportunities for grants under the Hazard Mitigation Grant Program (HMGP) through the State of Connecticut [Department of Emergency Management and Homeland Security (DEMHS)]. Federal Emergency Management Agency (FEMA) grant programs require a local match of 25% of the project cost, and application materials must show that the proposed action will be cost effective (i.e., provide more long-term benefits in preventing damage than the up-front costs).

The plan will address flooding, hurricanes and tropical storms, winter storms and nor'easters, ice jams, summer storms and tornadoes, landslides, earthquakes, dam failure, and wildfires. These hazards were discussed along with critical facilities, development trends, and mitigation strategies and actions for the town of New Milford.

C. Critical Facilities

- The following critical facilities have backup power and generators:
  - Ambulance facility, this facility houses the Emergency Operations Center
  - Senior Center
  - Teen Center
  - Fire Departments:
    - Water Witch Hose Co. #2
    - Gaylordsville
    - Northville
  - New Milford Police Department
  - Public Works Department – Highway garage has a generator, but they need one for the mechanic shed.
  - Sewage facility/Wastewater Treatment Plant
- The Town Hall and Public Works Highway Office both do not have any backup power. The Town wants to acquire a generator for this facility and move the EOC to this location. An HMGP grant is considered for obtaining generators.
- The Public Works Department is within the 100 Year floodplain. The access roads to the Sewage facility/Wastewater Treatment Plant, and the Ambulance facility are all in the 100-year floodplain. Floodproofing is the initial preventive strategy, but relocation is a long-term goal for the Public Works Department. All of these facilities are not accessible in a 10-15 year storm event.
- The Sarah Noble School, Teen Center, and Senior Center are all considered shelters for the town and are equipped with backup power.
- Marla Scribner, Emergency Management Director, will email a more detailed and comprehensive list of critical facilities and shelters.
- Aquarion Water Company has been raising wellheads above the Base Flood Elevation (BFE) and installing generators. Currently, two wellheads are being elevated at Indian Field and Peagler Hill.

D. Development Trends

- Town staff discussed that in 2013 four new single-family homes were constructed, and reportedly in 2014 permits for 10 new single-family homes have already been approved.
- Along U.S. Route 7, there is moderate commercial/retail development. The completion of "Super 7" has not spurred residential development in New Milford, but it has made the commercial development more attractive as residents in surrounding communities come to New Milford to shop and commute through on their way to work. A portion of this corridor is located in the flood zone and some development occurs in the floodplain as regulated by the zoning regulations.

- Town personnel indicated that economic development is consistent with the town's Plan of Conservation and Development.
- The Bleachery, a renovated historic mill on Lake Lillinonah, has over 100 commercial units. The access road to this development is floodprone and a secondary access is needed.
- The town removed any regulations associated with the now defunct State of Connecticut Stream Channel Encroachment Lines (SCELs). In areas where the SCEL lines were landward of the Special Flood Hazard Area (SFHA), this has removed state oversight and permitting. In addition, the lack of updated FIRMs in Litchfield County sometimes causes issues with where the floodplain actually lies.
- U.S. Route 202 has also had some new commercial development. Reportedly, substantial retail development could occur along U.S. Route 202 but is currently limited by Zoning District Regulations.
- The Subdivision Regulations currently require new construction to install utilities underground.
- The Town uses ICC codes for building.

E. Flooding

- The town's Floodplain Management standards are located in the Zoning Regulations.
- The areas that have continuous flooding in town are from these four primary sources: the Housatonic River, East and West Aspetuck Rivers, and the Still River.
- The Public Works Department fields the majority of the phone calls related to flooding and drainage complaints. Occasionally, the police receive these complaints as well.
- Flooding traditionally occurs in stages in New Milford.
- The town would like a study conducted associated with the flooding on the Housatonic River. Reportedly, the stormwater drainage and infrastructure are continuously flooded, particularly on Route 7.
- Mr. Zarba indicated that floods require the town to close Route 7 between Bridge Street and Sunny Valley Road and set up detours on narrow roads. It impacts emergency vehicles, school buses, and the general public. Usually seven to 10 days a year this portion of Route 7 is closed. Police must pull people out of flooded areas along this road 6-7 days per year.
- Scouring and washouts around railroad tracks have occasionally occurred. There is concern about possible derailment of trains from settling tracks if erosion is not stopped.
- Minor repairs, replacements, and stabilization of culverts have been done. Larger pipe diameters have been installed at Paper Mill Road. New Milford could encourage the Connecticut Department of Transportation (CTDOT) to apply for funding to remediate these areas since state agencies may apply for grants.
- In 2011, Tropical Storms Irene and Lee caused many road washouts and road closures. Trees and debris were washed into the rivers and water sources, exacerbating flooding primarily along Route 7, Ericson Road, River Road, Youngs Field Road, West Road, Cross Road, Aspetuck Avenue, and Spring Street.

- Due to wet unstable soils, trees frequently fall into the Aspetuck River and create flooding issues on Route 202. This has happened four or five times in the last 15 years.
- There are currently 15 Repetitive Loss Properties in New Milford. These are predominantly located within the SFHA of the Housatonic River.
- The Pratt Nature Center at the intersection of Stone Tent Road and Paper Mill Road is a concern. This structure and area have been prone to flooding.
- At this time, the town has no interest in Repetitive Loss Property acquisitions or elevations.
- There are three bridge crossings of the Housatonic River in central New Milford. These could be areas of concern during flooding. These are the Marsh Bridge on the Grove Street Corridor to the south, the central crossing near downtown provided by Veterans Bridge carrying combined Routes 67 and 202, and to the north the Boardman Bridge on Boardman Road. All three link Route 7, which remains on the west side of the Housatonic in this part of the town, with the east side of the community. Town officials are concerned with a potential severe flood event completely isolating one side of the Housatonic River from the other. In particular, Route 67 could be destroyed during a severe flood. Elevation of one of these roads may be a potential project.
- The Bleachery Dam is typically the water level control for the Housatonic River in New Milford until the 10% annual chance flood elevation is reached. At that point, the Lovers Leap Gorge becomes the flow control. The Town doesn’t want to remove the dam because they need the backwater condition during the low-flow summer months to both supply water to Candlewood Lake and to prevent erosion of the riverbed which is laden with PCB’s. Inflatable membranes have been suggested to help control spill and flooding, as was done on the neighboring Farmington River.
- The U.S. Army Corps of Engineers has had discussions with the town about the possibility of installing high water inflatable flashboards to raise the water level in the summer (to keep backwater conditions out of the center of town) and to lower it in the winter (to prevent flooding and potential ice jam problems).
- Kimberly-Clark Corporation has a large bleach containment area adjacent to Pickett District Road about which the town has concerns if the area was compromised by flooding.
- The Iroquois Pipeline Operating Company, which operates the New Milford Meter Station, is a concern to the town if this meter station or gas pipes associated with it were compromised by flooding.
- Ice jams in the Lover's Leap Gorge have occasionally caused flooding, but the flooding the town hopes to alleviate is that caused by normal spring thaws and heavy rains.
- Accessibility to the Ambulance facility is compromised and impassable during flooding. The town is recommending regrading and elevating the approach above the base flood elevation.
- New Milford is not a member of the Community Rating System.
- The Iroquois pipeline and station has potential flooding and erosion impacts.
- The Town would like to perform a drainage study along the Housatonic River considering the installation of check valves to prevent water coming back up through

storm drains on Route 7. Route 7 often floods due to backwater conditions in the drainage system.

- ❑ The Still River confluence with the Housatonic River is just upstream of the Lovers Leap Gorge. Backwater conditions from flooding at the gorge can cause backwater flooding all the way upstream into Brookfield.
- ❑ The Housatonic River goes through stages of flooding depending on the peaks. Emergency officials “chase” the flood wave through New Milford, closing and reopening roads as the flood waters rise and fall. The Police Department has a lot of challenges directing traffic during these times.
- ❑ First Light monitors the stage in the Housatonic River and does its best to give the Town forewarning. They can lower the water level behind the dam in Derby to alleviate some of the flooding.
- ❑ Town staff indicate that they require one foot of freeboard for residential development, although the regulations require the lowest floor to be “at or above” the BFE. Many businesses have had to raise their electrical and other utilities above the 1% annual chance flood elevation to comply with recent updates to the building code.
- ❑ Big Y installed flood doors several years ago.
- ❑ The town feels that the local regulations can’t be fixed because there really isn’t any other place to move businesses to in New Milford. The regulations are believed to be ok from an environmental perspective.
- ❑ New Developments need Stormwater Management Plans.
- ❑ The town recently acquired a property along Larson Road (6-7 years ago) and demolished the house/structure and excavated a storm water management system on the property to protect the road and other houses in the area.
- ❑ There are a few beaver dams in town that could present minor flooding. These beaver dams are located adjacent to Mud Pond Road on Mud Pond, on Tamarac Road on the Denman Brook, Fort Hill Road by Ferris Pond, and on Larson Road adjacent to an unidentified water source. Some of these can cause flooding at Route 7. In particular, the beavers are ruining the drainage infrastructure on Tamarac Road.

F. Ice Jams and Landslides

- ❑ Ice jams occur frequently during the winter in the Lover's Leap Gorge. Occasionally, these ice jams have caused flooding. The town hopes to mitigate this flooding caused by normal spring thaws and heavy rains by installing floodgates or strategically placed flood barriers.
- ❑ Several areas along Route 7 and Grove Street are ripe for a slide due to the steep topography and underlying soils types.
- ❑ During heavy rain events, mudslides have traditionally flowed over Grove Street and have been behind Hill Street, as well as behind Fordyce Road.
- ❑ MMI conducted studies of the mudslides on Grove Street in 1983 and 2011.

G. Wind

- Power was not lost during Tropical Storm Irene. Many neighboring communities relied on the town for gas and supplies.
- Downbursts are the most common type of wind that causes significant tree damage in New Milford due to the area's ridges and hills. There are elevated areas that have significant vulnerability to wind. Town staff indicated that there is a wind corridor between several hills that often experiences a straight line of wind in the south and west portions of town. These areas are considered to be the most vulnerable, especially along Sherry Lane close to Lake Candlewood, Pumpkin Hill Road, and Carmen Hill Road.
- The town has a very proactive and aggressive approach to tree trimming. This progressive approach to tree trimming has helped considerably to prevent outages on Route 7. The Tree Warden has a budget of $100,000 a year. This is separate from CL&P clearing and any emergency response actions.
- The town feels that CL&P is being more proactive recently than in past years. CL&P has a facility in town, but it is being relocated out of New Milford. Staff believe that reduced response times will occur in the future.
- Tree damage and damage to power lines were the biggest impact during Tropical Storm Alfred. There was up to a week of power outages in outlying areas.
- The Town buried utilities along Bank Street and Railroad Street.
- The Town experienced a tornado a few years ago.

H. Winter Storms

- New Milford received heavy snowfall in January 2011 as in many other areas of Connecticut. There was a lot of roof shoveling in town during this time. Canterbury School's ice arena roof collapsed as well as other barns and garages.
- During Tropical Storm Alfred in October 2011, the town had assistance and reimbursements totaling $800,000.
- John Pettibone and Hill & Plain Elementary Schools had snow accumulation on their flat roofs, but no structural damage was reported. The library also had to be cleared.
- Icing is a problem on Route 7 in the southern portion of town.
- A few roads are narrow and require bucket loaders to plow.
- The northern section of town traditionally has repetitive snow drift accumulation, especially along Merryall Road, Geiger Road, and the Ridge Road area.

I. Earthquakes

- No earthquakes were discussed that have recently affected New Milford.

J. Dam Failure

- There is a concern about the replacement of the penstock, the pipe that brings water to Candlewood Lake from the Housatonic River via the Rocky River hydroelectric power plant. The 50-year old penstock, made of strips of Douglas fir held in place by iron rings, leaks badly. FirstLight Power Resources has discussed replacing portions of the penstock, and some of this work may have already been completed. In the case of a failure, the Town would have 11 minutes to respond before flooding affected Downtown.

- The Bleachery Dam is defined as a low-hazard dam that has an effect on the hydraulic control on the Housatonic River. It is owned by the town and is considered a concern of maintenance and observation because any failure could have devastating results. A number of spillway issues prior to the town ownership. The dam was scoured by the 1955 flood but never repaired. The face of the spillway is now too steep. The Town is trying to get funding to fix it. This dam alters and affects much of the flooding downstream in the Lover's Leap Gorge.
- The Gourds / Trading Post / Upper Reservoir #3 dam(s) are in bad shape. The spillway is into the road. It is a moderate hazard dam but the town is worried that it will fail.
- FirstLight Power Resources monitors several dams and water elevations in various areas around the town but predominantly around Candlewood Lake.
- Mr. Ferlow provided MMI with a list of dams that the town considers to be of concern or moderate to high hazard:
    - The United Waters New Milford Reservoir Dam #3
    - The Bleachery Dam
    - 4 Dams on Candlewood Lake
    - Bulls Bridge Dam, located northwest in the town of Kent (Mr. Ferlow provided MMI with a copy of the Bulls Bridge Dam Emergency Action Plan.)
    - Lake Waramaug Dam, located northeast in the town of Washington

K. Wildfires

- A dry hydrant program has been implemented, but maintenance has proven difficult and expensive particularly for those hydrants installed in tanks. Instead, the Fire Department prefers using those hydrants installed in ponds or just a direct connection to a pond to fight fires in outlying areas. The town utilizes its pumpers first to fight fires before drawing water from surface sources.
- No large fires have occurred in recent times; only a few small fires have occurred in the northwestern side of the town. The largest known wildfire occurred in the neighboring town of Kent in 2001. The fire burned approximately 570 acres of the Schaghticoke Mountains. The last known fire that occurred around the New Milford–Kent border was in March 2011; an uncontrolled five-acre grass fire occurred off North Kent Road. Unfortunately, the Town of Kent lost a fire truck that could not be moved fast enough.
- The town requires burning permits, which has reportedly helped to reduce uncontrolled fires.
- Accessibility in the north of town is limited; elevations are steep with slopes and the availability of water is limited. It is the town's opinion that this area is at the greatest risk for wildfires.
- New Milford has a reliable pumper and tanker truck system for assisting with fighting fires, water is limited, in case a hydrant is not available or disabled.
- New Milford has mutual aid agreements with all of its neighbors.

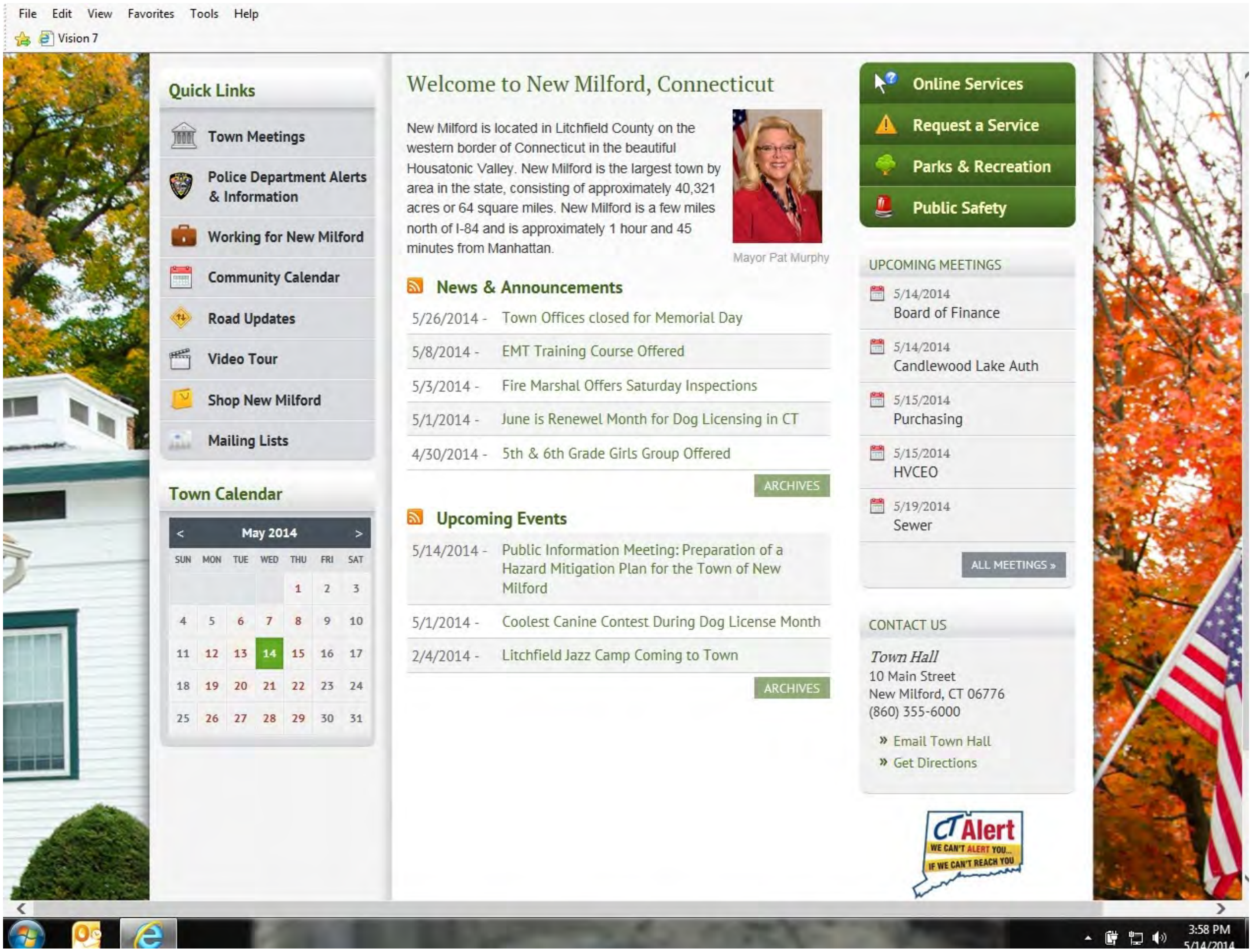
- DEMHS Region 5 has a Tanker Brigade on which New Milford can rely for assistance.
- It is not a concern for a "wildfire," but there may be potential for an underground fire at the Waste Management grounds. This area is surrounded by residential properties.
- Overall, fire response in town is believed to be sufficient for the wildfire risk.
- The Fire Marshal and Fire Departments have done a considerable amount of public outreach and education throughout the community.

M. Mitigation Strategies and Actions

- The town would like to relocate the Public Works Department out of the SFHA.
- The town plans to reduce flooding and its frequency along U.S. Route 7 and adjacent to the Bleachery Dam.
- The town plans to conduct a study of the Housatonic River, with an emphasis on the flooding and drainage of the associated stormwater drainage and infrastructure adjacent to the river.
- The town is considering revision of the Stormwater and Inland Wetland Regulations due to drainage issues. Town staff currently feels that the Floodplain Regulations are sufficient to prevent new development and substantial improvement in floodplains that would result in adverse impacts.

N. Public Outreach

- The public outreach meeting is scheduled for early March 2014.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Vision 7

Quick Links

- Town Meetings
- Police Department Alerts & Information
- Working for New Milford
- Community Calendar
- Road Updates
- Video Tour
- Shop New Milford
- Mailing Lists

Town Calendar

< May 2014 >

SUN	MON	TUE	WED	THU	FRI	SAT
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Welcome to New Milford, Connecticut

New Milford is located in Litchfield County on the western border of Connecticut in the beautiful Housatonic Valley. New Milford is the largest town by area in the state, consisting of approximately 40,321 acres or 64 square miles. New Milford is a few miles north of I-84 and is approximately 1 hour and 45 minutes from Manhattan.

Mayor Pat Murphy

News & Announcements

- 5/26/2014 - Town Offices closed for Memorial Day
- 5/8/2014 - EMT Training Course Offered
- 5/3/2014 - Fire Marshal Offers Saturday Inspections
- 5/1/2014 - June is Renewel Month for Dog Licensing in CT
- 4/30/2014 - 5th & 6th Grade Girls Group Offered

ARCHIVES

Upcoming Events

- 5/14/2014 - Public Information Meeting: Preparation of a Hazard Mitigation Plan for the Town of New Milford
- 5/1/2014 - Coolest Canine Contest During Dog License Month
- 2/4/2014 - Litchfield Jazz Camp Coming to Town

ARCHIVES

Online Services

Request a Service

Parks & Recreation

Public Safety

UPCOMING MEETINGS

- 5/14/2014 Board of Finance
- 5/14/2014 Candlewood Lake Auth
- 5/15/2014 Purchasing
- 5/15/2014 HVCEO
- 5/19/2014 Sewer

ALL MEETINGS »

CONTACT US

Town Hall
10 Main Street
New Milford, CT 06776
(860) 355-6000

» Email Town Hall
» Get Directions

CT Alert WE CAN'T ALERT YOU... IF WE CAN'T REACH YOU

3:58 PM 5/14/2014

5/14/2014 - Public Information Meeting: Preparation of a Hazard Mitigation Plan for the Town of New Milford

Public Information Meeting Preparation of a Hazard Mitigation Plan for the Town of New Milford

The Town of New Milford will host a public information meeting on May 14, 2014 at 5:45 P.M., in the E. Paul Martin Room in the Roger Sherman Town Hall to discuss the preparation of a Natural Hazard Mitigation Plan for the Town.

The purpose of a Natural Hazard Mitigation Plan is to identify potential natural hazards and associated risks, existing capabilities to address risks, and activities that can be undertaken by the community to prevent potential injury and property damage associated with identified natural hazards.

Residents, property owners and business owners are encouraged to participate in this discussion. For those who are unable to attend the meeting, comments may be sent to the Emergency Management Director via email at newmilfordemergencymanagement@newmilford.org or mailed/dropped off to the Mayor's Office at 10 Main Street New Milford, CT 06776.

For more information, please contact the office of Public Works Director at (860) 355-6040.

ARCHIVES

The Greater New Milford Spectrum
Monday, July 07, 2014

Public information meeting set

Published 10:19 pm, Friday, May 2, 2014

The Town of New Milford will host a public information meeting to discuss the preparation of a Natural Hazard Mitigation Plan for the town May 14.

The meeting will be held at 5:45 p.m. in the E. Paul Martin Room at Roger Sherman Town Hall at 10 Main St.

The purpose of a Natural Hazard Mitigation Plan is to identify potential natural hazards and associated risks, existing capabilities to address risks, and activities that can be undertaken by the community to prevent potential injury and property damage associated with identified natural hazards.

Residents, property owners and business owners are encouraged to participate in this discussion.

For those who are unable to attend the meeting, comments may be sent to the Emergency Management Director via email at newmilfordemergencymanagement@newmilford.org or mailed/dropped off to the mayor's office at town hall.

For more information, call the Public Works director at 860-355-6040.

Comments

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Development of the Hazard Mitigation Plan For the Town of New Milford

HMGP
HAZARD MITIGATION GRANT PROGRAM

FMA
FLOOD MITIGATION ASSISTANCE

PDM
PRE-DISASTER MITIGATION

Presented by: David Murphy, Milone & MacBroom, Inc. May 14, 2014

History of Hazard Mitigation Planning

- **Authority and Goals**
  - Disaster Mitigation Act of 2000
  - Encourage disaster preparedness
  - Encourage hazard mitigation measures to reduce losses of life and property
- **Status of Plans in Connecticut**
  - Most initial plans developed 2005-2010
  - A few areas of the State remain
  - The State hazard mitigation plan has been updated every three years (changing to five)
  - Local plans are updated every five years

FEDERAL EMERGENCY MANAGEMENT AGENCY

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What is a Natural Hazard?

- **An extreme natural event that poses a risk to people, infrastructure, and resources**

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What is Hazard Mitigation?

- **Actions that reduce or eliminate long-term risk to people, property, and resources from natural hazards and their effects**

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Long-Term Goals of Hazard Mitigation

- Reduce loss of life and damage to property and infrastructure
- Reduce the cost to residents, businesses, and taxpayers
- Educate residents and policy-makers about natural hazard risk and vulnerability
- Connect hazard mitigation planning to other community planning efforts
- Enhance and preserve natural resource systems in the community

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What are the Benefits of having a Plan?

A Hazard Mitigation Plan:

- Provides a comprehensive risk assessment that supports proposed mitigation strategies
- Provides a detailed action plan of strategies that your community may implement to reduce risk
- Promotes coordination with other local, regional, State, and federal entities
- Provides State and FEMA with information on a community's vulnerabilities to help guide emergency response and post-event assistance

MILONE & MACBROOM

What are the Benefits of having a Plan?

- **Local municipalities must have a FEMA-approved Hazard Mitigation Plan in place to receive Federal Grant Funds for Hazard Mitigation Projects through:**
  - o **PDM (Pre-Disaster Mitigation)**
  - o **HMGP (Hazard Mitigation Grant Program)**
  - o **FMA (Flood Mitigation Assistance)**
- **Grant funding typically covers 75% of project costs**
- **Projects may reduce municipal service costs (e.g. emergency response, infrastructure maintenance)**
- **Can fund post-disaster mitigation of damaged structures and infrastructure**

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Components of Hazard Mitigation Planning Process

- **Identify natural hazards that could occur in New Milford**
- **Assess the vulnerability of structures and populations and identify critical facilities and areas of concern**
- **Incorporate effects and local costs of federally declared disasters that have occurred in the last few years, such as:**
  - o **March 2010 floods**
  - o **Winter snow loads/collapsing roofs in January 2011**
  - o **Tropical Storm Irene in August 2011 (and T.S. Lee afterward)**
  - o **Winter Storm Alfred in October 2011**
  - o **Hurricane Sandy in October 2012**
  - o **Winter Storm Nemo in February 2013**

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Components of Hazard Mitigation Planning Process

- HAZUS vulnerability/risk analysis
- Assess adequacy of mitigation measures currently in place such as regulations, public information, and infrastructure
- Outreach to neighboring towns
- Public participation
- Develop mitigation goals, strategies, and actions
- Develop plan document
- State and FEMA approvals
- Local adoption

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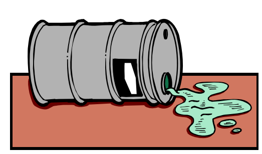
What a Hazard Mitigation Plan Does not Address

- Terrorism and Sabotage
- Disaster Response and Recovery
- Human Induced Emergencies (some fires, hazardous spills and contamination, disease, etc.)



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Primary Natural Hazards Facing New Milford

- Floods
- Hurricanes and tropical storms
- Summer storms and tornadoes

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Primary Natural Hazards Facing New Milford

- Winter storms and nor'easters
- Earthquakes
- Wildfires
- Dam failure

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Hurricanes and Tropical Storms

- Strong winds
- Heavy rain
- Floods

1955 Flood Images

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Summer Storms and Tornadoes

- Tornadoes
- Downbursts
- Lightning
- Heavy rain
- Hail

Tornado photos courtesy of the Hartford Courant

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Winter Storms and Nor’easters

- Blizzards and nor’easters
- Heavy snow and drifts
- Freezing rain and ice
- Downed trees

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Winter Storms and Nor’easters

- Collapsed Buildings

Photos courtesy of the Hartford Courant

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Earthquakes

- Connecticut is prone to very low-energy earthquakes
- Can cause dam failure, shaking, liquefaction, slides/slumps

Photos courtesy of FEMA

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Wildfires

- Fire
- Heat
- Smoke
- April is the month of maximum risk in Connecticut

Photos courtesy of FEMA and the Middlebury Fire Department

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Dam Failure

- Severe rains or earthquakes can cause failure
- Possibility of loss of life and millions of dollars in damage
- Numerous registered high and significant hazard dams in New Milford and upstream

Recent dam failure in Sherman, CT

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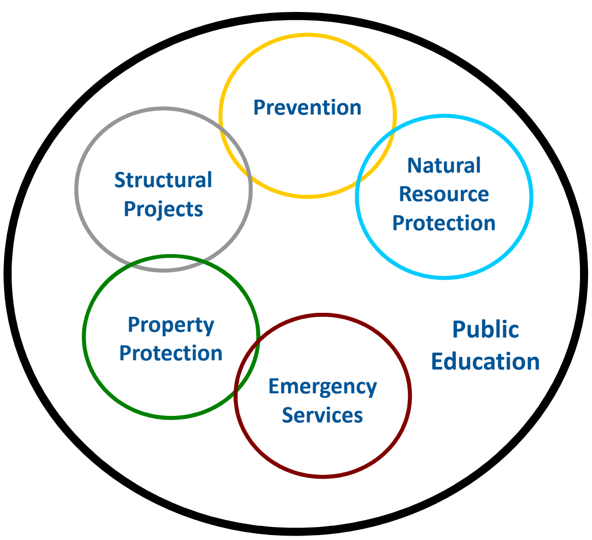
Categories of Hazard Mitigation Strategies



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Flood Mitigation Strategies

Flood Mitigation

Structural Projects

- Replace Bridges and Culverts
- Remove In-Stream Dams
- Remove Obstructions
- Upstream Detention
- Install Stormwater Systems
- Create Floodways
- Enlarge Channels
- Reduce Flow Resistance
- Install Levees
- Install Flood Walls

Property Protection

- Wet Floodproofing
- Dry Floodproofing
- Elevate Buildings
- Relocate Buildings
- Secure Utilities
- Anchor Floatables
- Remove Hazardous Materials
- Re-Grade Properties
- Purchase Flood Insurance
- Join the Community Rating System (CRS)

Prevention

- Modify Zoning
- Modify Comp Plan
- Stormwater Management Regulations
- Increase Flood Damage Prevention Standards
- Freeboard
- Low Impact Development
- Minimize Impervious Cover

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Flood Mitigation Strategies

Flood Mitigation

Natural Resources

- Acquire or Preserve Floodplain Land
- Acquire and Remove Structures from Floodplains and Convert to Open Space
- Acquire or Preserve Other Lands
- Increase Wetland Storage
- Re-Connect Streams to Floodplains

Emergency Services

- Improve Local Capacity to Respond
- Move Critical Facilities from Flood Risk Areas
- Establish Emergency Shelters
- Elevate Roads or Bridges to Ensure Egress
- Develop Community Evacuation Plans
- Develop Site-Specific Evacuation Plans
- Establish Satellite Facilities in Areas Subject to Isolation

Public Education

- Newsletters
- Community Meetings
- Information Kiosks
- Web Site with Flood Risk Maps
- Education of Municipal Staff
- Leverage State and FEMA Education Programs
- Establish a Standing Committee or Board to Oversee Outreach

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Other Typical Hazard Mitigation Strategies

- Strengthen or reinforce shelters and critical facilities
- Create backup critical facilities
- Replace overhead utilities with underground utilities
- Harden utilities and buildings
- Localized power grids ("microgrids")
- Expand tree maintenance programs
- Snow load removal and response plans
- Shutters, load path, and roof projects
- Backup systems and equipment
- Enhance fire suppression capabilities with dry hydrants, cisterns, etc.
- Bracing for potential earthquake damage
- Public education programs and resources

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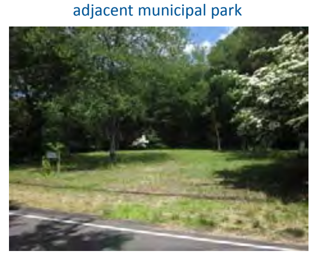
How Can FEMA Grants be Used?

- Grants can be used for:
  - Building acquisitions or elevations
  - Culvert replacements
  - Drainage projects
  - Riverbank stabilization
  - Landslide stabilization
  - Wind retrofits
  - Seismic retrofits
  - Snow load retrofits
  - Standby power supplies for critical facilities
- The State of Connecticut prioritizes applications
- FY 2014 funding is $112 million for PDM and FMA; HMGP funding is disaster-specific

This home in Trumbull was acquired and demolished using a FEMA grant and the land combined with the adjacent municipal park



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Example Projects

Culvert Replacement to be funded by HMGP

Floyd 1999

Irene 2011

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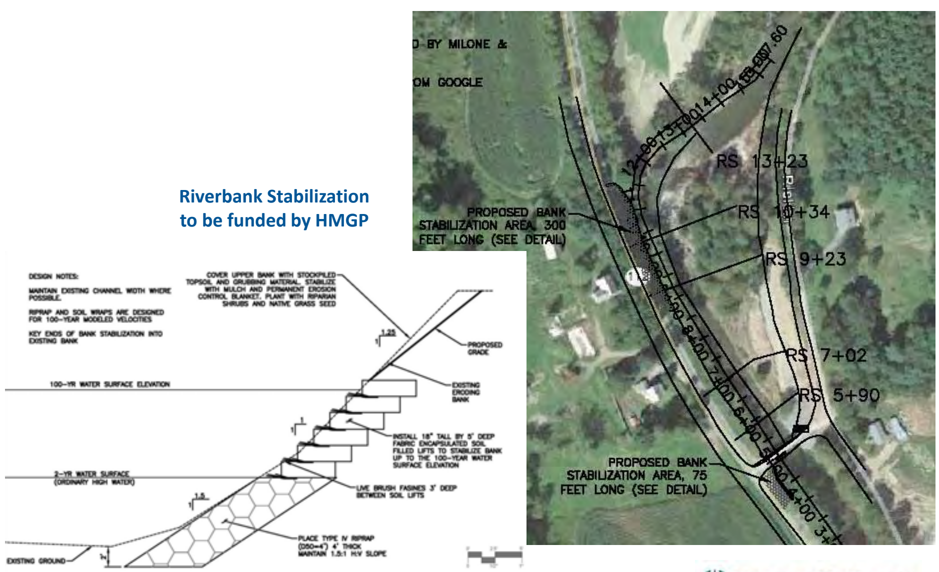
Example Projects

Riverbank Stabilization to be funded by HMGP



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Next Steps

- Incorporate input from residents, business owners, and public officials
- Develop mitigation strategies
- Prepare draft plans for review by the town and the public
- Adopt and implement the plan
- Seek hazard mitigation funds

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New Milford Hazard Mitigation Plan Public Meeting
May 14, 2014
Meeting Minutes

A public meeting was held at 5:45 PM on the evening of May 14, 2014. The public was notified via the Danbury News Times and the town's web site. Attendees included:

- David Hannon, HVCEO
- Marla Scribner, Emergency Management Director
- Mike Crespan, Director of Health
- Mike Zarba, Director of Public Works
- Shawn Boyne, Chief of Police

Members of the public did not attend.

Mr. David Murphy, P.E., CFM presented a power point slide show and then turned over the meeting for an informal discussion. Discussion points included:

- The last application period for HMGP grants closed in late 2013, and the PDM and FMA application period is open until mid-June. The selection of PDM and FMA grant applications from the state will be very competitive in 2014, as only two project grants will be forwarded to FEMA.
- New generators may be of interest to the town.
- Some small businesses would be well served with generators, but these are privately funded. For example an ice cream shop is sometimes flooded by Housatonic River/Still River flooding. The building is at the high point on its property and is not flooded, but the building loses power and loses its ability to maintain its inventory. A generator could help reduce losses.
- New Milford would be severely impacted by a failure of any Candlewood Lake dam. First Light has participated in several dam failure tabletop exercises in the region. Most recently, they held an exercise for failure of the Danbury Dike.

July 8, 2014

TO:

Tony Hay, Supervisor, Town of Southeast, NY	Carol Hubert, Chief of Staff, Town of Southbury, CT
Adam Stiebeling, Commissioner of Emergency Services, Putnam County Bureau of Emergency Management (NY)	Anna Rycenga, ZEO, Town of Oxford, CT
Warren Lucas, Supervisor, Town of North Salem, NY	Sam Gold, Executive Director, COGCNV (CT)
Peter Parsons, Supervisor, Town of Lewisboro, NY	Barbara Henry, First Selectman, Town of Roxbury
Dennis Delborgo, Director, Westchester County Office of Emergency Management (NY)	Mark Lyon, First Selectman, Town of Washington
Bill Brennan, First Selectman, Town of Wilton, CT	Bruce Adams, First Selectman, Town of Kent
Gayle Weinstein, First Selectman, Town of Weston, CT	Jocelyn Ayer, Community & Economic Development Director, Northwest Hills Council of Governments (CT)
David Hannon, for South Western Regional Planning Agency (CT)	Brian Bidolli, Executive Director, Greater Bridgeport Regional Council (CT)
Adam Dunsby, First Selectman, Town of Easton, CT	Steve Vavrek, First Selectman, Town of Monroe, CT

RE: Hazard Mitigation Plans for Bethel, Bridgewater, Brookfield, Newtown, New Milford, Redding, and Ridgefield (Connecticut)
MMI #3101-14-1

Milone & MacBroom, Inc. (MMI) is working with the Housatonic Valley Council of Elected Officials (HVCEO) and the towns of Bethel, Bridgewater, Brookfield, Newtown, New Milford, Redding, and Ridgefield to develop hazard mitigation plans. In recent years, the Federal Emergency Management Agency (FEMA) has emphasized the need for communities to work together to address hazards that span municipal boundaries. Thus, these municipalities are interested in coordinating with your jurisdictions relative to hazards that could cross municipal boundaries such as flooding, as well as strategies for hazard mitigation that could be addressed by two or more communities.

We understand that you may be the representative involved with hazard mitigation planning in your municipality and, therefore, will have the most valuable input for the plans being developed for Bethel, Bridgewater, Brookfield, Newtown, New Milford, Redding, and Ridgefield. Please take a moment to share your thoughts for the following:

1. Does your municipality face any shared hazards with Bethel, Bridgewater, Brookfield, Newtown, New Milford, Redding, or Ridgefield that could be addressed by both communities? Examples could be flooding along a stream that flows across a town boundary or wind storms that damage power lines that cross the town boundary.
2. Can you think of any strategies for hazard mitigation that could benefit both communities?
3. Does your municipality currently cooperate with Bethel, Bridgewater, Brookfield, Newtown, New Milford, Redding, or Ridgefield on any of the following:

- Local emergency communications or response
- Road maintenance, drainage system maintenance, public works, etc.
- Communications with electric and other utility providers

You may contact the undersigned via email or telephone. A written response is not necessary. Thank you for your time.

Very truly yours,

MILONE & MACBROOM, INC.

David Murphy, P.E., CFM, Associate
Senior Project Manager, Water Resources Engineering
davem@miloneandmacbroom.com

Maryellen Edwards
Environmental Scientist
maryellene@miloneandmacbroom.com

3101-14-1-jl714-ltr

FLOOD DAMAGE SURVEY

Municipality _Town of New Milford_ County _Litchfield_
Name of Contact _Patrick Hackett_ Title _Public Works Director_
Tel _860-355-6040_ Fax _860-355-6055_ Email _prhackett@newmilford.org_

ESTIMATED COST OF EMERGENCY WORK
PUBLIC WORKS

CATEGORY	ESTIMATED COST
Category A: Debris Removal (Force Account labor including cost of equipment and overtime only. Cost of straight time is not eligible except if additional, unscheduled personnel were used. All contractual debris removal costs are eligible.)	$0
Category B: Protective Measures (Force Account including Police, Fire, Public Works overtime and cost of equipment and materials. Cost of straight time is not eligible except if for additional, unscheduled personnel were used. All contractual protective measure work is eligible)	$0

ESTIMATED COST OF PERMANENT RESTORATIVE WORK FOR PUBLIC WORKS

Category C: Roads and Bridges (Repair of roads, bridges and associated features such as shoulders, ditches, culverts, lighting and signs)	$46,000
Category D: Water Control Facilities (Repair of irrigation systems, drainage channels, pumping facilities, levees, dams and flood control channels)	$0
Category E: Buildings and Equipment (Repair or replacement of buildings, including their contents and systems; heavy equipment and vehicles)	$0
Category F: Category Utilities (Repair of water treatment and delivery systems, power generation facilities and distribution lines; sewage collection and treatment facilities)	$0
Category G: Parks, Recreational Facilities and Other Items (Repair and restoration of parks, playgrounds, pools, cemeteries, and beaches. This category also is used for any work or facility that cannot be characterized adequately by categories A-	$0

Please list name and address of any private non-profit facilities in your municipality known to have sustained damages as a result of this event.
594 Kent Road and 72 West Street(possible insurance claims)_

Estimates should include all costs associated with rains, flooding and high winds which occurred between October 13, 2005 and October 17, 2005.
Any costs covered by insurance should NOT be included in the estimates above.

FLOOD DAMAGE SURVEY

Municipality _Town of New Milford_ County _Litchfield_
Name of Contact _Patrick R. Hackett_ Title _Public Works Director_
Tel _860-355-6040_ Fax _860-355-6055_ Email _prhackett@newmilford.org_

RESIDENTIAL AND BUSINESS DAMAGES

Type of Unit	Number of Units With Major Damage (Flooding to the first floor)	Number of Units With Minor Damage (Flooded areas are below grade)
Single Family		
Multi-Family		
Apartment Units		
Businesses		

Please list streets on which the most significant residential flooding occurred between October 13, and October 17, 2005:
Larson Road, Cedar Hill Road, River Road, West Street, Wells Road, Boardman Road, Housatonic Ave, Sawyer Hill Road, Cherniski Road, Connelly Road, Aspetuck Ridge Road, Hartwell Road, Mud Pond Rd, Old Northville Road, North Sawyer Hill Road, Frenchmen Road, Indian Trail Road, Gaffney Road, Long Mountain Road, Stilson Hill Road, Old Stilson Hill Road

Please list streets on which the most significant flooding of business establishments occurred between October 13, and October 17, 2005:

Danbury Road, Young's Field Road, West Street

Please provide a brief narrative describing the most serious impacts of this event upon the community, including continuing threats to public health and safety and any other ongoing concerns related to this event.
The most serious impacts of the event for Public Works has been the washouts from the Aspetuck River (East and West Branch) overflowing a number of roads, Merryall Brook overflowing and washing out the west side of Indian Trail Road, and Mill Pond overtopping and washing out part of Mud Pond Road.

Storm Damage Report
April 15-16, 2007 Storm

Statistical Data About the Storm

- Rain began late Saturday evening and it rained heavy all day Sunday and early Monday
- Rainfall data showed nearly 6.5" of rain over the past 24 hours (by Monday morning)
- The Housatonic River was already over 3 feet above flood stage and still rising
- The river "crested" Tuesday Morning (about 2:00am) at nearly 5 feet above flood stage
- During the Peak of the storm damage we had 11 roads closed due to flooding, 20 more roads closed from washouts, and many other roads with moderate damage.
- Over 1800 cubic yards of processed gravel has been replaced (Thru Friday 4/20)

Chronological Synopsis of Events

MONDAY April 16, 2007

Initial assessments of roadways on Monday revealed the following:

- 6 roads needed to be closed due to flooding including
    1. Peagler Hill Road
    2. Route 7
    3. West Street
    4. River Road
    5. East Buck's Rock
    6. Aspetuck Ridge Road

- In addition to flooding problems we found many roads impassable and/or partially washed out due to erosion and mud. By mid morning we had recorded at least 26 roads (some with multiple locations) with these problems – many of which needed to be closed. These include:
    1. Jerusalem Road
    2. Grove Street – (Landslide)
    3. Sand Pit Road
    4. Old Stone Road
    5. Wellsville Avenue
    6. Taylor Street
    7. Pleasant Street
    8. Long Mountain Road
    9. Canterbury Road
    10. Clatter Valley Road
    11. Cedar Hill Road
    12. Stilson Hill Road
    13. Old Northville Road
    14. Squires Hill Road
    15. Old Mill Road
    16. Candlewood Mountain Road
    17. Judds Bridge Road
    18. Hartwell Road
    19. Old Mine Road
    20. Squash Hollow Road
    21. Indian Trail
    22. Pumpkin Hill Road
    23. Hine Road
    24. Gaffney Road
    25. Front of the Mountain Road
    26. West Meetinghouse Road

- By afternoon/early evening 5 more roads needed to be closed due to flooding
    1. Cross Road
    2. Young's Field Road

3. North Sawyer Hill
4. Erickson Road
5. Spring Street

Note: In addition to adding 5 more roads - the flooding worsened on most of the original 6 roads, especially Route 7, Peagler Hill Road, West Street, and River Road

- We set our goal - after the initial assessment – to get all the ***non-flooded*** roads ***passable*** by days end (which we extended to 8:00pm or dark). The only two roads not qualifying for this would be Jerusalem, due to the severity of the washouts and the extent of damage to the road, and Grove St. which needed to be evaluated to insure the slide was safe. Other than flooded roads and the above two, by 8:00 pm Monday evening we had all ***non-flooded*** roads ***passable*** except for the following three roads:
    1. Clatter Valley Road
    2. Judds Bridge Road
    3. Hartwell Road

- Emergency Planning Personnel met at the EOC at 2:00 pm to coordinate efforts share information and determine general parameters of each department's responsibilities throughout the event.

- Emergency Planning Personnel reconvened at the EOC at 7:00 pm to update information, provide status reports on each department's efforts, and coordinate further efforts.

TUESDAY April 17, 2007

All Highway personnel were scheduled to return at 6:30 am to continue the cleanup efforts. Flooded roads were re-evaluated to determine their status – especially those affected by the smaller streams and rivers. By 8:00 am Tuesday the following roads had been reopened:

1. Aspetuck Ridge Road (no longer flooded)
2. Clatter Valley (washout repaired)
3. North Sawyer Hill Rd.
4. East Buck's Rock Rd.
5. Erickson Road

- Engineering personnel went out to Grove Street to re-evaluate the slope stability around the landslide location. It was determined that Grove Street could be reopened once Highway personnel were able to clean up the roadway and clean out several clogged basins, culverts, and headwalls.
- Emergency Planning Personnel again reconvened at the EOC at 9:00 am to update information, provide status reports on each department's efforts, and coordinate further efforts.
- Grove Street was re-opened to two way thru traffic at 3:00 pm.

- Engineering staff evaluated several bridge locations that were/may have been affected by flood waters. They also evaluated the extent of damage to Jerusalem Road in an effort to plan the necessary fixes and begin estimating the cost of repairs. They also needed to begin evaluating critical dams, retention ponds and major pipe/culvert crossings.
- By 6:00pm Tuesday afternoon all roads (except the flooded ones and Jerusalem) were at a minimum passable to traffic.
- Flood waters did not recede far enough to allow for any of the major roadways affected by them to be reopened on Tuesday.

WEDNESDAY April 18, 2007

With all of the washed out roads (except Jerusalem) repaired enough to support traffic our efforts shifted to the cleanup and permanent restorative efforts. It was decided that for Jerusalem Road we would need to provide permanent (immovable) barricades in the washed out section (no homes affected by barricade placement) to insure that traffic could not drive thru these dangerous areas.

- Flood waters did recede enough by Wednesday to allow us to reopen some of the flooded roads
    1. Cross Road
    2. River Road (southern portion)
    3. Spring Street

- Flood waters had still not receded far enough to allow for any of the major roadways affected to be reopened. However later in the day Veterans Bridge was reopened to allow northbound Route 7 traffic to use it, rather than Young's Field Road to Boardman Road. Roads remaining closed were:
    1. Route 7 (Bridge Street to Sunny Valley Road)
    2. Peagler Hill Road
    3. West Street.
    4. River Road (to thru traffic)

APPENDIX E
HAZUS DOCUMENTATION

Hazus-MH: Flood Event Report

Region Name: New Milford, CT Flood

Flood Scenario: Housatonic River 100 Year

Print Date: Tuesday, December 31, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

Table of Contents

General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	258,350	68.6%
Commercial	70,356	18.7%
Industrial	37,959	10.1%
Agricultural	2,530	0.7%
Religion	6,893	1.8%
Government	175	0.0%
Education	125	0.0%
Total	**376,388**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	Housatonic River 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 60 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 48 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	2	3.33	10	16.67	48	80.00
Total	**0**		**0**		**0**		**2**		**10**		**48**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	100.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	2	3.39	10	16.95	47	79.66

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 15,823 tons of debris will be generated. Of the total amount, Finishes comprises 13% of the total, Structure comprises 50% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 633 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 140 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 277 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 74.09 million dollars, which represents 19.69 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 73.86 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 33.53% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	16.41	9.91	4.73	1.49	32.54
	Content	8.41	19.04	8.69	3.41	39.56
	Inventory	0.00	0.54	1.16	0.07	1.77
	Subtotal	**24.83**	**29.49**	**14.58**	**4.96**	**73.86**
Business Interruption						
	Income	0.00	0.08	0.00	0.01	0.08
	Relocation	0.01	0.02	0.00	0.00	0.03
	Rental Income	0.00	0.01	0.00	0.00	0.01
	Wage	0.01	0.08	0.00	0.02	0.11
	Subtotal	**0.02**	**0.19**	**0.00**	**0.03**	**0.23**
ALL	**Total**	**24.84**	**29.68**	**14.58**	**4.99**	**74.09**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Flood Event Report

Region Name: New Milford, CT Flood

Flood Scenario: Still River 100 Year

Print Date: Tuesday, December 31, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	27,041	31.0%
Commercial	35,783	41.0%
Industrial	19,317	22.2%
Agricultural	1,856	2.1%
Religion	2,740	3.1%
Government	35	0.0%
Education	426	0.5%
Total	**87,198**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	Still River 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 22 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 16 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	2	9.09	4	18.18	16	72.73
Total	**0**		**0**		**0**		**2**		**4**		**16**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	2	9.09	4	18.18	16	72.73

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 1,868 tons of debris will be generated. Of the total amount, Finishes comprises 22% of the total, Structure comprises 45% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 75 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 31 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 80 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 22.07 million dollars, which represents 25.31 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 22.01 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 27.26% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	3.91	3.59	1.15	0.45	9.09
	Content	2.11	6.44	2.85	0.76	12.15
	Inventory	0.00	0.13	0.53	0.10	0.76
	Subtotal	**6.01**	**10.16**	**4.53**	**1.30**	**22.01**
Business Interruption						
	Income	0.00	0.03	0.00	0.00	0.03
	Relocation	0.00	0.01	0.00	0.00	0.01
	Rental Income	0.00	0.01	0.00	0.00	0.01
	Wage	0.00	0.02	0.00	0.00	0.02
	Subtotal	**0.00**	**0.06**	**0.00**	**0.00**	**0.06**
ALL	**Total**	**6.02**	**10.22**	**4.53**	**1.30**	**22.07**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Flood Event Report

Region Name:	New Milford, CT Flood
Flood Scenario:	East Aspetuck River 100 Year
Print Date:	Monday, December 30, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	182,888	83.7%
Commercial	26,582	12.2%
Industrial	6,187	2.8%
Agricultural	613	0.3%
Religion	1,742	0.8%
Government	0	0.0%
Education	589	0.3%
Total	**218,601**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	East Aspetuck River 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 87 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 65 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	5	5.75	17	19.54	65	74.71
Total	**0**		**0**		**0**		**5**		**17**		**65**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	100.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	5	5.95	17	20.24	62	73.81

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 3,675 tons of debris will be generated. Of the total amount, Finishes comprises 29% of the total, Structure comprises 41% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 147 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 145 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 313 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 30.37 million dollars, which represents 13.89 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 30.32 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 75.93% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	15.39	1.36	0.70	0.06	17.50
	Content	7.66	3.26	1.36	0.24	12.50
	Inventory	0.00	0.04	0.27	0.01	0.32
	Subtotal	**23.04**	**4.65**	**2.33**	**0.30**	**30.32**
Business Interruption						
	Income	0.00	0.01	0.00	0.00	0.01
	Relocation	0.01	0.00	0.00	0.00	0.02
	Rental Income	0.00	0.00	0.00	0.00	0.01
	Wage	0.00	0.02	0.00	0.00	0.02
	Subtotal	**0.02**	**0.03**	**0.00**	**0.00**	**0.04**
ALL	**Total**	**23.06**	**4.68**	**2.33**	**0.30**	**30.37**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Flood Event Report

Region Name: New Milford, CT Flood

Flood Scenario: West Aspetuck River 100 Year

Print Date: Monday, December 30, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

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Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	137,176	81.7%
Commercial	15,502	9.2%
Industrial	12,644	7.5%
Agricultural	692	0.4%
Religion	1,842	1.1%
Government	0	0.0%
Education	0	0.0%
Total	**167,856**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	West Aspetuck River 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 311 tons of debris will be generated. Of the total amount, Finishes comprises 38% of the total, Structure comprises 35% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 12 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 35 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 18 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 4.02 million dollars, which represents 2.39 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 4.02 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 57.11% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	1.53	0.17	0.25	0.01	1.96
	Content	0.76	0.36	0.77	0.06	1.94
	Inventory	0.00	0.00	0.11	0.00	0.11
	Subtotal	**2.29**	**0.53**	**1.13**	**0.07**	**4.02**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**2.29**	**0.53**	**1.13**	**0.07**	**4.02**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Flood Event Report

Region Name: New Milford, CT Flood

Flood Scenario: Great Brook 100 Year

Print Date: Tuesday, December 31, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	158,649	74.6%
Commercial	37,965	17.8%
Industrial	6,795	3.2%
Agricultural	634	0.3%
Religion	2,756	1.3%
Government	932	0.4%
Education	4,987	2.3%
Total	**212,718**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	Great Brook 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	**1-10**		**11-20**		**21-30**		**31-40**		**41-50**		**Substantially**	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 277 tons of debris will be generated. Of the total amount, Finishes comprises 46% of the total, Structure comprises 30% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 11 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 27 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 27 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 5.41 million dollars, which represents 2.54 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 5.38 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 40.56% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	1.09	0.74	0.07	0.09	1.98
	Content	1.10	1.74	0.14	0.40	3.38
	Inventory	0.00	0.01	0.02	0.00	0.02
	Subtotal	**2.18**	**2.49**	**0.22**	**0.49**	**5.38**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.01
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.01	0.01	0.00	0.01	0.02
	Subtotal	**0.01**	**0.01**	**0.00**	**0.01**	**0.02**
ALL	**Total**	**2.19**	**2.50**	**0.22**	**0.50**	**5.41**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Flood Event Report

Region Name: New Milford, CT Flood

Flood Scenario: Town Farm Brook 100 Year

Print Date: Tuesday, December 31, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 62 square miles and contains 412 census blocks. The region contains over 10 thousand households and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 10,627 buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90.46% of the buildings (and 74.65% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religion	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	82,067	92.3%
Commercial	5,602	6.3%
Industrial	580	0.7%
Agricultural	168	0.2%
Religion	467	0.5%
Government	0	0.0%
Education	0	0.0%
Total	**88,884**	**100.00%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds.
There are 7 schools, 2 fire stations, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	New Milford, CT Flood
Scenario Name:	Town Farm Brook 100 Year
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0**		**0**		**0**		**0**		**0**		**0**	

Table 4: Expected Building Damage by Building Type

Building Type	1-10		11-20		21-30		31-40		41-50		Substantially	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 62 hospital beds available for use. On the day of the scenario flood event, the model estimates that 62 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	2	0	0	0
Hospitals	1	0	0	0
Police Stations	1	0	0	0
Schools	7	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 58 tons of debris will be generated. Of the total amount, Finishes comprises 55% of the total, Structure comprises 27% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 2 truckloads (@25 tons/truck) to remove the debris generated by the flood.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 13 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 8 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 1.46 million dollars, which represents 1.64 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 1.46 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 83.72% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	0.81	0.04	0.03	0.01	0.88
	Content	0.41	0.09	0.03	0.04	0.58
	Inventory	0.00	0.00	0.01	0.00	0.01
	Subtotal	**1.22**	**0.12**	**0.07**	**0.05**	**1.46**
Business Interruption						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental Income	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
ALL	**Total**	**1.22**	**0.12**	**0.07**	**0.05**	**1.46**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Total Study Region	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 10-year Return Period

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 10 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	63	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	635	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	20	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	6	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	246	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	9,613	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**10,627**		**0**		**0**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 10 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	148	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,006	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	140	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	498	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	8,843	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total						
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 20-year Return Period

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 20 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	63	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	635	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Education	20	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	6	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	246	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Religion	44	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	9,613	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Total	**10,627**		**0**		**0**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 20 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	148	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	1,006	100.00	0	0.00	0	0.00	0	0.00	0	0.00
MH	140	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	498	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Wood	8,843	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 0 tons, Brick/Wood comprises 0% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.0 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Total						
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 50-year Return Period

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 50 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	63	99.68	0	0.32	0	0.00	0	0.00	0	0.00
Commercial	632	99.58	3	0.42	0	0.00	0	0.00	0	0.00
Education	20	99.57	0	0.43	0	0.00	0	0.00	0	0.00
Government	6	99.52	0	0.48	0	0.00	0	0.00	0	0.00
Industrial	245	99.53	1	0.47	0	0.00	0	0.00	0	0.00
Religion	44	99.67	0	0.33	0	0.00	0	0.00	0	0.00
Residential	9,595	99.82	17	0.18	1	0.01	0	0.00	0	0.00
Total	**10,605**		**21**		**1**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 50 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	147	99.42	1	0.58	0	0.00	0	0.00	0	0.00
Masonry	998	99.24	7	0.72	0	0.04	0	0.00	0	0.00
MH	140	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	496	99.51	2	0.48	0	0.00	0	0.00	0	0.00
Wood	8,835	99.91	8	0.09	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 81 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 81 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 3 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 1.2 million dollars, which represents 0.05 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 1 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 95% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	1,129.97	46.40	13.51	5.57	1,195.45
	Content	3.80	0.00	0.00	0.00	3.80
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**1,133.77**	**46.40**	**13.51**	**5.57**	**1,199.25**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	2.31	0.15	0.00	0.00	2.46
	Rental	2.71	0.00	0.00	0.00	2.71
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**5.02**	**0.15**	**0.00**	**0.00**	**5.17**
Total						
	Total	**1,138.79**	**46.55**	**13.51**	**5.57**	**1,204.42**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name:	New Milford
Hurricane Scenario:	Probabilistic 100-year Return Period
Print Date:	Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

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There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

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Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 9 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	62	98.64	1	1.23	0	0.10	0	0.03	0	0.00
Commercial	627	98.70	8	1.22	1	0.08	0	0.00	0	0.00
Education	20	98.77	0	1.22	0	0.02	0	0.00	0	0.00
Government	6	98.71	0	1.27	0	0.02	0	0.00	0	0.00
Industrial	243	98.61	3	1.33	0	0.05	0	0.01	0	0.00
Religion	44	98.93	0	1.06	0	0.01	0	0.00	0	0.00
Residential	9,451	98.32	154	1.60	8	0.08	0	0.00	0	0.00
Total	**10,452**		**166**		**9**		**0**		**0**	

Table 3: Expected Building Damage by Building Type : 100 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	146	98.42	2	1.56	0	0.02	0	0.00	0	0.00
Masonry	979	97.31	23	2.30	4	0.38	0	0.01	0	0.00
MH	140	99.98	0	0.01	0	0.00	0	0.00	0	0.00
Steel	491	98.65	6	1.27	0	0.08	0	0.00	0	0.00
Wood	8,717	98.58	124	1.40	2	0.02	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 4,939 tons of debris will be generated. Of the total amount, 3,626 tons (73%) is Other Tree Debris. Of the remaining 1,313 tons, Brick/Wood comprises 36% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 19 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 837 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 4.9 million dollars, which represents 0.19 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 5 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 96% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	4,520.37	122.75	35.53	17.46	4,696.12
	Content	140.98	0.00	4.15	0.20	145.34
	Inventory	0.00	0.00	0.89	0.02	0.91
	Subtotal	**4,661.36**	**122.75**	**40.57**	**17.69**	**4,842.37**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	56.85	2.90	0.17	0.22	60.15
	Rental	41.59	0.00	0.00	0.00	41.59
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**98.44**	**2.90**	**0.17**	**0.22**	**101.74**
Total						
	Total	**4,759.80**	**125.66**	**40.74**	**17.91**	**4,944.11**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 200-year Return Period

Print Date: Tuesday, November 19, 2013

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 59 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 200 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	60	94.69	3	4.37	0	0.66	0	0.27	0	0.01
Commercial	607	95.56	25	3.91	3	0.49	0	0.04	0	0.00
Education	19	96.06	1	3.74	0	0.19	0	0.00	0	0.00
Government	6	95.80	0	3.95	0	0.24	0	0.01	0	0.00
Industrial	235	95.56	10	3.90	1	0.42	0	0.11	0	0.00
Religion	42	95.90	2	3.94	0	0.17	0	0.00	0	0.00
Residential	8,940	93.00	618	6.43	54	0.56	0	0.00	0	0.00
Total	**9,909**		**658**		**58**		**1**		**0**	

Table 3: Expected Building Damage by Building Type : 200 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	141	95.22	7	4.45	0	0.33	0	0.00	0	0.00
Masonry	925	91.96	61	6.11	18	1.83	1	0.10	0	0.00
MH	140	99.82	0	0.15	0	0.03	0	0.00	0	0.00
Steel	477	95.84	18	3.62	2	0.49	0	0.06	0	0.00
Wood	8,267	93.48	550	6.22	26	0.29	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 21,697 tons of debris will be generated. Of the total amount, 16,137 tons (74%) is Other Tree Debris. Of the remaining 5,560 tons, Brick/Wood comprises 27% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 60 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,055 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 12.9 million dollars, which represents 0.49 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 13 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 92% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	10,817.55	491.42	178.12	78.06	11,565.15
	Content	621.27	53.81	67.88	11.31	754.27
	Inventory	0.00	1.19	13.22	1.11	15.52
	Subtotal	**11,438.83**	**546.41**	**259.22**	**90.49**	**12,334.95**
Business Interruption Loss						
	Income	0.00	24.26	0.43	0.00	24.69
	Relocation	326.66	32.74	3.80	2.43	365.63
	Rental	191.80	11.22	0.43	0.02	203.47
	Wage	0.00	8.62	0.70	0.00	9.32
	Subtotal	**518.46**	**76.85**	**5.36**	**2.45**	**603.12**
Total						
	Total	**11,957.29**	**623.26**	**264.58**	**92.94**	**12,938.06**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 500-year Return Period

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 350 buildings will be at least moderately damaged. This is over 3% of the total number of buildings in the region. There are an estimated 9 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 500 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	52	81.87	8	13.20	2	3.23	1	1.55	0	0.16
Commercial	532	83.77	79	12.42	21	3.36	3	0.45	0	0.00
Education	17	85.44	2	11.83	1	2.58	0	0.16	0	0.00
Government	5	83.71	1	12.71	0	3.35	0	0.23	0	0.00
Industrial	207	84.13	29	11.66	8	3.33	2	0.82	0	0.07
Religion	37	84.06	6	13.55	1	2.27	0	0.12	0	0.00
Residential	7,521	78.24	1,782	18.53	292	3.04	9	0.10	8	0.09
Total	**8,371**		**1,907**		**326**		**15**		**9**	

Table 3: Expected Building Damage by Building Type : 500 - year Event

Building	None		Minor		Moderate		Severe		Destruction	
Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	123	82.94	19	13.05	6	3.84	0	0.17	0	0.00
Masonry	779	77.44	149	14.79	71	7.09	6	0.61	1	0.07
MH	138	98.39	2	1.11	1	0.41	0	0.01	0	0.09
Steel	422	84.81	55	11.03	18	3.56	3	0.59	0	0.00
Wood	6,976	78.89	1,657	18.74	195	2.21	7	0.08	8	0.09

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	1	0	0
Police Stations	1	0	0	1
Schools	7	0	0	2

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 35,769 tons of debris will be generated. Of the total amount, 24,321 tons (68%) is Other Tree Debris. Of the remaining 11,448 tons, Brick/Wood comprises 42% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 194 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 6,601 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 30 households to be displaced due to the hurricane. Of these, 6 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 43.1 million dollars, which represents 1.63 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 43 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 83% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	28,734.47	2,401.40	1,015.36	398.21	32,549.44
	Content	4,828.29	691.69	648.06	121.09	6,289.13
	Inventory	0.00	15.11	118.58	8.25	141.95
	Subtotal	**33,562.76**	**3,108.21**	**1,782.00**	**527.55**	**38,980.52**
Business Interruption Loss						
	Income	0.00	353.57	14.50	37.47	405.54
	Relocation	1,560.44	461.50	68.30	67.30	2,157.54
	Rental	752.40	219.61	12.43	4.92	989.35
	Wage	0.00	388.14	24.47	109.29	521.91
	Subtotal	**2,312.84**	**1,422.82**	**119.70**	**218.98**	**4,074.34**
Total						
	Total	**35,875.60**	**4,531.03**	**1,901.70**	**746.52**	**43,054.85**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: Probabilistic 1000-year Return Period

Print Date: Tuesday, November 19, 2013

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 1,015 buildings will be at least moderately damaged. This is over 10% of the total number of buildings in the region. There are an estimated 54 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 1000 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	40	63.33	15	23.63	5	8.35	3	4.06	0	0.64
Commercial	423	66.67	136	21.42	63	9.93	12	1.97	0	0.02
Education	14	68.47	4	21.09	2	9.10	0	1.34	0	0.00
Government	4	66.93	1	20.90	1	10.45	0	1.73	0	0.00
Industrial	165	67.18	49	19.86	24	9.92	7	2.78	1	0.26
Religion	29	66.92	11	24.02	4	8.04	0	1.02	0	0.00
Residential	5,767	59.99	2,953	30.72	778	8.10	61	0.64	53	0.55
Total	**6,443**		**3,169**		**877**		**84**		**54**	

Table 3: Expected Building Damage by Building Type : 1000 - year Event

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	97	65.40	31	21.02	18	12.18	2	1.40	0	0.00
Masonry	601	59.77	227	22.56	154	15.34	20	2.02	3	0.30
MH	133	94.82	4	2.89	2	1.75	0	0.10	1	0.45
Steel	339	68.06	93	18.76	53	10.62	13	2.53	0	0.02
Wood	5,355	60.55	2,797	31.63	590	6.68	52	0.59	49	0.55

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 0.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	1	0	0
Police Stations	1	0	0	1
Schools	7	1	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 85,044 tons of debris will be generated. Of the total amount, 58,720 tons (69%) is Other Tree Debris. Of the remaining 26,324 tons, Brick/Wood comprises 42% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 444 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 15,220 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 115 households to be displaced due to the hurricane. Of these, 23 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 116.2 million dollars, which represents 4.41 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 116 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 82% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	67,841.50	7,194.75	2,932.57	1,151.02	79,119.84
	Content	18,652.04	3,008.41	2,115.95	451.23	24,227.62
	Inventory	0.00	58.88	372.28	25.49	456.65
	Subtotal	**86,493.54**	**10,262.04**	**5,420.80**	**1,627.73**	**103,804.11**
Business Interruption Loss						
	Income	0.15	535.30	37.79	66.14	639.37
	Relocation	5,918.20	1,457.15	210.25	214.19	7,799.78
	Rental	2,321.16	711.12	34.96	15.75	3,083.00
	Wage	0.35	604.96	63.54	182.63	851.49
	Subtotal	**8,239.86**	**3,308.53**	**346.54**	**478.71**	**12,373.64**
Total						
	Total	**94,733.40**	**13,570.57**	**5,767.34**	**2,106.44**	**116,177.75**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars)		
		Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: UN-NAMED-1938-4

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	UN-NAMED-1938-4
Type:	Historic
Max Peak Gust in Study Region:	95 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 90 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	59	92.86	4	5.72	1	0.98	0	0.42	0	0.02
Commercial	597	93.96	33	5.21	5	0.76	0	0.07	0	0.00
Education	19	94.61	1	5.00	0	0.39	0	0.01	0	0.00
Government	6	94.17	0	5.34	0	0.49	0	0.01	0	0.00
Industrial	231	94.04	12	5.07	2	0.70	0	0.18	0	0.01
Religion	42	94.37	2	5.31	0	0.32	0	0.00	0	0.00
Residential	8,726	90.77	806	8.38	80	0.83	1	0.01	0	0.00
Total	**9,678**		**859**		**88**		**2**		**0**	

Table 3: Expected Building Damage by Building Type

Building Type	None		Minor		Moderate		Severe		Destruction	
	Count	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	138	93.51	9	5.84	1	0.64	0	0.00	0	0.00
Masonry	902	89.66	77	7.61	26	2.58	1	0.14	0	0.01
MH	140	99.73	0	0.21	0	0.05	0	0.00	0	0.01
Steel	470	94.39	24	4.75	4	0.77	0	0.09	0	0.00
Wood	8,074	91.30	727	8.22	42	0.47	0	0.00	0	0.01

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (only 0.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	0
Police Stations	1	0	0	1
Schools	7	0	0	6

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 24,656 tons of debris will be generated. Of the total amount, 18,058 tons (73%) is Other Tree Debris. Of the remaining 6,598 tons, Brick/Wood comprises 30% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 80 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 4,610 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 4 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 16.7 million dollars, which represents 0.63 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 17 million dollars. 1% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 90% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	13,257.43	700.85	255.75	110.93	14,324.95
	Content	1,033.63	95.82	115.04	19.77	1,264.27
	Inventory	0.00	2.14	22.10	1.75	25.99
	Subtotal	**14,291.05**	**798.81**	**392.90**	**132.46**	**15,615.21**
Business Interruption Loss						
	Income	0.00	92.58	2.33	11.94	106.85
	Relocation	418.09	97.23	10.59	12.84	538.75
	Rental	259.32	45.38	2.02	1.13	307.85
	Wage	0.00	81.64	3.90	33.99	119.53
	Subtotal	**677.40**	**316.83**	**18.84**	**59.91**	**1,072.98**
Total						
	Total	**14,968.46**	**1,115.64**	**411.74**	**192.36**	**16,688.19**

Appendix A: County Listing for the Region

Connecticut
- Litchfield

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Hurricane Event Report

Region Name: New Milford

Hurricane Scenario: GLORIA

Print Date: Tuesday, November 19, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.60 square miles and contains 6 census tracts. There are over 10 thousand households in the region and has a total population of 27,121 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 million dollars (2006 dollars). Approximately 90% of the buildings (and 75% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 10,627 buildings in the region which have an aggregate total replacement value of 2,634 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	1,966,616	74.7%
Commercial	464,031	17.6%
Industrial	135,117	5.1%
Agricultural	15,017	0.6%
Religious	30,105	1.1%
Government	3,092	0.1%
Education	20,458	0.8%
Total	**2,634,436**	**100.0%**

Essential Facility Inventory

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	GLORIA
Type:	Historic
Max Peak Gust in Study Region:	59 mph

Building Damage

General Building Stock Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0% of the total number of buildings in the region. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	63	99.85	0	0.15	0	0.00	0	0.00	0	0.00
Commercial	634	99.78	1	0.22	0	0.00	0	0.00	0	0.00
Education	20	99.76	0	0.24	0	0.00	0	0.00	0	0.00
Government	6	99.74	0	0.26	0	0.00	0	0.00	0	0.00
Industrial	245	99.75	1	0.25	0	0.00	0	0.00	0	0.00
Religion	44	99.83	0	0.17	0	0.00	0	0.00	0	0.00
Residential	9,609	99.96	4	0.04	0	0.00	0	0.00	0	0.00
Total	**10,621**		**6**		**0**		**0**		**0**	

Table 3: Expected Building Damage by Building Type

	None		Minor		Moderate		Severe		Destruction	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	148	99.70	0	0.30	0	0.00	0	0.00	0	0.00
Masonry	1,003	99.68	3	0.31	0	0.00	0	0.00	0	0.00
MH	140	100.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	497	99.74	1	0.26	0	0.00	0	0.00	0	0.00
Wood	8,843	100.00	0	0.00	0	0.00	0	0.00	0	0.00

Essential Facility Damage

Before the hurricane, the region had 62 hospital beds available for use. On the day of the hurricane, the model estimates that 62 hospital beds (only 100.00%) are available for use. After one week, 100.00% of the beds will be in service. By 30 days, 100.00% will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	2	0	0	2
Hospitals	1	0	0	1
Police Stations	1	0	0	1
Schools	7	0	0	7

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 2 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 2 tons, Brick/Wood comprises 100% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 0 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 0.1 million dollars, which represents 0.00 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 0 million dollars. 0% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 100% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	71.63	0.00	0.00	0.00	71.63
	Content	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00
	Subtotal	**71.63**	**0.00**	**0.00**	**0.00**	**71.63**
Business Interruption Loss						
	Income	0.00	0.00	0.00	0.00	0.00
	Relocation	0.09	0.00	0.00	0.00	0.09
	Rental	0.00	0.00	0.00	0.00	0.00
	Wage	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.09**	**0.00**	**0.00**	**0.00**	**0.09**
Total						
	Total	**71.72**	**0.00**	**0.00**	**0.00**	**71.72**

Appendix A: County Listing for the Region

Connecticut

- Litchfield

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Litchfield	27,121	1,966,616	667,820	2,634,436
Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**
Study Region Total	**27,121**	**1,966,616**	**667,820**	**2,634,436**

Hazus-MH: Earthquake Event Report

Region Name: New Milford

Earthquake Scenario: East Haddam

Print Date: November 19, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.59 square miles and contains 6 census tracts. There are over 10 thousand households in the region which has a total population of 27,121 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 (millions of dollars). Approximately 90.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 10 thousand buildings in the region which have an aggregate total replacement value of 2,634 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 13 dams identified within the region. Of these, 6 of the dams are classified as ‘high hazard’. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 620.00 (millions of dollars). This inventory includes over 96 kilometers of highways, 37 bridges, 880 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	37	169.10
	Segments	11	349.60
	Tunnels	0	0.00
		Subtotal	**518.70**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	25.60
	Tunnels	0	0.00
		Subtotal	**25.60**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	0	0.00
		Subtotal	**0.00**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
		Subtotal	**0.00**
		Total	**544.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.80
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**8.80**
Waste Water	Distribution Lines	NA	5.30
	Facilities	1	76.60
	Pipelines	0	0.00
		Subtotal	**81.90**
Natural Gas	Distribution Lines	NA	3.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**3.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	0	0.00
		Subtotal	**0.00**
		Total	**94.20**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	East Haddam
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.40
Latitude of Epicenter	41.50
Earthquake Magnitude	6.40
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Building Damage

Hazus estimates that about 266 buildings will be at least moderately damaged. This is over 3.00 % of the buildings in the region. There are an estimated 2 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	54	0.57	6	0.69	2	1.04	0	1.50	0	1.44
Commercial	533	5.66	66	7.06	31	12.93	5	18.20	0	22.60
Education	17	0.18	2	0.22	1	0.39	0	0.48	0	0.75
Government	5	0.05	1	0.07	0	0.12	0	0.14	0	0.22
Industrial	206	2.19	25	2.71	13	5.32	2	6.75	0	8.96
Other Residential	1,242	13.17	138	14.85	52	21.70	7	26.17	1	28.00
Religion	38	0.40	4	0.46	2	0.77	0	1.16	0	1.52
Single Family	7,337	77.79	686	73.94	138	57.72	12	45.61	1	36.50
Total	**9,432**		**928**		**238**		**26**		**2**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	7,975	84.55	728	78.42	130	54.54	8	31.61	0	9.52
Steel	416	4.42	51	5.50	27	11.49	3	13.28	0	17.59
Concrete	98	1.03	11	1.19	6	2.38	0	1.58	0	1.79
Precast	26	0.28	3	0.28	2	0.88	1	1.93	0	0.31
RM	173	1.83	13	1.35	9	3.69	2	5.82	0	0.24
URM	638	6.76	104	11.16	53	22.17	11	41.95	1	69.24
MH	107	1.13	20	2.10	12	4.84	1	3.83	0	1.31
Total	**9,432**		**928**		**238**		**26**		**2**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 62 hospital beds available for use. On the day of the earthquake, the model estimates that only 44 hospital beds (71.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 87.00% of the beds will be back in service. By 30 days, 97.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	0	0	1
Schools	7	0	0	7
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	37	0	0	37	37
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	440	17	4
Waste Water	264	8	2
Natural Gas	176	3	1
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,018	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.01 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 64.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 240 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 11 households to be displaced due to the earthquake. Of these, 6 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

· Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
· Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
· Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
· Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	3	0	0	0
	Total	**4**	**0**	**0**	**0**
2 PM	Commercial	3	0	0	0
	Commuting	0	0	0	0
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**4**	**1**	**0**	**0**
5 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	1	0	0	0
	Total	**4**	**1**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 26.28 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 25.09 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 55 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.12	1.08	0.05	0.02	1.27
	Capital-Related	0.00	0.05	0.84	0.03	0.01	0.92
	Rental	0.19	0.27	0.55	0.02	0.01	1.04
	Relocation	0.67	0.19	0.87	0.10	0.12	1.94
	Subtotal	**0.86**	**0.63**	**3.34**	**0.19**	**0.16**	**5.17**
Capital Stock Losses							
	Structural	1.64	0.41	0.99	0.26	0.17	3.47
	Non_Structural	6.43	1.80	2.87	0.79	0.37	12.26
	Content	1.68	0.39	1.33	0.47	0.18	4.06
	Inventory	0.00	0.00	0.03	0.10	0.01	0.13
	Subtotal	**9.75**	**2.61**	**5.22**	**1.61**	**0.72**	**19.92**
	Total	**10.61**	**3.24**	**8.56**	**1.81**	**0.88**	**25.09**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	349.57	$0.00	0.00
	Bridges	169.10	$0.26	0.15
	Tunnels	0.00	$0.00	0.00
	Subtotal	**518.70**	**0.30**	
Railways	Segments	25.64	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**25.60**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**544.30**	**0.30**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	8.80	$0.08	0.86
	Subtotal	**8.81**	**$0.08**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	76.60	$0.80	1.05
	Distribution Lines	5.30	$0.04	0.72
	Subtotal	**81.88**	**$0.84**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	3.50	$0.01	0.37
	Subtotal	**3.52**	**$0.01**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**94.21**	**$0.93**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

Litchfield,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Litchfield	27,121	1,966	667	2,634
Total State		**27,121**	**1,966**	**667**	**2,634**
Total Region		**27,121**	**1,966**	**667**	**2,634**

Hazus-MH: Earthquake Event Report

Region Name: New Milford

Earthquake Scenario: Haddam

Print Date: November 19, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.59 square miles and contains 6 census tracts. There are over 10 thousand households in the region which has a total population of 27,121 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 (millions of dollars). Approximately 90.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 10 thousand buildings in the region which have an aggregate total replacement value of 2,634 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 13 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 620.00 (millions of dollars). This inventory includes over 96 kilometers of highways, 37 bridges, 880 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	37	169.10
	Segments	11	349.60
	Tunnels	0	0.00
		Subtotal	**518.70**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	25.60
	Tunnels	0	0.00
		Subtotal	**25.60**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	0	0.00
		Subtotal	**0.00**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
		Subtotal	**0.00**
		Total	**544.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.80
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**8.80**
Waste Water	Distribution Lines	NA	5.30
	Facilities	1	76.60
	Pipelines	0	0.00
		Subtotal	**81.90**
Natural Gas	Distribution Lines	NA	3.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**3.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	0	0.00
		Subtotal	**0.00**
		Total	**94.20**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Haddam
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.55
Latitude of Epicenter	41.77
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Hazus estimates that about 60 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	60	0.59	2	0.72	1	1.06	0	1.38	0	1.12
Commercial	604	5.88	22	7.65	7	13.13	1	17.54	0	19.52
Education	19	0.19	1	0.23	0	0.37	0	0.45	0	0.66
Government	6	0.06	0	0.07	0	0.10	0	0.11	0	0.15
Industrial	235	2.29	8	2.79	3	4.80	0	5.72	0	6.26
Other Residential	1,375	13.38	49	16.68	14	25.24	1	28.38	0	32.38
Religion	42	0.41	2	0.54	1	0.92	0	1.34	0	1.80
Single Family	7,933	77.21	209	71.32	30	54.37	2	45.07	0	38.11
Total	**10,274**		**293**		**55**		**5**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	8,600	83.71	214	73.23	25	45.92	1	25.50	0	0.00
Steel	478	4.65	15	5.21	5	8.73	0	8.46	0	6.47
Concrete	111	1.08	3	1.08	1	1.55	0	0.67	0	0.00
Precast	30	0.29	1	0.37	1	1.19	0	2.36	0	0.17
RM	187	1.82	5	1.72	3	4.69	0	6.16	0	0.00
URM	740	7.20	46	15.70	18	32.23	3	54.04	0	93.36
MH	128	1.24	8	2.69	3	5.70	0	2.81	0	0.00
Total	**10,274**		**293**		**55**		**5**		**0**	

*Note:
RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 62 hospital beds available for use. On the day of the earthquake, the model estimates that only 53 hospital beds (86.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 95.00% of the beds will be back in service. By 30 days, 99.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	0	0	1
Schools	7	0	0	7
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	37	0	0	37	37
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	440	3	1
Waste Water	264	1	0
Natural Gas	176	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,018	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 73.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 2 households to be displaced due to the earthquake. Of these, 1 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

- Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
- Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
- Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
- Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	1	0	0	0
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 5.53 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 5.38 (millions of dollars); 21 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 56 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.02	0.23	0.01	0.01	0.27
	Capital-Related	0.00	0.01	0.18	0.01	0.00	0.20
	Rental	0.04	0.07	0.13	0.00	0.00	0.25
	Relocation	0.14	0.05	0.19	0.02	0.03	0.42
	Subtotal	**0.18**	**0.15**	**0.73**	**0.04**	**0.04**	**1.14**
Capital Stock Losses							
	Structural	0.41	0.11	0.22	0.05	0.04	0.83
	Non_Structural	1.41	0.40	0.60	0.16	0.08	2.64
	Content	0.29	0.07	0.26	0.09	0.03	0.74
	Inventory	0.00	0.00	0.01	0.02	0.00	0.03
	Subtotal	**2.10**	**0.58**	**1.09**	**0.33**	**0.15**	**4.24**
	Total	**2.29**	**0.73**	**1.81**	**0.36**	**0.19**	**5.38**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	349.57	$0.00	0.00
	Bridges	169.10	$0.01	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**518.70**	**0.00**	
Railways	Segments	25.64	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**25.60**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**544.30**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	8.80	$0.01	0.14
	Subtotal	**8.81**	**$0.01**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	76.60	$0.13	0.16
	Distribution Lines	5.30	$0.01	0.12
	Subtotal	**81.88**	**$0.13**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	3.50	$0.00	0.06
	Subtotal	**3.52**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**94.21**	**$0.15**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

Litchfield,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Litchfield	27,121	1,966	667	2,634
Total State		**27,121**	**1,966**	**667**	**2,634**
Total Region		**27,121**	**1,966**	**667**	**2,634**

Hazus-MH: Earthquake Event Report

Region Name: New Milford

Earthquake Scenario: Portland

Print Date: November 19, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.59 square miles and contains 6 census tracts. There are over 10 thousand households in the region which has a total population of 27,121 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 (millions of dollars). Approximately 90.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 10 thousand buildings in the region which have an aggregate total replacement value of 2,634 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 13 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 620.00 (millions of dollars). This inventory includes over 96 kilometers of highways, 37 bridges, 880 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	37	169.10
	Segments	11	349.60
	Tunnels	0	0.00
		Subtotal	**518.70**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	25.60
	Tunnels	0	0.00
		Subtotal	**25.60**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	0	0.00
		Subtotal	**0.00**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
		Subtotal	**0.00**
		Total	**544.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.80
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**8.80**
Waste Water	Distribution Lines	NA	5.30
	Facilities	1	76.60
	Pipelines	0	0.00
		Subtotal	**81.90**
Natural Gas	Distribution Lines	NA	3.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**3.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	0	0.00
		Subtotal	**0.00**
		Total	**94.20**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Portland
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-72.60
Latitude of Epicenter	41.60
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Building Damage

Hazus estimates that about 71 buildings will be at least moderately damaged. This is over 1.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	60	0.59	2	0.71	1	1.04	0	1.35	0	1.15
Commercial	600	5.87	25	7.48	8	12.96	1	17.20	0	19.51
Education	19	0.19	1	0.22	0	0.37	0	0.44	0	0.63
Government	6	0.06	0	0.06	0	0.10	0	0.11	0	0.15
Industrial	233	2.28	9	2.75	3	4.79	0	5.64	0	6.26
Other Residential	1,366	13.37	55	16.39	16	24.78	2	27.98	0	32.41
Religion	42	0.41	2	0.53	1	0.91	0	1.31	0	1.79
Single Family	7,894	77.24	241	71.86	36	55.06	3	45.97	0	38.10
Total	**10,220**		**336**		**65**		**6**		**0**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	8,560	83.76	249	74.07	31	47.18	2	26.75	0	0.00
Steel	475	4.65	17	5.15	6	8.82	0	8.36	0	6.55
Concrete	110	1.08	4	1.08	1	1.61	0	0.71	0	0.30
Precast	29	0.29	1	0.36	1	1.15	0	2.29	0	0.17
RM	186	1.82	6	1.67	3	4.59	0	6.13	0	0.00
URM	732	7.17	51	15.11	20	31.20	3	53.07	0	92.97
MH	127	1.24	9	2.56	4	5.45	0	2.69	0	0.00
Total	**10,220**		**336**		**65**		**6**		**0**	

*Note:

RM	Reinforced Masonry
URM	Unreinforced Masonry
MH	Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 62 hospital beds available for use. On the day of the earthquake, the model estimates that only 52 hospital beds (85.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 94.00% of the beds will be back in service. By 30 days, 99.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	1	0	0	1
Schools	7	0	0	7
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 %	
					After Day 1	After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	37	0	0	37	37
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	440	3	1
Waste Water	264	1	0
Natural Gas	176	1	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,018	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 72.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 40 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 3 households to be displaced due to the earthquake. Of these, 1 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

· Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
· Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
· Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
· Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	1	0	0	0
	Total	**1**	**0**	**0**	**0**
2 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**
5 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**1**	**0**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 6.80 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 6.57 (millions of dollars); 20 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 57 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.03	0.27	0.01	0.01	0.32
	Capital-Related	0.00	0.01	0.21	0.01	0.00	0.23
	Rental	0.05	0.08	0.15	0.00	0.00	0.29
	Relocation	0.17	0.06	0.22	0.02	0.03	0.49
	Subtotal	**0.22**	**0.18**	**0.84**	**0.04**	**0.04**	**1.33**
Capital Stock Losses							
	Structural	0.48	0.13	0.26	0.06	0.05	0.97
	Non_Structural	1.73	0.50	0.73	0.20	0.09	3.25
	Content	0.39	0.10	0.34	0.12	0.04	0.98
	Inventory	0.00	0.00	0.01	0.03	0.00	0.03
	Subtotal	**2.60**	**0.72**	**1.33**	**0.41**	**0.18**	**5.24**
	Total	**2.81**	**0.90**	**2.18**	**0.45**	**0.23**	**6.57**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

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(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	349.57	$0.00	0.00
	Bridges	169.10	$0.01	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**518.70**	**0.00**	
Railways	Segments	25.64	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**25.60**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**544.30**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	8.80	$0.01	0.15
	Subtotal	**8.81**	**$0.01**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	76.60	$0.20	0.26
	Distribution Lines	5.30	$0.01	0.13
	Subtotal	**81.88**	**$0.21**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	3.50	$0.00	0.07
	Subtotal	**3.52**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**94.21**	**$0.22**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

Litchfield,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Litchfield	27,121	1,966	667	2,634
Total State		**27,121**	**1,966**	**667**	**2,634**
Total Region		**27,121**	**1,966**	**667**	**2,634**

Hazus-MH: Earthquake Event Report

Region Name: New Milford

Earthquake Scenario: Stamford

Print Date: November 19, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

Table of Contents

General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 63.59 square miles and contains 6 census tracts. There are over 10 thousand households in the region which has a total population of 27,121 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 10 thousand buildings in the region with a total building replacement value (excluding contents) of 2,634 (millions of dollars). Approximately 90.00 % of the buildings (and 75.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 544 and 76 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 10 thousand buildings in the region which have an aggregate total replacement value of 2,634 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 83% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 1 hospitals in the region with a total bed capacity of 62 beds. There are 7 schools, 2 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 13 dams identified within the region. Of these, 6 of the dams are classified as 'high hazard'. The inventory also includes 0 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 620.00 (millions of dollars). This inventory includes over 96 kilometers of highways, 37 bridges, 880 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	37	169.10
	Segments	11	349.60
	Tunnels	0	0.00
		Subtotal	**518.70**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	25.60
	Tunnels	0	0.00
		Subtotal	**25.60**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
		Subtotal	**0.00**
Bus	Facilities	0	0.00
		Subtotal	**0.00**
Ferry	Facilities	0	0.00
		Subtotal	**0.00**
Port	Facilities	0	0.00
		Subtotal	**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
		Subtotal	**0.00**
		Total	**544.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	8.80
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**8.80**
Waste Water	Distribution Lines	NA	5.30
	Facilities	1	76.60
	Pipelines	0	0.00
		Subtotal	**81.90**
Natural Gas	Distribution Lines	NA	3.50
	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**3.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
		Subtotal	**0.00**
Electrical Power	Facilities	0	0.00
		Subtotal	**0.00**
Communication	Facilities	0	0.00
		Subtotal	**0.00**
		Total	**94.20**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	Stamford
Type of Earthquake	Arbitrary
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	NA
Longitude of Epicenter	-73.60
Latitude of Epicenter	41.15
Earthquake Magnitude	5.70
Depth (Km)	10.00
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	Central & East US (CEUS 2008)

Building Damage

Building Damage

Hazus estimates that about 170 buildings will be at least moderately damaged. This is over 2.00 % of the buildings in the region. There are an estimated 1 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	57	0.58	4	0.66	1	0.97	0	1.35	0	1.22
Commercial	565	5.77	47	7.14	19	12.64	3	17.65	0	20.79
Education	18	0.18	1	0.21	1	0.36	0	0.44	0	0.65
Government	5	0.05	0	0.06	0	0.11	0	0.13	0	0.19
Industrial	220	2.24	18	2.69	8	4.97	1	6.14	0	7.58
Other Residential	1,293	13.20	105	15.84	36	23.72	4	28.38	0	29.99
Religion	39	0.40	3	0.49	1	0.83	0	1.27	0	1.67
Single Family	7,598	77.57	482	72.89	87	56.39	7	44.65	0	37.90
Total	**9,795**		**662**		**154**		**15**		**1**	

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	8,249	84.21	508	76.76	80	51.87	4	28.70	0	7.45
Steel	446	4.56	35	5.29	16	10.11	2	10.67	0	12.53
Concrete	104	1.06	8	1.15	3	2.07	0	1.15	0	1.25
Precast	28	0.28	2	0.31	1	0.96	0	2.08	0	0.26
RM	179	1.82	10	1.46	6	4.00	1	6.05	0	0.16
URM	678	6.92	83	12.47	39	25.07	7	46.95	1	77.58
MH	112	1.15	17	2.55	9	5.93	1	4.39	0	0.77
Total	**9,795**		**662**		**154**		**15**		**1**	

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 62 hospital beds available for use. On the day of the earthquake, the model estimates that only 47 hospital beds (76.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 90.00% of the beds will be back in service. By 30 days, 98.00% will be operational.

Table 5: Expected Damage to Essential Facilities

Classification	Total	# Facilities		
		At Least Moderate Damage > 50%	Complete Damage > 50%	With Functionality > 50% on day 1
Hospitals	1	0	0	1
Schools	7	0	0	7
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	2	0	0	2

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	11	0	0	11	11
	Bridges	37	0	0	37	37
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	# of Locations				
	Total #	With at Least Moderate Damage	With Complete Damage	with Functionality > 50 %	
				After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	1	0	0	1	1
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	440	6	2
Waste Water	264	3	1
Natural Gas	176	1	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service				
		At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	10,018	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 67.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 160 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 7 households to be displaced due to the earthquake. Of these, 4 people (out of a total population of 27,121) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

· Severity Level 1: Injuries will require medical attention but hospitalization is not needed.
· Severity Level 2: Injuries will require hospitalization but are not considered life-threatening
· Severity Level 3: Injuries will require hospitalization and can become life threatening if not promptly treated.
· Severity Level 4: Victims are killed by the earthquake.

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	1	0	0	0
	Single Family	2	0	0	0
	Total	**3**	**0**	**0**	**0**
2 PM	Commercial	2	0	0	0
	Commuting	0	0	0	0
	Educational	1	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**3**	**0**	**0**	**0**
5 PM	Commercial	1	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	1	0	0	0
	Total	**3**	**0**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 18.20 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 17.20 (millions of dollars); 19 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 55 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.07	0.67	0.03	0.02	0.78
	Capital-Related	0.00	0.03	0.52	0.02	0.01	0.57
	Rental	0.12	0.17	0.36	0.01	0.01	0.67
	Relocation	0.41	0.13	0.53	0.06	0.07	1.21
	Subtotal	**0.53**	**0.39**	**2.07**	**0.12**	**0.10**	**3.22**
Capital Stock Losses							
	Structural	1.06	0.27	0.63	0.16	0.11	2.23
	Non_Structural	4.36	1.25	2.04	0.63	0.27	8.54
	Content	1.23	0.29	1.05	0.39	0.14	3.10
	Inventory	0.00	0.00	0.02	0.08	0.01	0.11
	Subtotal	**6.65**	**1.81**	**3.73**	**1.26**	**0.53**	**13.98**
	Total	**7.18**	**2.20**	**5.81**	**1.38**	**0.63**	**17.20**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	349.57	$0.00	0.00
	Bridges	169.10	$0.03	0.02
	Tunnels	0.00	$0.00	0.00
	Subtotal	**518.70**	**0.00**	
Railways	Segments	25.64	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**25.60**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**544.30**	**0.00**	

Table 13: Utility System Economic Losses

(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	8.80	$0.03	0.31
	Subtotal	**8.81**	**$0.03**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	76.60	$0.91	1.19
	Distribution Lines	5.30	$0.01	0.26
	Subtotal	**81.88**	**$0.93**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	3.50	$0.00	0.13
	Subtotal	**3.52**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**94.21**	**$0.96**	

Table 14. Indirect Economic Impact with outside aid

(Employment as # of people and Income in millions of $)

LOSS		Total	%

Appendix A: County Listing for the Region

Litchfield,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Litchfield	27,121	1,966	667	2,634
Total State		**27,121**	**1,966**	**667**	**2,634**
Total Region		**27,121**	**1,966**	**667**	**2,634**

APPENDIX F
FEMA SNOW LOAD GUIDANCE

FEMA Snow Load Safety Guidance

www.FEMA.gov

This flyer summarizes warning signs of overstress conditions during a snow event, key safety issues and risks a snow event poses to buildings, and what to do after a snow event.

Warning Signs of Overstress Conditions during a Snow Event

Overstressed roofs typically display some warning signs. Wood and steel structures may show noticeable signs of excessive ceiling or roof sagging before failure. The following warning signs are common in wood, metal, and steel constructed buildings:

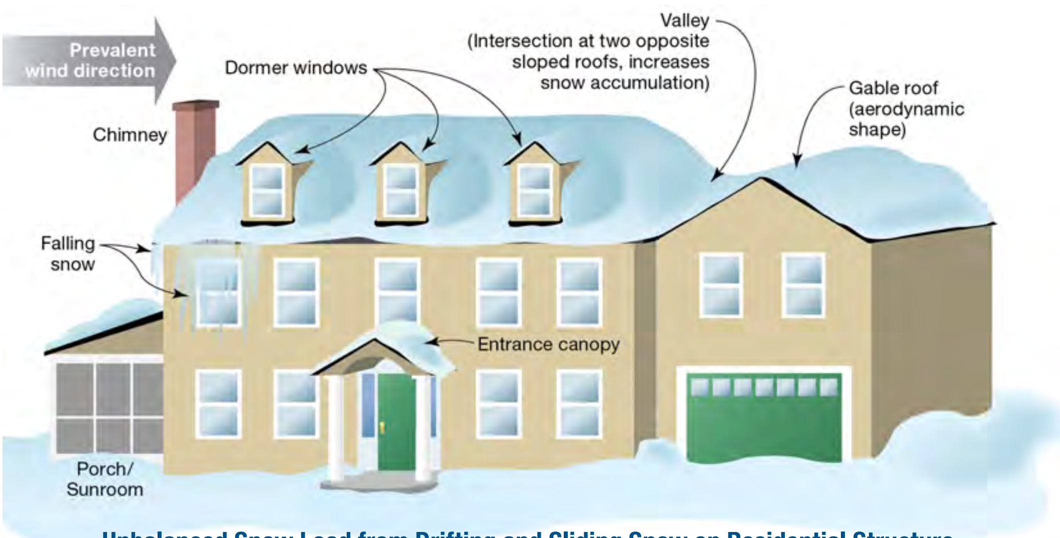
- Sagging ceiling tiles or boards, ceiling boards falling out of the ceiling grid, and/or sagging sprinkler lines and sprinkler heads
- Sprinkler heads deflecting below suspended ceilings
- Popping, cracking, and creaking noises
- Sagging roof members, including metal decking or plywood sheathing
- Bowing truss bottom chords or web members
- Doors and/or windows that can no longer be opened or closed
- Cracked or split wood members
- Cracks in walls or masonry
- Severe roof leaks
- Excessive accumulation of water at nondrainage locations on low slope roofs

Warning! If any of these warning signs are observed, the building should be promptly evacuated and a local building authority and/or a qualified design professional should be contacted to perform a detailed structural inspection.

Key Safety Issues and Risks

Snow accumulation in excess of building design conditions can result in structural failure and possible collapse. Structural failure due to roof snow loads may be linked to several possible causes, including but not limited to the following:

- **Unbalanced snow load from drifting and sliding snow.** When snow accumulates at different depths in different locations on a roof, it results in high and concentrated snow loads that can potentially overload the roof structure.
- **Rain-on-snow load.** Heavy rainfall on top of snow may cause snow to melt and become further saturated, significantly increasing the load on the roof structure.
- **Snow melt between snow events.** If the roof drainage system is blocked, improperly designed or maintained, ice dams may form, which creates a concentrated load at the eaves and reduces the ability of sloped roofs to shed snow. On flat or low slope roof systems, snow melt may accumulate in low areas on roofs, creating a concentrated load.
- **Roof geometry.** Simple roofs with steep slopes shed snow most easily. Roofs with geometric irregularities and obstructions collect snow drifts in an unbalanced pattern. These roof geometries include flat roofs with parapets, stepped roofs, saw-tooth roofs, and roofs with obstructions such as equipment or chimneys.



Unbalanced Snow Load from Drifting and Sliding Snow on Residential Structure

What to Do After a Snow Event

After a snow event, snow removal may be in order. To determine whether snow removal is necessary, one may enlist valuable resources such as a local building authority and/or a qualified design professional, who will be familiar with the snow conditions of the region and the design capacities of local buildings per the building code. If it is determined that the snow should be removed, snow removal should only be performed by qualified individuals. The qualified individual should follow necessary protocols for safe snow removal to minimize risk of personal injury and lower the potential for damaging the roof covering during the snow removal process.

> Warning! Snow removal is a dangerous activity that should only be done by qualified individuals following safety protocols to minimize risks. If at any time there is concern that snow loads may cause a collapse of the roof structure, cease all removal activity and evacuate the building.

If subsequent snow events are anticipated, removing snow from the roof will minimize the risk of accumulating snow causing structural damage. One benefit of immediate snow removal is that the effort required to remove the snow from the rooftop is reduced.

Safety Measures for Snow Removal

Below are some safety measures to take during snow removal to minimize risk of personal injury.

- Any roof snow removal should be conducted following proper OSHA protocol for work on rooftops. Use roof fall arrest harnesses where applicable.
- Always have someone below the roof to keep foot traffic away from locations where falling snow or ice could cause injuries.
- Ensure someone confirms that the area below removal site is free of equipment that could be damaged by falling snow or ice.
- Whenever snow is being removed from a roof, be careful of dislodged icicles. An icicle falling from a short height can still cause damage or injury.
- When using a non-metallic snow rake, be aware that roof snow can slide at any moment. Keep a safe distance away from the eave to remain outside of the sliding range.
- Buried skylights pose a high risk to workers on a roof removing snow. Properly mark this hazard as well as other rooftop hazards.

Methods of Snow Removal

Below are some recommended methods of snow removal that allow the qualified individual to remove snow safely and minimize risk of personal injury and property damage.

- Removing snow completely from a roof surface can result in serious damage to the roof covering and possibly lead to leaks and additional damage. At least a couple of inches of snow should be left on the roof.
- Do not use mechanical snow removal equipment. The risk of damaging the roof membrane or other rooftop items outweighs the advantage of speed.
- Do not use sharp tools, such as picks, to remove snow. Use plastic rather than metal shovels.
- Remove drifted snow first at building elevation changes, parapets, and around equipment.
- Once drifted snow has been removed, start remaining snow removal from the center portion of the roof.
- Remove snow in the direction of primary structural members. This will prevent unbalanced snow loading.
- Do not stockpile snow on the roof.
- Dispose of removed snow in designated areas on the ground.
- Keep snow away from building exits, fire escapes, drain downspouts, ventilation openings, and equipment.
- If possible, remove snow starting at the ridge and moving toward the eave for gable and sloped roofs.
- In some cases a long-handled non-metallic snow rake can be used from the ground, thereby reducing the risk. Metal snow rakes can damage roofing material and pose an electrocution risk and should be avoided.
- Upon completion of snow removal, the roofing material should be inspected for any signs of damage. Additionally, a quick inspection of the structural system may be prudent after particularly large snow events.

If you have any additional questions on this topic or other mitigation topics, contact the FEMA Building Science Helpline at FEMA-Buildingsciencehelp@fema.dhs.gov or 866-927-2104.

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