# TOWN OF PROSPECT
# HAZARD MITIGATION PLAN UPDATE, 2015

## Original Adoption and Approval: August 2008
## Update Adopted February 2015

**MMI #1014-49**

***Prepared for:***

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## ACKNOWLEDGEMENTS AND CONTACT INFORMATION

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# TABLE OF CONTENTS

EXECUTIVE SUMMARY .....ES-1

1.0 INTRODUCTION

1.1 Background and Purpose ..... 1-1
1.2 Hazard Mitigation Goals ..... 1-4
1.3 Identification of Hazards and Document Overview ..... 1-5
1.4 Documentation of the Planning Process ..... 1-8
1.5 Coordination with Neighboring Communities ..... 1-11

2.0 COMMUNITY PROFILE

2.1 Physical Setting ..... 2-1
2.2 Existing Land Use ..... 2-1
2.3 Geology ..... 2-5
2.4 Current Climate Conditions and Climate Change ..... 2-10
2.5 Drainage Basins and Hydrology ..... 2-10
2.6 Population and Demographic Setting ..... 2-13
2.7 Governmental Structure ..... 2-15
2.8 Development Trends ..... 2-15
2.9 Critical Facilities and Sheltering Capacity ..... 2-20

3.0 FLOODING

3.1 Setting ..... 3-1
3.2 Hazard Assessment ..... 3-1
3.3 Historic Record ..... 3-4
3.4 Existing Capabilities ..... 3-7
3.5 Vulnerabilities and Risk Assessment ..... 3-11
3.5.1 HAZUS-MH Vulnerability Analysis ..... 3-15
3.6 Potential Mitigation Strategies and Actions ..... 3-15
3.6.1 Prevention ..... 3-15
3.6.2 Property Protection ..... 3-17
3.6.3 Emergency Services ..... 3-19
3.6.4 Public Education and Awareness ..... 3-19
3.6.5 Natural Resource Protection ..... 3-20
3.6.6 Structural Projects ..... 3-21
3.7 Status of Mitigation Strategies and Actions ..... 3-22

4.0 HURRICANES

4.1 Setting ..... 4-1
4.2 Hazard Assessment ..... 4-1

## TABLE OF CONTENTS (continued)


4.3 Historic Record ..... 4-2
4.4 Existing Capabilities ..... 4-5
4.5 Vulnerabilities and Risk Assessment ..... 4-6
4.6 Potential Mitigation Strategies and Actions ..... 4-13
4.6.1 Prevention ..... 4-14
4.6.2 Property Protection ..... 4-14
4.6.3 Public Education and Awareness ..... 4-15
4.6.4 Emergency Services ..... 4-15
4.6.5 Structural Projects ..... 4-15
4.7 Status of Mitigation Strategies and Actions ..... 4-15

5.0 SUMMER STORMS AND TORNADOES

5.1 Setting ..... 5-1
5.2 Hazard Assessment ..... 5-1
5.3 Historic Record ..... 5-5
5.4 Existing Capabilities ..... 5-7
5.5 Vulnerabilities and Risk Assessment ..... 5-9
5.6 Potential Mitigation Strategies and Actions ..... 5-10
5.7 Status of Mitigation Strategies and Actions ..... 5-11

6.0 WINTER STORMS

6.1 Setting ..... 6-1
6.2 Hazard Assessment ..... 6-1
6.3 Historic Record ..... 6-3
6.4 Existing Capabilities ..... 6-8
6.5 Vulnerabilities and Risk Assessment ..... 6-8
6.6 Potential Mitigation Strategies and Actions ..... 6-10
6.6.1 Prevention ..... 6-10
6.6.2 Property Protection ..... 6-11
6.6.3 Public Education and Awareness ..... 6-11
6.6.4 Emergency Services ..... 6-11
6.7 Status of Mitigation Strategies and Actions ..... 6-12

7.0 EARTHQUAKES

7.1 Setting ..... 7-1
7.2 Hazard Assessment ..... 7-1
7.3 Historic Record ..... 7-3
7.4 Existing Capabilities ..... 7-4
7.5 Vulnerabilities and Risk Assessment ..... 7-5

## TABLE OF CONTENTS (continued)


7.6 Potential Mitigation Strategies and Actions ..... 7-11
7.7 Status of Mitigation Strategies and Actions ..... 7-12

8.0 DAM FAILURE

8.1 Setting ..... 8-1
8.2 Hazard Assessment ..... 8-1
8.3 Historic Record ..... 8-5
8.4 Existing Capabilities ..... 8-6
8.5 Vulnerabilities and Risk Assessment ..... 8-8
8.6 Potential Mitigation Strategies and Actions ..... 8-9
8.7 Status of Mitigation Strategies and Actions ..... 8-10

9.0 WILDFIRES

9.1 Setting ..... 9-1
9.2 Hazard Assessment ..... 9-1
9.3 Historic Record ..... 9-3
9.4 Existing Capabilities ..... 9-5
9.5 Vulnerabilities and Risk Assessment ..... 9-6
9.6 Potential Mitigation Strategies and Actions ..... 9-7
9.7 Status of Mitigation Strategies and Actions ..... 9-7

10.0 MITIGATION STRATEGIES AND ACTIONS .....

10.1 Additional Strategies ..... 10-1
10.2 Summary of Proposed Strategies and Actions ..... 10-1
10.3 Priority Strategies and Actions ..... 10-4
10.4 Sources of Funding ..... 10-5

11.0 PLAN IMPLEMENTATION

11.1 Implementation Strategy and Schedule ..... 11-1
11.2 Progress Monitoring and Public Participation ..... 11-2
11.3 Updating the Plan ..... 11-3
11.4 Technical and Financial Resources ..... 11-5

12.0 REFERENCES ..... 12-1

## TABLE OF CONTENTS (continued)

## TABLES


Table 1-1 Eligible Mitigation Project Activities by Program ..... 1-3
Table 1-2 Hazard Event Ranking ..... 1-6
Table 1-3 Hazard Effect Ranking ..... 1-7
Table 1-4 Local Plan Development Participants ..... 1-9
Table 1-5 Municipalities Adjacent to Prospect ..... 1-11
Table 2-1 Land Use by Area ..... 2-5
Table 2-2 Population Density by Municipality, Region, and State, 2000 and 2010 ..... 2-14
Table 2-3 Critical Facilities in Prospect ..... 2-20
Table 3-1 FIRM Zone Descriptions ..... 3-3
Table 3-2 HAZUS-MH Flood Scenario – Basic Information ..... 3-14
Table 3-3 Status of Previous Strategies and Actions ..... 3-22
Table 4-1 Tropical Cyclones by Month within 150 Nautical Miles of Waterbury Since 1851 ..... 4-3
Table 4-2 Return Period (in Years) for Hurricanes to Strike Connecticut ..... 4-7
Table 4-3 HAZUS-MH Hurricane Scenarios – Number of Residential Buildings Damaged ..... 4-10
Table 4-4 HAZUS-MH Hurricane Scenarios – Total Number of Buildings Damaged ..... 4-11
Table 4-5 HAZUS-MH Hurricane Scenarios – Essential Facility Damage ..... 4-11
Table 4-6 HAZUS-MH Hurricane Scenarios – Debris Generation (Tons) ..... 4-12
Table 4-7 HAZUS-MH Hurricane Scenarios – Shelter Requirements ..... 4-12
Table 4-8 HAZUS-MH Hurricane Scenarios – Economic Losses ..... 4-13
Table 4-9 Status of Previous Strategies and Actions ..... 4-16
Table 5-1 Fujita Scale ..... 5-3
Table 5-2 Enhanced Fujita Scale ..... 5-4
Table 5-3 Tornado Events Near Prospect from 1648 to July 2013 ..... 5-6
Table 5-4 NOAA Weather Watches ..... 5-7
Table 5-5 NOAA Weather Warnings ..... 5-8
Table 5-6 Status of Previous Strategies and Actions ..... 5-11
Table 6-1 RSI Categories ..... 6-3
Table 6-2 Reported Roof Collapse Damage, 2011 ..... 6-5
Table 6-3 Status of Previous Strategies and Actions ..... 6-12
Table 7-1 Comparison of Earthquake Magnitude and Intensity ..... 7-2
Table 7-2 HAZUS-MH Earthquake Scenarios – Number of Residential Buildings Damaged ..... 7-7
Table 7-3 HAZUS-MH Earthquake Scenarios – Total Number of Buildings Damaged ..... 7-7
Table 7-4 HAZUS-MH Earthquake Scenarios – Essential Facility Damage ..... 7-8
Table 7-5 HAZUS-MH Earthquake Scenarios – Utility, Infrastructure, and Fire Damage ..... 7-8
Table 7-6 HAZUS-MH Earthquake Scenarios – Debris Generation (Tons) ..... 7-9
Table 7-7 HAZUS-MH Earthquake Scenarios – Shelter Requirements ..... 7-9
Table 7-8 HAZUS-MH Earthquake Scenarios – Casualty Estimates ..... 7-10

## TABLE OF CONTENTS (continued)


Table 7-9 HAZUS-MH Estimated Direct Losses from Earthquake Scenarios ..... 7-10
Table 7-10 Status of Previous Strategies and Actions ..... 7-12
Table 8-1 Dams Registered with the DEEP in the Town of Prospect..... 8-5
Table 8-2 Dams Damaged Due to Flooding from October 2005 Storms..... 8-5
Table 8-3 Status of Previous Strategies and Actions ..... 8-10
Table 9-1 Wildland Fire Statistics for Connecticut..... 9-4
Table 9-2 Status of Previous Strategies and Actions ..... 9-8
Table 11-1 Schedule for Hazard Mitigation Plan Update ..... 11-3


## FIGURES


Figure 2-1 Prospect Location Map ..... 2-2
Figure 2-2 Prospect in the CNVR..... 2-3
Figure 2-3 Prospect Generalized Land Use ..... 2-4
Figure 2-4 Prospect Bedrock Geology ..... 2-8
Figure 2-5 Prospect Surficial Geology ..... 2-9
Figure 2-6 Elderly Population ..... 2-16
Figure 2-7 Linguistically Isolated Households..... 2-17
Figure 2-8 Disabilities Map ..... 2-18
Figure 3-1 FEMA Flood Zones in Prospect ..... 3-5
Figure 4-1 Historical Hurricane Storm Track..... 4-9
Figure 5-1 Anatomy of a Tornado ..... 5-2
Figure 8-1 High Hazard Dams in Prospect (Cheshire Reservoir Dam)..... 8-2
Figure 8-2 High Hazard Dams in Prospect (Waterbury Reservoir Dam #2)..... 8-3
Figure 8-3 High Hazard Dams in Prospect (Moody Reservoir Dam) ..... 8-4
Figure 9-1 Prospect Wildfire Risk Areas..... 9-2


## APPENDICES


Appendix A STAPLEE Matrix..... A-1
Appendix B Documentation of Plan Development..... A-6
Appendix C HAZUS Documentation..... A-64
Appendix D Record of Municipal Adoption ..... A-294
Appendix E FEMA Snow Load Guidance..... A-296
Appendix F Mitigation Project Status Worksheet ..... A-299

# 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 |
| CLEAR | Center for Land Use Education and Research (University of Connecticut) |
| CM | Centimeter |
| CRS | Community Rating System |
| DEEP | Department of Energy & Environmental Protection |
| DEMHS | Department 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 |
| ICC | International Code Council |
| IPCC | Intergovernmental Panel on Climate Change |
| 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 |
| SCCOG | Southeastern Connecticut Council of Governments |
| 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 |
| TNC | The Nature Conservancy |
| USD | United States Dollars |
| USDA | United States Department of Agriculture |
| USGS | United States Geological Survey |

# EXECUTIVE SUMMARY

When the initial Hazard Mitigation Plan for the Town of Prospect was developed in 2007 and adopted and approved in 2008, the town had not been struck by a major disaster in many years. Widespread property damage caused by a natural hazard event had not occurred since Tropical Storm Floyd in 1999. In the years since the first Hazard Mitigation Plan was adopted and approved, a number of severe storms have occurred, resulting in presidential disaster declarations in Connecticut. These include flooding of March 2010, winter storms of January 2011, Tropical Storm Irene of August 2011, Winter Storm Alfred of October 2011, "Superstorm" Sandy of August 2012, and Winter Storm Nemo of February 2013.

These storms have tested the resilience of Prospect, demonstrating that the town has considerable capacity to recover from storms. However, certain areas of town such Gramar Avenue and Putting Green Lane remain at risk from flooding due to poor drainage and Marks Brook, respectively. The town also remains at risk to localized or widespread power outages caused by wind and snow events that damage utility lines, as well as residential and non-residential structural damage from heavy snow loads.

Unlike many other communities in the region, Prospect continues to experience moderate development and growth. A new bank and a banquet facility have been constructed near the Waterbury town line and construction of Prospect at Regency, a 55 and over community is almost complete. The Zoning Regulations were revised and adopted in 2011 and the town intends to continue carefully regulating development especially as related to areas of risk to natural hazards.

The town believes that recent state legislation regarding significant and high hazard dams will help address dam safety. Wind and snow hazards from hurricanes, tropical storms, thunderstorms, nor'easters, and other storms will continue to be addressed by preventive methods (such as tree limb trimming) that have been improved over the last few years based on experience with storms Irene and Alfred as well as other events.

In light of the recent disasters, the primary goal of this hazard mitigation plan is the same as it was in 2008: to reduce the loss of or damage to life, property, infrastructure, and natural resources from natural disasters. This includes the reduction of public and private costs. Going forward, the town intends to focus on a number of strategies carried forward from the first Hazard Mitigation Plan, while also focusing on a handful of new strategies such as improving drainage and obtaining generators for critical facilities.

When this plan is next updated in 2019-2020, the town intends to revisit issues related to land development if moderate development occurs over the next few years. The next plan will also report on the status of any mitigation efforts pursued by the town.

# 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 disasters, pre-disaster hazard mitigation is commonly defined as any sustained action that 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 natural hazards and risks, existing capabilities, and activities that can be undertaken by a community to prevent loss of life and reduce property damages associated with the identified hazards. Public safety and property loss reduction are the driving forces 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 update was prepared specifically to identify hazards and potential mitigation measures in Prospect, Connecticut. The town's previous HMP was adopted by the Town Council and approved by the Federal Emergency Management Agency (FEMA) in August 2008 and is on file at the FEMA Region I office. The HMP expired in August 2013. 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. While an update of the previous HMP, this HMP has been reformatted to be consistent with current FEMA planning requirements.

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" contains several competitive grant programs deigned to mitigate the impacts of natural hazards. This HMP update 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 Management Assistance (FMA) programs. These programs are briefly described below.

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 subject plan update was funded through the HMGP program.

Pre-Disaster Mitigation (PDM) Program

The Pre-Disaster Mitigation 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 pre-disaster mitigation planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of HMPs 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. The town's initial HMP was funded through the PDM program.

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 the FMA program:

- 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

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.

**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.**

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 |
| Minor Localized Flood Reduction Projects | X | 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 |

| Eligible Activities | HMGP | PDM | FMA |
|---|---|---|---|
| Soil Stabilization | X | X | X |
| Wildfire Mitigation | X | X | |
| Post-Disaster Code Enforcement | X | | |
| Generators | X | X | |
| 5% Initiative Projects | X | | |
| Advance Assistance | X | | |

*Source: Table 3 – HMA Unified Guidance document*

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 hazard mitigation plan 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 hazard mitigation plan is expected to address the following secondary goals:

- ***Increase access to and awareness of funding sources for hazard mitigation projects.*** Certain funding sources, such as the Pre-Disaster Mitigation Competitive Grant Program and the Hazard Mitigation Grant Program, will be available if the hazard mitigation plan 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 strategies and actions, which can then be prioritized and acted upon as funding allows.

- ***Connect hazard mitigation planning to other community planning efforts.*** This HMP can be used to guide Prospect's development through inter-departmental and inter-municipal coordination.

- ***Improve the mechanisms for pre- and post-disaster decision making efforts.*** This plan emphasizes actions that can be taken now to reduce or prevent future disaster damages. If the actions identified in this plan are implemented, damage from future hazard events can be minimized, thereby easing recovery and reducing the cost of repairs and reconstruction.

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

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

- ***Educate residents and policy makers about natural 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, and thus the benefits that it derives from FEMA. The Town of Prospect has never participated in the Community Rating System.

## 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 Connecticut Natural Hazard Mitigation Plan and correspondence with local officials, the following have been identified as natural hazards that are most likely to affect the Town of Prospect:

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

These are the same hazards that were addressed in the initial Prospect Hazard Mitigation Plan. They were reviewed during the development of the 2014 Connecticut Hazard Mitigation Plan Update (adopted January 2014) and Prospect's plan contributed to the Hazard Identification and Risk Assessment (HIRA) presented in the Connecticut Hazard Mitigation Plan Update. Thus, the plans are consistent. The only hazard given attention in the Connecticut Hazard Mitigation Plan Update but not addressed in the Prospect Hazard Mitigation Plan Update is drought; however, this is the lowest-ranked hazard of those discussed in the state's plan, with a medium-low composite risk score for New Haven County. In addition, the statewide and countywide annual estimated loss (AEL) in the state plan for this hazard is $0. As such, its inclusion was considered not necessary in the Prospect Hazard Mitigation Plan Update.

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 and 1-3 provide summaries of the hazard events and hazard effects that impact the Town of Prospect, 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.

**TABLE 1-2**
**Hazard Event Ranking**

| Natural Hazards | Location | Frequency of Occurrence | Magnitude/ Severity | Rank |
|---|---|---|---|---|
| | 1 = small<br>2 = medium<br>3 = large | 0 = unlikely<br>1 = possible<br>2 = likely<br>3 = highly likely | 1 = limited<br>2 = significant<br>3 = critical<br>4 = catastrophic | |
| Winter Storms | 3 | 3 | 2 | 8 |
| Hurricanes | 3 | 1 | 3 | 7 |
| Summer Storms and Tornadoes | 2 | 3 | 2 | 7 |
| Earthquakes | 3 | 1 | 2 | 6 |
| Wildfires | 1 | 2 | 1 | 4 |

- ❑ 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.

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 1-3**
**Hazard Effect Ranking**

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

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%

Despite the 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 associated with other hazards, each hazard has been individually discussed in a separate chapter.

This document begins with a general discussion of Prospect's community profile, including the physical setting, demographics, development trends, governmental structure, and sheltering capacity. Next, each chapter of this Plan 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 Strategies and Actions,* and if necessary*, a Summary of Strategies and Actions.* These are described below.

- ***Setting*** addresses the general areas that are at risk from the hazard. General land uses are identified.

- ***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 of Prospect is currently undertaking to mitigate the given hazard. These may take the form of ordinances and codes, structural measures such as dams, or public outreach initiatives.

- ***Vulnerabilities and Risk Assessment*** focuses on the specific areas 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*** identify mitigation alternatives, including those that may be the least cost effective or inappropriate for Prospect.

- ***Status of Mitigation Strategies and Actions*** provides a summary of the recommended courses of action for Prospect that are included in the STAPLEE analysis described below.

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

## 1.4 Documentation of the Planning Process

The Town of Prospect is a member of the Council of Governments of the Central Naugatuck Valley (COGCNV), the responsible regional planning body for Prospect and twelve other member municipalities: Beacon Falls, Bethlehem, Cheshire, Middlebury, Naugatuck, Oxford, Southbury, Thomaston, Waterbury, Watertown, Wolcott, and Woodbury. All of these communities maintain single-jurisdiction hazard mitigation plans.

Ms. Virginia Mason, former Assistant Director of the COGCNV coordinated the development of the town's initial Hazard Mitigation Plan using a PDM grant. The following individuals from the Town of Prospect provided information, data, studies, reports, and observations; and were involved in the development of the initial Plan and this update:

**TABLE 1-4**
**Local Plan Development Participants**

| Name | Department or Commission | Initial Plan? | First Update? |
|---|---|---|---|
| Mr. Robert J. Chatfield, Mayor | Mayor | Yes | Yes |
| Mr. William Donovan, Land Use Inspector | Land Use | Yes | Yes |
| Mr. Gene McCarthy | Public Works | No | Yes |
| Mr. Nelson Abarzua | Prospect Resident State Trooper | Yes | No |
| *Mr. Richard Mortenson | Prospect Local Emergency Planning Commission | Yes | No |

*As of January 1, 2014, Michael Miele is the Chair of the Emergency Management Advisory Council.

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. The following is a list of meetings that were held to develop the initial Hazard Mitigation Plan and update the plan in 2013-2014:

Initial Plan

- ***A project initiation meeting was held June 26, 2006.*** This meeting addressed the scope of services necessary to develop this HMP. Initial input was provided by the project team.
- ***Field inspections were performed on June 28, 2006.*** Observations were made of problem areas called out by Town officials during the project initiation meeting.

- ***A project meeting with Town officials was held July 25, 2006.*** Necessary documentation was collected, and hazard-prone areas within the Town were discussed.
- ***A public information meeting was held November 20, 2006 at 7:30 P.M.*** Preliminary findings were presented and public comments solicited.

Residents were invited to the public information meeting of November 2006 via newspaper, but few attended. Residents were also encouraged to contact the COG with comments via newspaper articles.

As another direct gauge of public interest, a thorough review of complaint files stored by the Office of the Mayor was undertaken to document problems of public concern. Finally, the Connecticut DEP was routinely briefed and consulted throughout the development process.

It is important to note that COGCNV manages the Central Naugatuck Valley Emergency Planning Committee. This committee was coordinating emergency services in the region during the development of the initial plan. Fire, Police, EMS, Red Cross, emergency management directors, and other departments participated in these efforts. In June 2004, over 120 responders participated in the region's first tabletop exercise on biological terrorism. Area health directors, hospitals, and other health care professionals also meet monthly with the Health and Medical Subcommittee to share information, protocols, and training. Thus, local knowledge and experience gained through the Emergency Planning Committee activities was been transferred by the COGCNV to the hazard mitigation planning process.

Additional opportunities for the public to review the initial Plan were implemented in advance of the public hearing to adopt this plan, tentatively scheduled for spring 2008, contingent on receiving conditional approval from FEMA. The draft that was sent for FEMA review was posted on the Town website and the COGCNV website to provide opportunities for public review and comment. During the public hearing to adopt the plan, any remaining comments from the public were addressed.

<u>First Update</u>

- ***A project meeting with Town officials was held May 29, 2013.*** The update process was described, necessary documentation was collected, and hazard-prone areas within the Town were discussed.
- ***Field inspections were performed on May 29, 2013.*** Observations were made of two primary remaining floodprone areas described by Town officials during the meeting.

In lieu of holding public information meetings for the plan update, the Town of Prospect elected to host a public survey via www.surveymonkey.com. The survey remains open and available. Notification of the survey was posted in the Prospect Pages newspaper, which is mailed free of charge throughout the town; on the town web site; and in the

Prospect Library. No residents participated in the survey, which is comparable to the two people who attended the public information meeting in 2006.

Newspaper Articles

In addition to the public outreach described above, the 13 COGCNV municipalities participated in a regional newspaper story about the plan update process and the need to remain eligible for potential hazard mitigation grants. The story, "Ready for Nature's Nastiness," was printed in the September 28, 2013 edition of the Waterbury Republican American, which maintains readership in all 13 COGCNV communities. A copy is included in Appendix B. The article noted that all of the municipalities were in various stages of the planning process. Potential mitigation projects in several of the towns were described. The article ended with a statement that residents and business owners can send ideas and comments for the plans to the COGCNV at comments@cogcnv.org.

Appendix B contains copies of meeting minutes, field notes and observations, the public information meeting presentation for the initial plan, survey results for the plan update, and other records that document the development of the Hazard Mitigation Plan.

## 1.5 Coordination with Neighboring Communities

Prospect has coordinated with neighboring municipalities in the past relative to hazard mitigation and emergency preparedness and will continue to do so. The following is a list of the communities that are adjacent to Prospect.

**TABLE 1-5**
**Municipalities Adjacent to Prospect**

| City / Town | Hazard Mitigation Plan Status |
|---|---|
| Borough of Naugatuck | Single Jurisdiction Plan |
| City of Waterbury | Single Jurisdiction Plan |
| Town of Cheshire | Single Jurisdiction Plan |
| Town of Hamden | Single Jurisdiction Plan |
| Town of Bethany | Single Jurisdiction Plan |

Input from neighboring communities was sought during the development of the initial HMP through outreach to the chief elected officials of those communities by way of the COGCNV involvement and the activity of the Central Naugatuck Valley Emergency Planning Committee described above.

The adjacent communities of Cheshire and Waterbury were given the opportunity to comment on this update during their hazard mitigation plan meetings. Representatives from these communities did not have any specific concerns or input.

The remaining surrounding communities of Bethany, Hamden and Naugatuck were individually invited via written correspondence to participate in the planning process (refer to Appendix B for copies of the letters). None of the community representatives had any specific comments for the Prospect HMP.

# 2.0 COMMUNITY PROFILE

## 2.1 Physical Setting

The Town of Prospect is located in New Haven County. It is bordered by Naugatuck to the west, Waterbury to the north, Cheshire to the east, and Bethany to the south. Refer to Figure 2-1 for a location schematic, Figure 2-2 for a location map. Of the thirteen communities in the Central Naugatuck Valley Region, Prospect is ranked 7th in terms of population density.

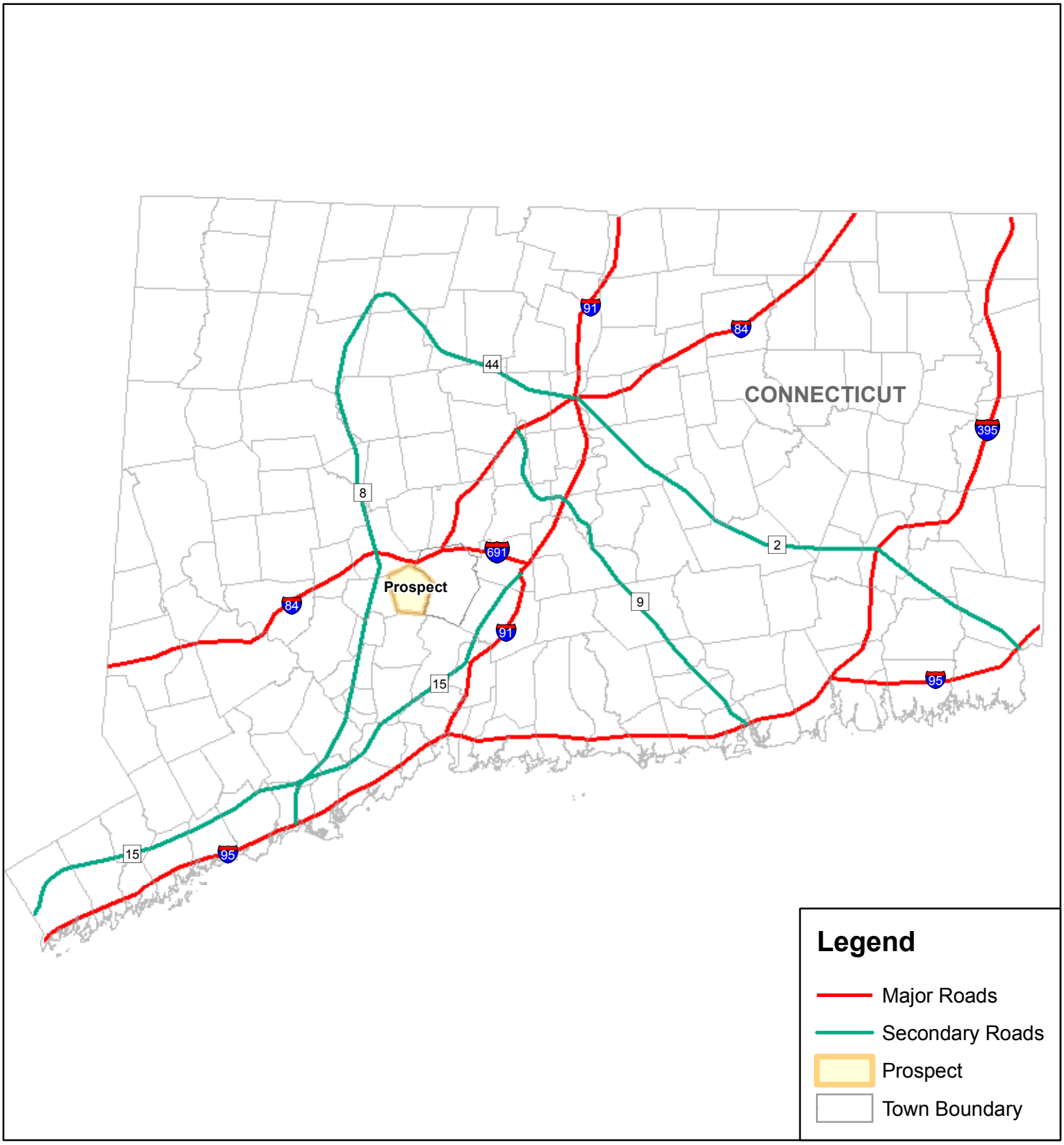
Prospect is located within the eastern part of the crystalline uplands, or Western Highlands, of western Connecticut. This geologic feature consists of three belts of metamorphic rocks bounded to the west by the sediments and low-rank metamorphic rocks of the Hudson River valley and on the east by the Triassic sediments of the Connecticut River valley. The topography of the Town ranges from gently rolling terrain in the river valleys to steep hilly terrain in several upland areas. Elevations ranging from 240 feet in the northeastern part of Town to 910 feet above sea level on top of Turkey Hill in the northwestern part of Town, based on the National Geodetic Vertical Datum of 1929. The hilly terrain of Prospect makes it particularly vulnerable to an array of natural hazards.

## 2.2 Existing Land Use

Prospect is characterized by its hills and steep slopes which limit development in much of the town. Municipal facilities are concentrated in the center of the town at the intersection of Routes 68 and 69. Commercial activity is principally located along Route 69 from the town center north. The commercial areas are surrounded by low-density residential districts interspersed with agricultural operations. Slopes and water features limit development at the northern and eastern ends of the town. In the southern half of the town, the undeveloped land is largely owned by one of three water supply operations for conservation purposes, posing a strict limitation to further development in this area. The largest concentration of industrial land uses is located about a mile west of the town center on Route 69.

In total, Prospect encompasses 14.43 square miles. Table 2-1 provides a summary of land use in Prospect by area. In addition, refer to Figure 2-3 for a map of generalized land use in the Central Naugatuck Valley Planning Region.

# Figure 2-1: Prospect Location Map




Source:"Roads", GDT
"Town Boundary", DEP
For general planning purposes only. Delineations may not be exact.
January 2007

0 10 20 Miles

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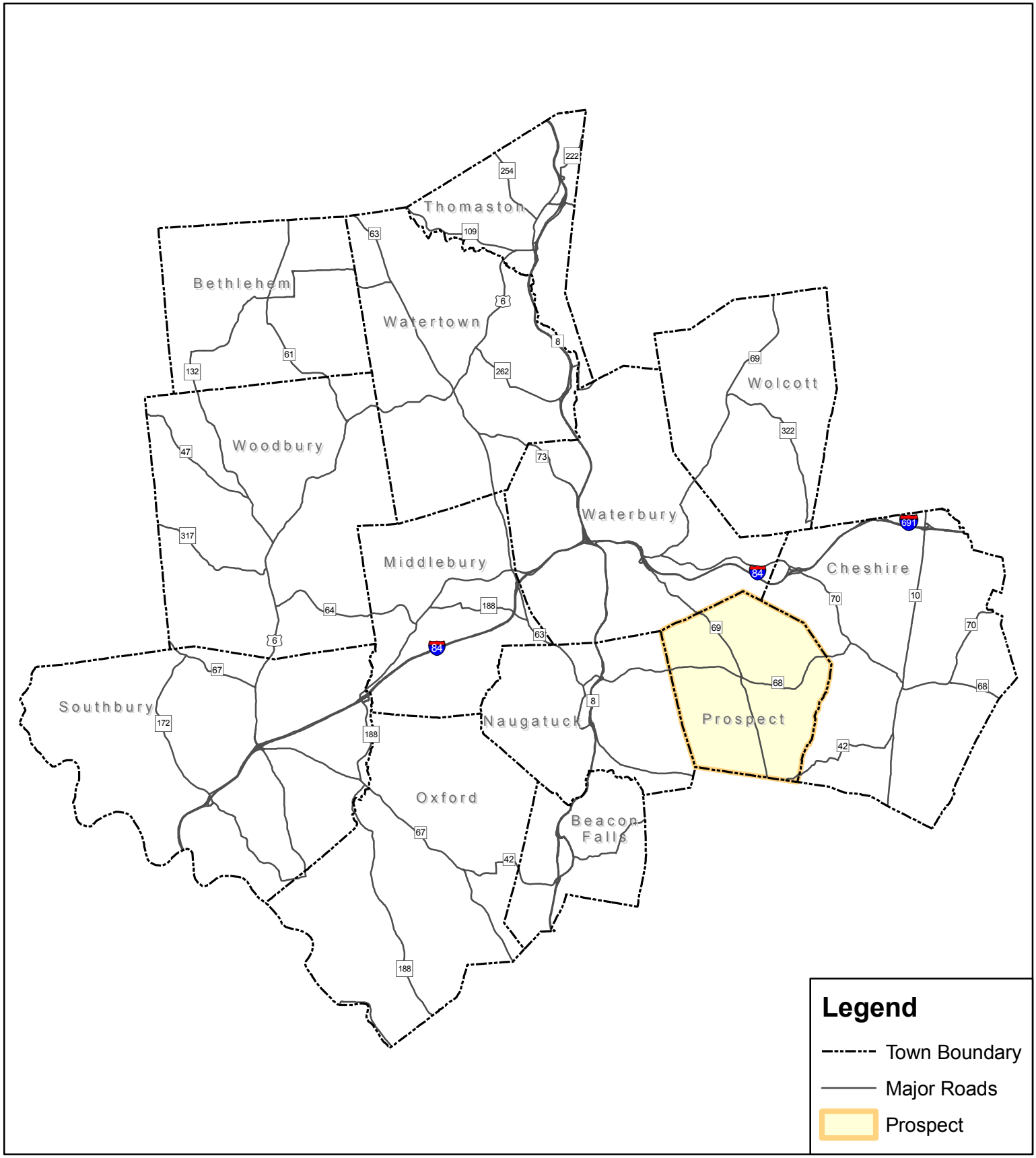
CENTRAL NAUGATUCK VALLEY

# Figure 2-2: Prospect in the CNVR




Source:"Roads", GDT
"Town Boundary", DEP
For general planning purposes only. Delineations may not be exact.
January 2007

0 2 4 Miles

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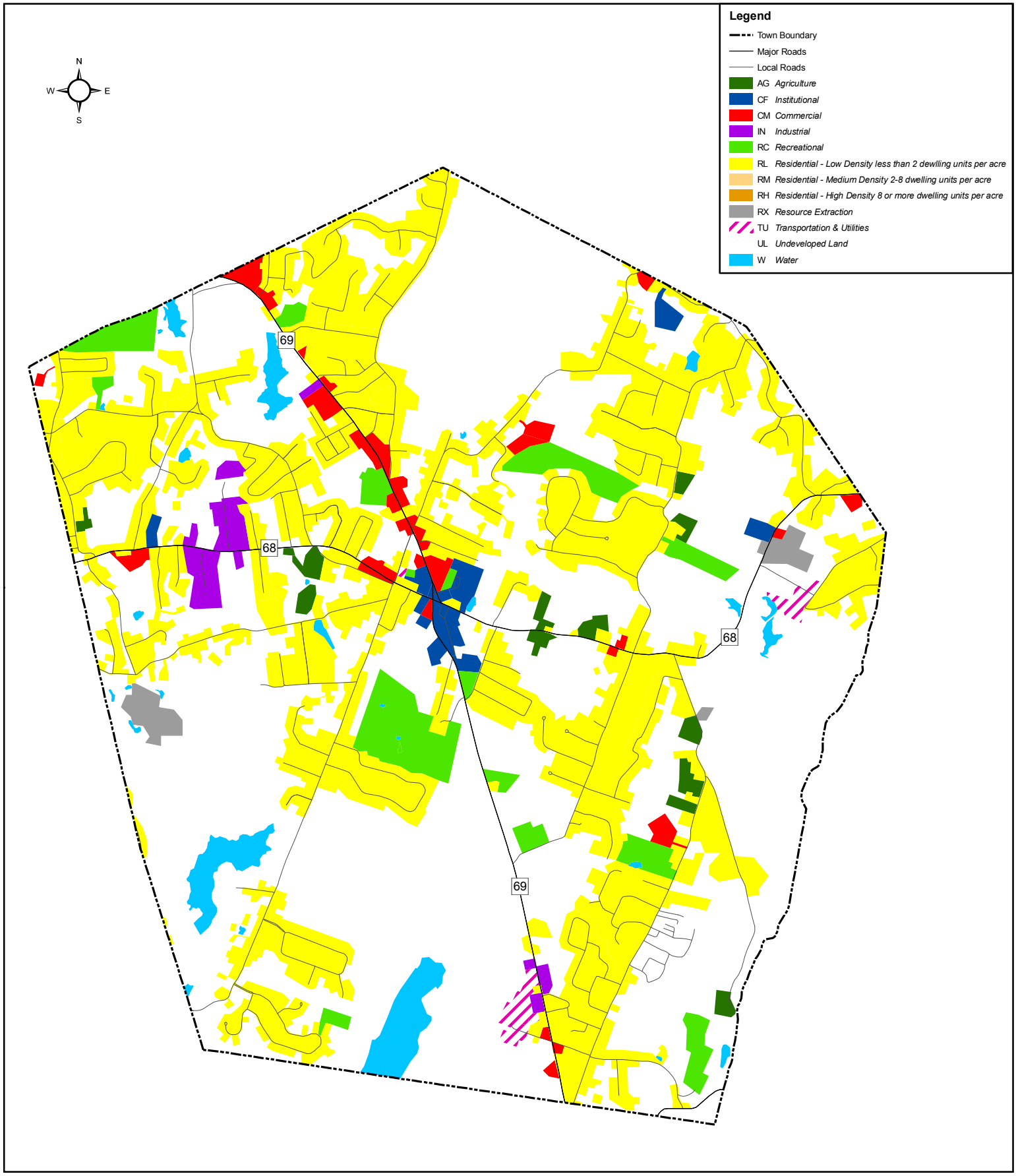
CENTRAL NAUGATUCK VALLEY

# Figure 2-3: Prospect Generalized Land Use




Source: "Roads", GDT
"Town Boundary", DEP
"Land Use", COGCNV

For general planning purposes only. Delineations may not be exact.

January 2007

0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

**TABLE 2-1**
**Land Use by Area**

| Land Use | Area (acres) | Pct. |
|---|---|---|
| Commercial: Office | 51 | 0.6% |
| Commercial: Automotive Sales & Services | 36 | 0.4% |
| Commercial: Retail & Services | 160 | 1.7% |
| Communications | 8 | 0.1% |
| Educational | 69 | 0.8% |
| Industrial: Extraction | 88 | 1.0% |
| Industrial: Light | 60 | 0.7% |
| Industrial: Warehouse & Storage | 69 | 0.7% |
| Parks & Open Space | 380 | 4.1% |
| Private Institution | 30 | 0.3% |
| Public Service | 63 | 0.7% |
| ROW | 491 | 5.3% |
| Residential: Condominium | 181 | 2.0% |
| Residential: Apartment/Multi-Family | 19 | 0.2% |
| Residential: Single Family | 3,991 | 43.3% |
| Residential: Mobile Home | 37 | 0.4% |
| Vacant Land | 1,076 | 11.7% |
| Water Co/Public | 2,407 | 26.1% |
| Town Total | 9,218 | 100% |

*Source: Milone & MacBroom, Inc. 2013*

## 2.3 Geology

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. Thus, it is important to understand the geologic setting and variation of bedrock and surficial formations in Prospect. The following discussion highlights Prospect's geology at several regional scales.

In terms of North American bedrock geology, the Town of Prospect is located in the northeastern part of the Appalachian Orogenic Belt, also known as the Appalachian Highlands. The Appalachian Highlands extend from Maine south into Mississippi and Alabama and were formed during the orogeny that occurred when the super-continent Pangea assembled during the late Paleozoic era. The region is generally characterized by deformed sedimentary rocks cut through by numerous thrust faults.

Regionally, in terms of New England bedrock geology the Town of Prospect lies within the Eugeosyncline Sequence. Bedrock belonging to the Eugeosyncline Sequence are typically deformed, metamorphosed, and intruded by small to large igneous plutons.

Connecticut bedrock geology is comprised of several "terranes." Terranes are geologic regions that reflect the role of plate tectonics in Connecticut's natural history. The bedrock beneath the Town of Prospect is part of the Iapetos Terrane, comprised of remnants of the Iapetos Ocean that existed before Pangaea was formed. This terrane formed when Pangaea was consolidated and its boundaries are coincident with the Eugeosyncline Sequence geologic province described above.

The Town of Prospect's bedrock consists of three general lithologies: volcanic and intrusive igneous silicate gneisses, metamorphic granofels, and metasedimentary and metaigneous schists. The bedrock alignment trends northeast-southwest through the Town. Refer to Figure 2-4 for a depiction of the bedrock geology in the Town of Prospect.

The five primary bedrock formations in the Town (from west to east) are Waterbury Gneiss, Taine Mountain & Collinsville Formation, The Straits Schist, Trap Falls Formation, and Beardsley Member of Harrison Gneiss. Waterbury Gneiss is a gray- to dark-gray, fine- to medium-grained schist and gneiss. Taine Mountain & Collinsville Formation is comprised of well-layered, gray granofels. The Straits Schist is a silvery to gray, coarse grained schist. The Trap Falls formation consists of gray to silvery, partly rusty-weathering, medium-grained schist, and Beardsley Member of Harrison Gneiss is gray to dark-gray, medium-grained, lineated gneiss. In addition, a small area of light-colored, foliated granitic gneiss believed to be from the Ordovician period exists in the southeastern portion of Town, and a small area of igneous buttress dolerite (basalt) exists in the northern portion of Town.

Two major faults exist in the Town: An unnamed fault and the Western Border Fault. The Western Border Fault is a large fault extending along the eastern edge of the Western Highlands and stretches from Milford northwards into Massachusetts. The unnamed fault divides Prospect from southwest to northeast. Both of these faults trace to the Jurassic period. Neither of these faults is active. Bedrock outcrops are difficult to find in Prospect due to the forested nature of the Town, although outcrops can be found at higher elevations and on hilltops. Figure 2-4 also depicts the location of known fault lines in the Town of Prospect.

At least twice in the late Pleistocene, continental ice sheets moved across Connecticut. As a result, surficial geology of the Town is characteristic of the depositional environments that occurred during glacial and postglacial periods. Refer to Figure 2-5 for a depiction of surficial geology.

A vast area of the Town is covered by glacial till. Tills contain an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. This area includes nearly all of the northern, central, and southern portions of Prospect and most of the remaining area of the Town. Stratified sand and gravel ("stratified drift") areas are also associated with the major rivers and brooks throughout the Town. These deposits

accumulated by glacial meltwater streams during the outwash period following the latest glacial recession.

With regard to soil types, approximately 60% of the Town falls within the Canton and Charlton soils (3650 acres), Ridgebury, Leicester and Whitman soils (1028 acres), and Charlton-Chatfield complex (839 acres). The remainder of the Town has soil types consisting primarily of various silty and sandy loams and Udorthents, disturbed soils underlying urban and built up lands where the original soil type is no longer easily identified.

The Canton and Charlton soils consists of very deep, well- drained soils formed in a loamy mantle underlain by sandy till with stones and boulders often present. The soils are found on nearly level to steep glaciated plains, hills, and ridges. Slope ranges from 0 to 50 percent. Saturated hydraulic conductivity is high in the solum and high or very high in the substratum.

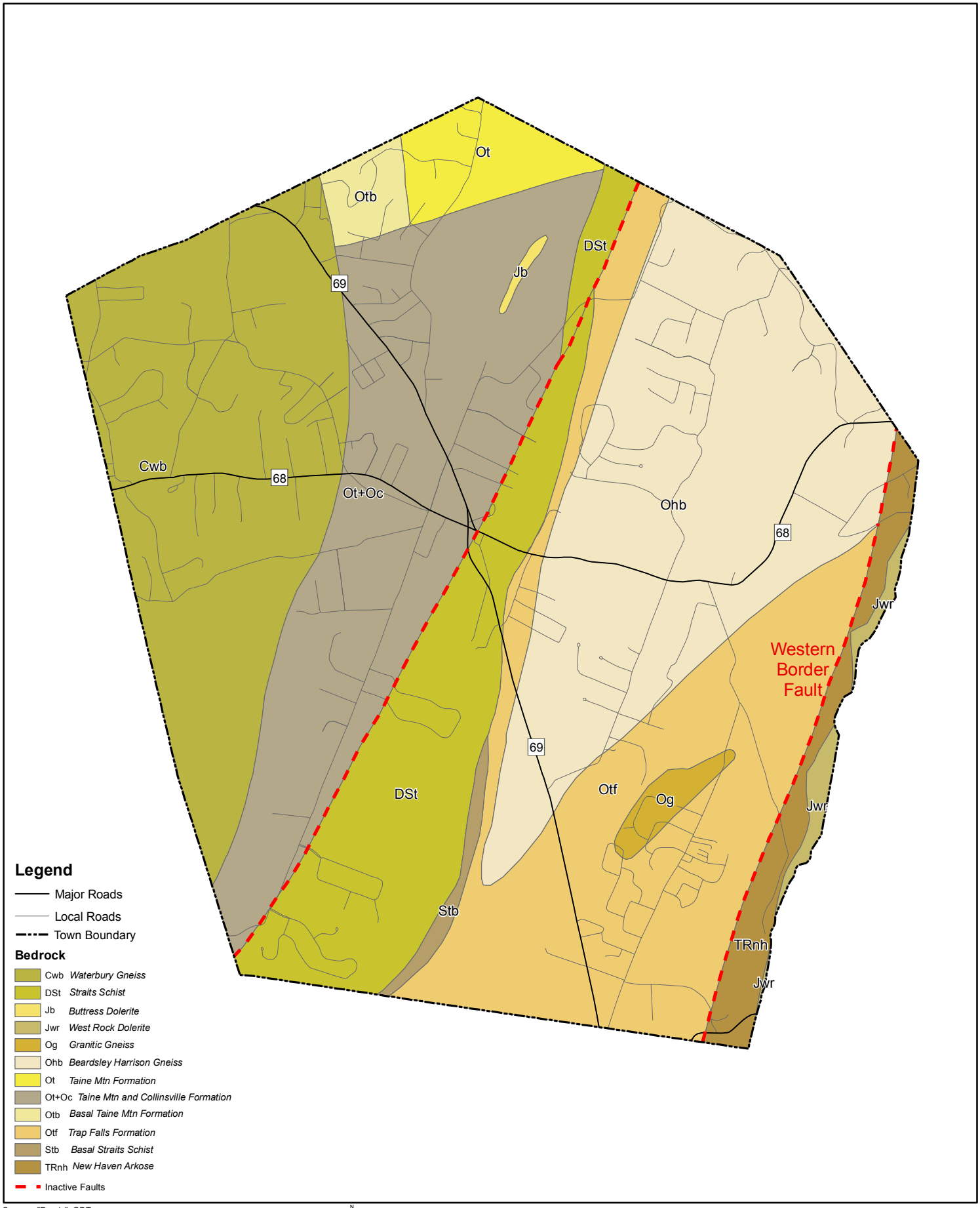
Ridgebury, Leicester and Whitman soils consist of somewhat poorly drained to very poorly drained, nearly level or gently sloping soils formed in compact glacial till. These soils occupy wet, low-lying areas. Slope ranges from 0 to 3 percent. Permeability is moderate in the surface layer and subsoil but is slow or very slow to moderately rapid in the substratum.

The Charlton-Chatfield series consists of moderately deep to deep, well-drained, and somewhat excessively drained soils formed in glacial till. They are very nearly level to very steep soils on glaciated plains, hills, and ridges. The soil is often stony or very stony. Slope ranges from 0 to 70 percent. Crystalline bedrock is at depths of 20 to 40 inches. Saturated hydraulic conductivity is moderately high to high in the mineral soil.

The amount of stratified drift present in the Town is important for several reasons as described below.

- The stratified drift in Prospect provides productive aquifers currently used by the Connecticut Water Company to provide drinking water via pumping wells to the Town of Prospect and the greater Naugatuck area.
- With regard to flooding, areas of stratified materials are generally coincident with floodplains. This is because these materials were deposited at lower elevations by glacial streams, and these valleys later were inherited by the larger of our present-day streams and rivers. However, smaller glacial till watercourses can also cause flooding, such as those in northwestern and eastern Prospect.
- The amount of stratified drift also has bearing on the relative intensity of earthquakes, as large areas of fine-grained sediment present special challenges during shaking as liquefaction may occur. These topics will be discussed in later sections.

# Figure 2-4: Prospect Bedrock Geology




Source: "Roads", GDT
"Town Boundary", "Bedrock Geology", DEP
For general planning purposes only. Delineations may not be exact.
January 2007

N W E S

0 0.5 1 Miles

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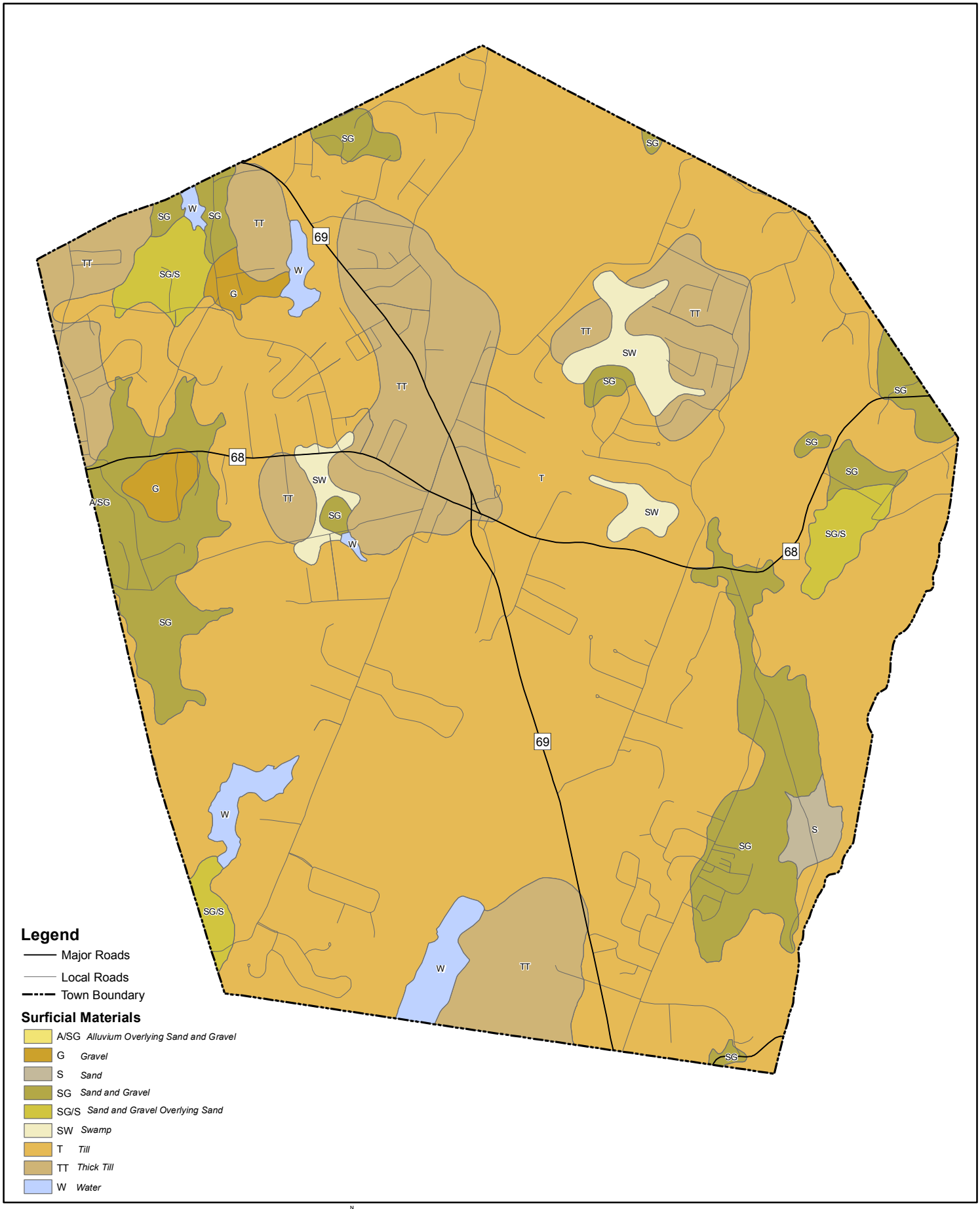
# Figure 2-5: Prospect Surficial Geology




Source: "Roads", GDT
"Town Boundary", "Surficial Materials", DEP
For general planning purposes only. Delineations may not be exact.
January 2007

N W E S

0 0.5 1 Miles

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## 2.4 Current Climate Conditions and Climate Change

Prospect has an agreeable climate, characterized by moderate but distinct seasons. The average mean temperature is approximately 48 degrees, with summer temperatures in the mid-80s and winter temperatures in the upper 20's to mid-30s, Fahrenheit. Extreme conditions raise summer temperatures to near 100 degrees and winter temperatures to below zero. Median snowfall is just over 28 inches per year as measured at the Mount Carmel weather station just south of Cheshire (NCDC, 2006). Median annual precipitation is 44 inches, which is spread evenly over the course of a year.

By comparison, average annual state-wide precipitation based on more than 100 years of record is nearly the same, at 45 inches. However, average annual precipitation in Connecticut has been increasing by 0.95 inches per decade since the end of the 19$^{th}$ century (Miller et. al., 2002; NCDC, 2005). Likewise, total annual precipitation in the Town has increased over time. 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.

Like many communities in the United States, Prospect 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.

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 a 1% annual chance event 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 (http://precip.eas.cornell.edu/) for engineering design. The availability of updated data has numerous implications for natural hazard mitigation as will be discussed in Section 3.

## 2.5 Drainage Basins and Hydrology

The Town of Prospect drains to seven major watersheds corresponding to the Ten Mile River, Willow Brook, West River, the Naugatuck River, Beaver Pond Brook, Fulling Mill Brook, and Beacon Hill Brook. These are described below. Over half of the land area of the Town of Prospect drains to the Ten Mile River and the Beacon Hill Brook.

The land surface is spotted with several ponds and reservoirs and numerous streams, most of which are unnamed.

Ten Mile River

A significant portion (4.76 square miles, 32.99% of total land area of Prospect) of the Ten Mile River basin lies within the northeastern boundary of Prospect, and this area provides the headwaters for the Ten Mile River. The headwaters consist of three main streams: Mountain Brook in the north part of the basin and West Brook and Mixville Brook in the southern part of the basin. Mountain Brook drains a large marsh in Prospect, and has a single impoundment on Brooks Pond, which provides an unnamed tributary to the brook. West Brook is impounded at the West Brook Reservoir, and then empties into Mixville Brook, which is impounded at the Cheshire Reservoir in Prospect.

The Ten Mile River has its source in Prospect as the outflow of the Cheshire Reservoir at the Cheshire Reservoir Dam. The Ten Mile River flows north and is next impounded in the town of Cheshire at Mixville Pond by the Mixville Pond Dam. The river is then joined by Mountain Brook before being impounded at Moss Farms Pond / Lake Percivel by the Lake Percivel Dam. Below this dam the Ten Mile River eventually empties into the Quinnipiac River near Milldale, CT. In total, the Ten Mile River drains 20.26 square miles across Prospect, Waterbury, Cheshire, Wolcott, and Southington, Connecticut.

Willow Brook

The southeastern town boundary of Prospect lies within the drainage area of Willow Brook. This drainage basin comprises an area of 1.24 square miles and 8.65% of Prospect's land area. The land use in southeastern Prospect is predominantly rural, and there are no dams of note on either of the two tributary streams flowing east into Cheshire to join Willow Brook. These streams are Roaring Brook to the north and Sanford Brook to the south. In total, Willow Brook drains a land area of 12.97 square miles across the towns of Cheshire, Prospect, Bethany, and Hamden.

West River

A very small portion (44.64 acres, 0.07 square miles) of Prospect lies within the West River drainage basin. This area comprises 0.48% of Prospect's land area. This section drains into an intermittent, unnamed stream and eventually into a large swamp in northeastern Bethany, Connecticut. This swamp drains into Sanford Brook towards Lake Bethany, and the outflow from the dam on Lake Bethany marks the beginning of West River. In total, West River drains a 34.494 square mile area in the towns of Prospect, Bethany, Woodbridge, Hamden, West Haven, and New Haven, Connecticut.

Naugatuck River

While about half of the land area in Prospect drains into the Naugatuck River, only a small portion (11.03 acres, 0.02 square miles) drains directly to the Naugatuck River. This area is in the northwestern part of the town near Clark Hill Road, comprises 0.12% of the land area in Prospect, and drains into Hills Pond Number 2 in Waterbury. The outflow from this impoundment drains through an unnamed stream to Hills Pond Number 1, and outflow from this pond empties into Hopeville Pond Brook. The total drainage area of Hopeville Pond Brook is 1.39 square miles, and most of this brook is in urban Waterbury.

The Naugatuck River originates near Torrington, Connecticut, and winds south almost 40 miles to meet the Housatonic River in Derby, giving it a total basin area of 311.16 square miles. It is the only major river in Connecticut whose headwaters are also within the boundaries of the state. The Naugatuck River is well-known for its many defunct dams, many of which have been removed or improved for fish passage.

Beaver Pond Brook

The northern section of Prospect (1.73 square miles) lies in the drainage basin of Beaver Pond Brook. This area comprises only 11.98% of the land area of Prospect, and is largely undeveloped with some residential land use. The drainage area within Prospect drains into one of three places: An unnamed brook in the eastern part of the basin that is a tributary of Beaver Pond Brook in Waterbury, the Waterbury / Prospect Reservoir (the source of Turkey Hill Brook), or into East Mountain Reservoir and eventually into East Mountain Brook in Waterbury. Both reservoirs listed above are impounded.

Beaver Pond Brook has its headwaters in a swamp near Milloy Road in the southwestern corner of Cheshire. It flows in a westerly direction into the southeastern part of Waterbury, being joined by Turkey Hill Brook and East Mountain Brook before intersecting the Mad River at City Mills Ponds (Upper) in Waterbury. The total drainage area of Beaver Pond Brook is 5.58 square miles extends into Wolcott, Cheshire, Prospect, and Waterbury.

Fulling Mill Brook

A large portion of the northwestern side of Prospect (2.40 square miles, 16.60% of Prospect's land area) lies within the Fulling Mill Brook watershed. This brook has its headwaters in central Prospect near Brewster Pond. Fulling Mill Brook begins at the west edge of Brewster Pond at the Salem Road Pond Dam, and flows west across Prospect into Beer Pond. After passing through the Beer Pond Dam, the brook flows west into Naugatuck, Connecticut.

Two unnamed streams drain the northwestern side of Prospect to Reilly Pond just northwest of Beer Pond. The unnamed outlet stream from Reilly Pond flows underneath

Spring Road into Passaro Pond, and outlets west into Naugatuck, joining Fulling Mill Brook near Maple Hill Road. Both Reilly Pond and Passaro Pond are impounded. Fulling Mill Brook drains a total land area of 5.38 square miles before emptying into the Naugatuck River in Naugatuck.

Beacon Hill Brook

The southwestern part of Prospect lies within the Beacon Hill Brook drainage basin. This basin comprises 4.21 square miles and 29.19% of Prospect's land area. Beacon Hill Brook has its headwaters near the Bethany / Prospect Town line near State Route 69. It drains southwest into Bethany, entering the New Naugatuck / Long Hill Reservoir which lies on the Prospect / Bethany town line. This reservoir is impounded and is also fed by two unnamed streams which drain swamps in southern Prospect. Beacon Hill Brook flows west out of the reservoir, joining with an unnamed stream near Route 63 in Bethany, and then flowing into southeastern Naugatuck through the Naugatuck State Forest near Beacon Cap. It is joined by an unnamed stream near Clark Road, and is then joined by Marks Brook west of Horton Hill Road.

Marks Brook drains most of the western side of Prospect, and has its headwaters just south of the intersection of Straitsville Road and Salem Road in central Prospect. It drains southwest into the Old Naugatuck / William Moody Reservoir, which is impounded by the Naugatuck Reservoir Dam. Marks brook continues to flow southwest into the Straitsville Reservoir, which is also impounded, and then flows southwest into Naugatuck to join with Beacon Hill Brook as described above. Beacon Hill Brook continues to flow west through a fairly developed part of Naugatuck, becoming the boundary between the towns of Naugatuck and Beacon Falls, CT before emptying into the Naugatuck River. In total, Beacon Hill Brook drains an area of 10.21 square miles in the towns of Prospect, Bethany, Naugatuck, and Beacon Falls, Connecticut.

## 2.6 Population and Demographic Setting

The total CNV Region population as indicated in the 2010 Census is 287,768 persons. The total land area is 309 square miles, giving a regional population density of 931 persons per square mile. Prospect has a population density of 657 individuals per square mile. By comparison, Waterbury has the highest population density in the region with 3,866 individuals per square mile; Bethlehem has the lowest population density in the region with 186 individuals per square mile (Table 2-2).

**TABLE 2-2**
**Population Density by Municipality, Region, and State, 2000 and 2010**

| Municipality | Land Area (sq. miles) | Population 2000 | Population Density, 2000 | Population, 2010 | Population Density, 2010 |
|---|---|---|---|---|---|
| Beacon Falls | 9.77 | 5,246 | 537 | 6,049 | 619 |
| Bethlehem | 19.36 | 3,422 | 177 | 3,607 | 186 |
| Cheshire | 32.90 | 28,543 | 868 | 29,261 | 889 |
| Middlebury | 17.75 | 6,451 | 363 | 7,575 | 427 |
| Naugatuck | 16.39 | 30,989 | 1,891 | 31,862 | 1,944 |
| Oxford | 32.88 | 9,821 | 299 | 12,683 | 386 |
| Prospect | 14.32 | 8,707 | 608 | 9,405 | 657 |
| Southbury | 39.05 | 18,567 | 475 | 19,904 | 510 |
| Thomaston | 12.01 | 7,503 | 625 | 7,887 | 657 |
| Waterbury | 28.55 | 107,271 | 3,757 | 110,366 | 3,866 |
| Watertown | 29.15 | 21,661 | 743 | 22,514 | 772 |
| Wolcott | 20.43 | 15,215 | 745 | 16,680 | 816 |
| Woodbury | 36.46 | 9,198 | 252 | 9,975 | 274 |
| CNV Region | 309.02 | 272,594 | 882 | 287,768 | 931 |
| Connecticut | 4844.80 | 3,405,565 | 703 | 3,574,097 | 738 |

*Source: United States Census Bureau, 2000 Census of Population and Housing, Summary File 1; Census 2010, Profile of General Population and Housing Characteristics*

Prospect is 103rd out of 169 municipalities in Connecticut in terms of population, with an estimated population of 8,707 in 2000. The town is the 69th most densely populated municipality in the state.

According the 2000 Census of Population and Housing from the United States Census Bureau, the median value of owner-occupied housing in the Town of Prospect was $180,700, which is higher than the statewide median value of $166,900.

Prospect was incorporated in 1827 as a combination of adjacent portions of Waterbury and Cheshire. Historically an agricultural town, Prospect developed limited industrial capacity in the second half of the 19th century. Manufacturing facilities employing water power were concentrated in the Rag Hollow area of town near the Cheshire border. Other manufacturing facilities were dispersed throughout the town. The manufacturing of matches was a prevalent industry in Prospect. By the turn of the century, most manufacturing had relocated to industrial centers in Waterbury, Naugatuck or Cheshire, and many residents resumed agricultural activities, primarily dairy and egg production. Prospect experienced dramatic residential development in the mid-20th century, growing by 50% from 1960-70. Growth dropped to 4% from 1970-80 and rose again to 12% from 1990-2000. Between 2000 and 2010 growth continued to rise to 8%.

Prospect has populations of people who are elderly, linguistically isolated, and/or disabled. These are depicted by census block on Figures 2-6, 2-7, and 2-8. The populations with these characteristics have numerous implications for hazard mitigation,

as they may require special assistance or different means of notification before disasters occur. These will be addressed as needed in subsequent sections.

## 2.7 Governmental Structure

The Town of Prospect is governed by a Mayor-Council form of government. The Town Council serves as the legislative body of the Town, responsible for policy, ordinances, and the general operating and capital budgets. In addition to the Town Council and the Mayor, there are boards, commissions and committees providing input and direction to Town Council and Town administrators. Also, there are Town departments providing municipal services and day-to-day administration. Many of these commissions and departments play a role in hazard mitigation, including the Planning and Zoning Commission, the Zoning Board of Appeals, the Inland-Wetlands Commission, the Building Inspector, the Civil Preparedness Director and Advisory Board, and the Fire Department.

Complaints related to Town maintenance issues are logged by the Office of the Mayor and reviewed monthly. These complaints are usually received via phone, fax, mail, or email and are recorded using standardized paper forms. The complaints are investigated as necessary until remediation surrounding the individual complaint is concluded.

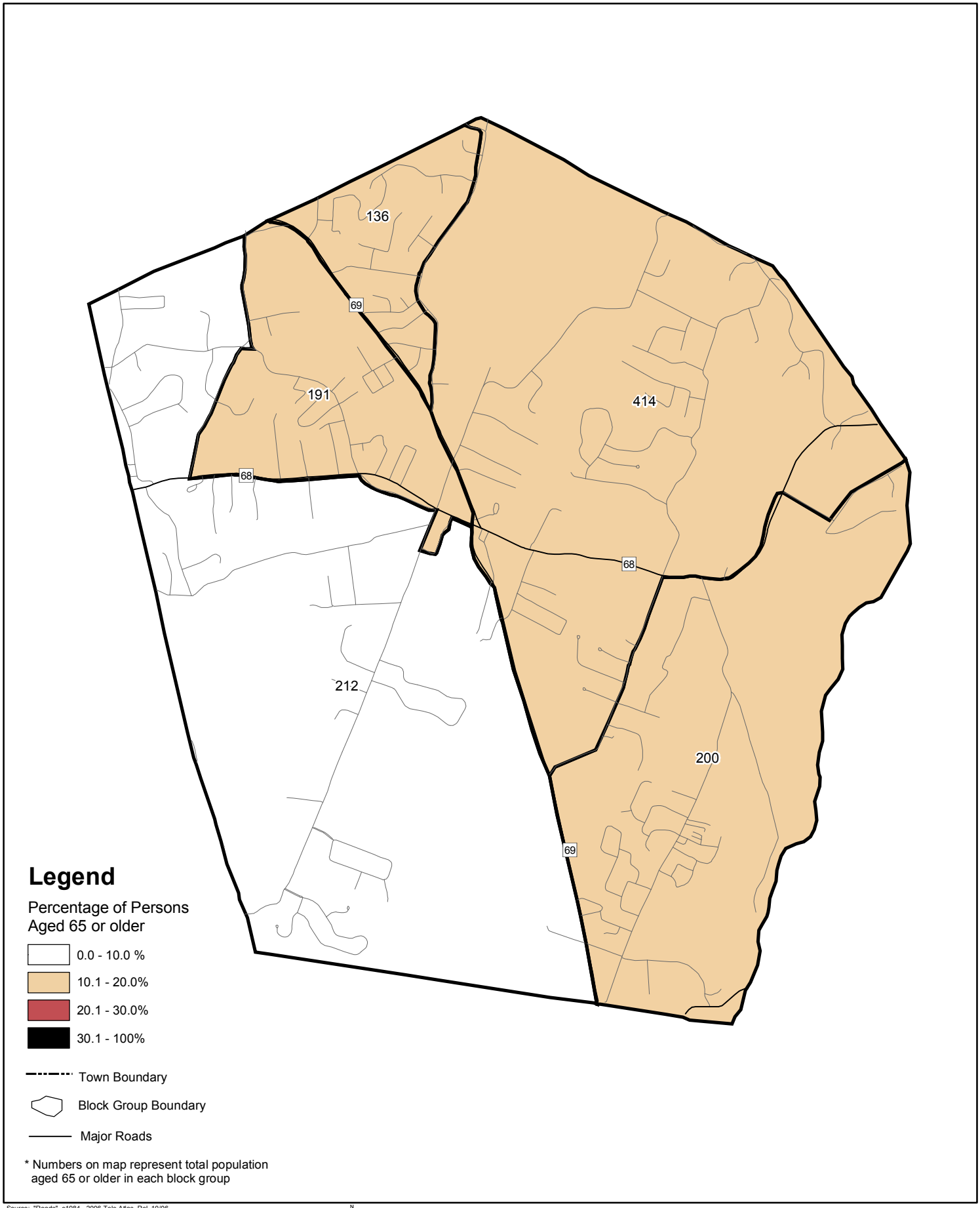
## 2.8 Development Trends

Based on the Town's 2002 Plan of Conservation and Development (POCD), the top priorities of the Town include preservation of the Town's historic character and aesthetic and environmental qualities, as well as maintenance of public and private open spaces. Residential development is expected to consist primarily of low-density single-family housing.

Residential development has slowed in recent years. From 1996-2005, an average of about 43 single-family permits were issued on an annual basis. The desired type of commercial development in Prospect is small, neighborhood-scale retail and service locations.

Subdivisions featuring cul-de-sacs offer only a single access point for emergency services, lengthening emergency response times and rendering those residential areas vulnerable if access is cut off by flooding or downed tree limbs. In Prospect, cul-de-sacs in new developments are discouraged and connectivity of roads is encouraged. Cul-de-sacs in Prospect must be a minimum of 60' wide at the end. A cul-de-sac must be able to allow a school bus to turn around without it backing up. A maximum of 20 houses are allowed on dead-end streets, and a 50' town right of way must be included at the end. New roads that are not dead ends must be a minimum of 30' wide.

# Figure 2-6: Prospect Elderly Population



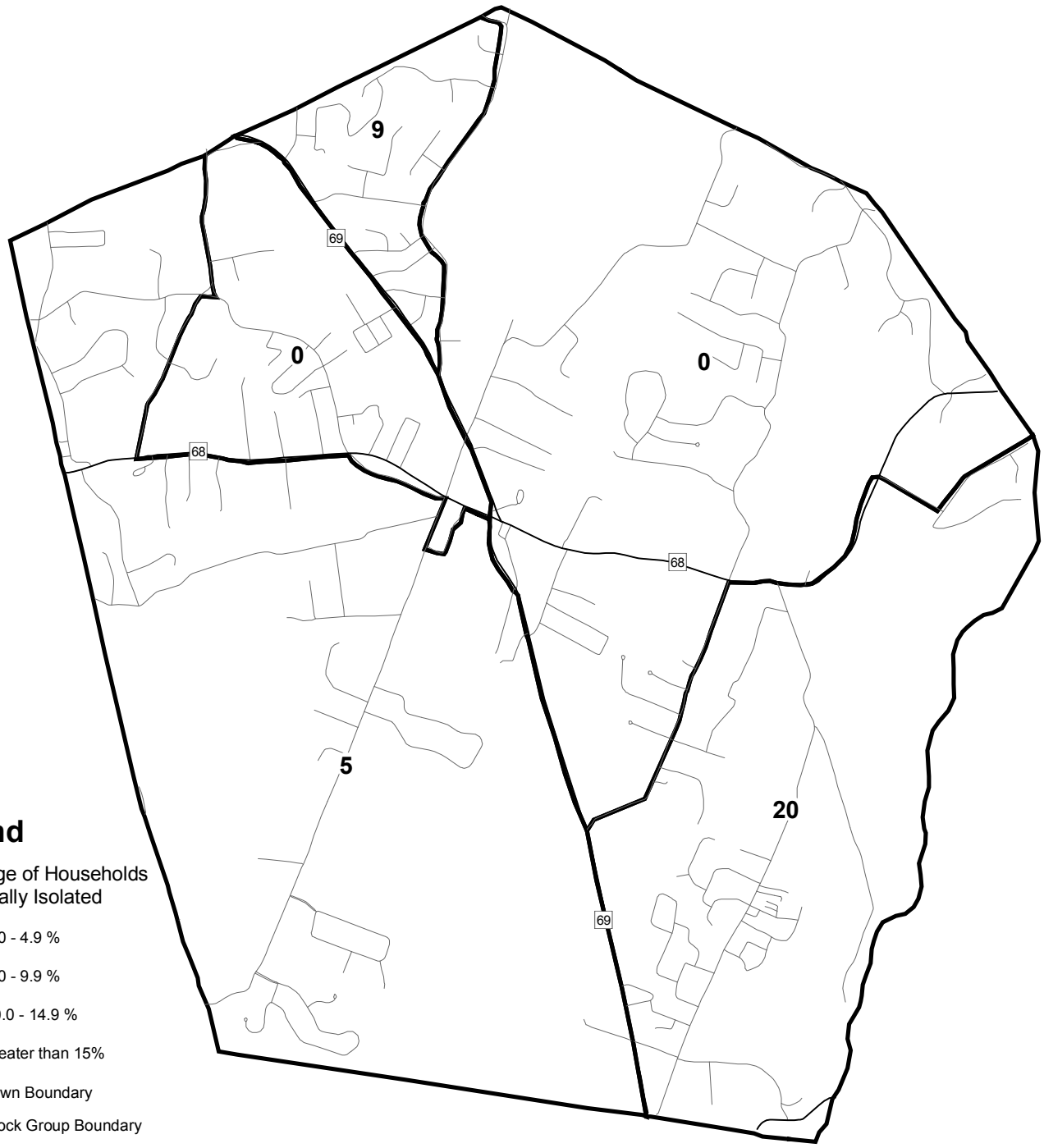

Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10/06.
"Town Boundary", DEP
"Age", "Block Groups", 2000 Census
For general planning purposes only. Delineations may not be exact.
October 2007

N W E S

0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

# Figure 2-7: Prospect Linguistically Isolated Households




## Legend

Percentage of Households Linguistically Isolated

- 0.0 - 4.9 %
- 5.0 - 9.9 %
- 10.0 - 14.9 %
- greater than 15%
- Town Boundary
- Block Group Boundary
- Major Roads

Data based on block group geography.
A linguistically isolated household is one in which no member 14 years old and over (1) speaks only English or (2) speaks a non-English language and speaks English "very well." In other words, all members 14 years old and over have at least some difficulty with English.

* Numbers on map represent total households that are linguistically isolated in each block group

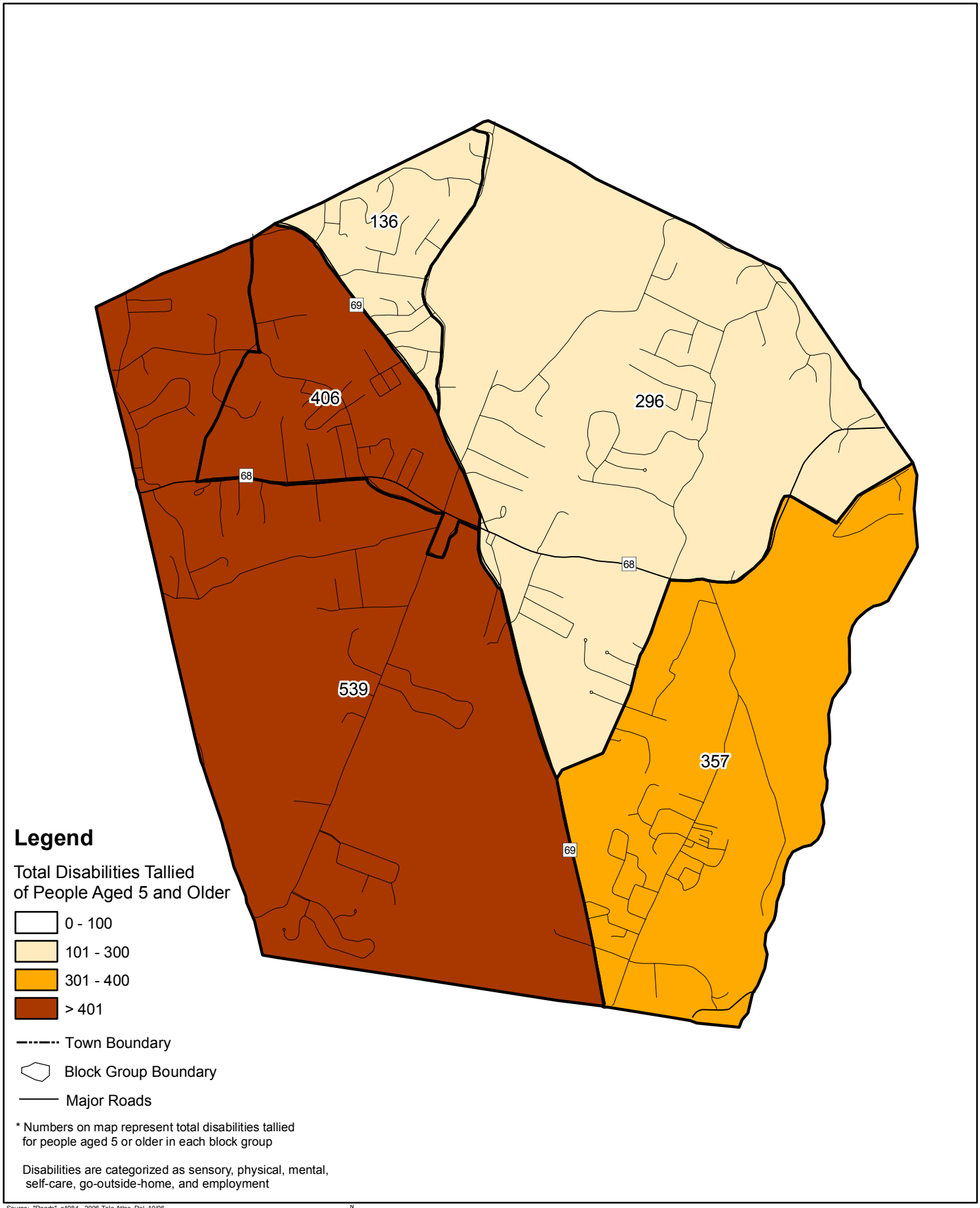
Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10/06.
"Town Boundary", DEP
"Linguistically Isolated", "Block Groups", 2000 Census
For general planning purposes only. Delineations may not be exact.
October 2007

N W E S

0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

# Figure 2-8: Prospect Disabilities Map



The Town of Prospect has been extremely proactive in its hazard mitigation efforts since 1983 and has been successful in convincing landowners and developers to make improvements in an effort to mitigate damage from natural hazards. For example, subdivisions must use oversized pipes and box culverts for drainage, and no twin culverts are allowed. In addition, utilities serving new developments must be installed underground; exceptions due to shallow bedrock are granted on a case-by-case basis.

In the five years since the adoption of the first HMP, a moderate amount of development has continued in Prospect such as:

- A portion of the Scott Road corridor was zoned for a Commerce Park (CP) designation. After the adoption, the CP regulation was amended to allow age restricted housing as a Special Permit. This resulted in the construction of an age restricted development by Toll Brothers. "Regency at Prospect" by Toll Brothers is a 55 and over adult community being constructed at the present time. Once completed, the development will consist of 366 units. Connecticut Water Company provides water to the development and Yankee Gas has extended lines from Waterbury. In addition, sanitary sewer is directed to the City of Waterbury. Town officials have indicated that no wetland encroachments have been needed during the project.
- A bank and a banquet facility have been constructed near the Waterbury town line.
- A new elementary school (Prospect Elementary) is in the final design stages and will be constructed at 75 New Haven Road. The Environmental Protection Agency (EPA) provided funding to extend the water mains to the site, which was completed in August 2013.
- Six new dead end streets have been constructed and 25% of the homes have been built. Three of the streets have tanks with dry hydrants and three have no fire protection at this time.

The Town of Prospect has continued to ensure that these new developments have been sited and approved with minimal risk from natural hazards.

The Town of Prospect updated its POCD in 2013 with an effective date of February 1, 2014. The updated POCD presented potential residential and non-residential build-out as follows:

- Residential: existing zoning requirements were applied to arrive at a residential potential development estimate of 822 units in the R-1 District and 36 units in the R-2 District for a total of 858 units.
- Non-residential: this calculation uses the 35% building coverage with a single-story building. This results in a potential floor area of 128,038 square feet in the B District, 1,042,962 square feet in the Ind-1 District, and 900,087 square feet in the Ind-2 District for a total of 2,071,087 square feet.

Although full build-out is not anticipated, the Town of Prospect will continue to ensure that new developments have been sited and approved with minimal risk from natural

hazards. In particular, according to the updated POCD, the Planning and Zoning Commission "proposes to adjust land use policies and development standards to influence the build-out potential downwards consistent with environmental conservation concerns and the desired community character."

## 2.9 Critical Facilities and Sheltering Capacity

The Town considers its police, fire, governmental, and major transportation facilities to be its most important critical facilities, for these are needed to ensure that emergencies are addressed while day-to-day management of Prospect continues. Convalescent homes and the mobile home park are included with critical facilities, as these house populations of individuals that would require special assistance during an emergency. Educational institutions are often included in critical facilities as well, as these are often used as shelters.

A list of critical facilities is provided in Table 2-3. Shelters, communications, transportation, public water, and sanitary sewer facilities are described in more detail below.

**TABLE 2-3**
**Critical Facilities in Prospect**

| Type | Name | Address | Located in SFHA? |
|---|---|---|---|
| Fire Dept | Prospect Fire Dept (designated shelter) | 26 New Haven Rd | No |
| Library | Prospect Library | 17 Center St | No |
| Mobile Home Park | Harmony Acres | Cook Road | No |
| Nursing Home | Marathon Health Center | 25 Royal Crest Drive | No |
| Police Station | Prospect Police Dept | 8 Center St | No |
| School | Algonquin School | 30 Coer Road | No |
| School | Long River Middle School | 38 Columbia Ave | No |
| School | Prospect Community Elementary School | 12 Center St | No |
| Town Office | Prospect Town Offices | 36 Center St | No |
| Town Office | Prospect Senior Center (designated shelter) | 6 Center Street | No |
| Public Works | Town Garage | 221 Cheshire Road | No |

Shelters

Emergency shelters are considered to be an important subset of critical facilities, as they are needed most in emergency situations. The Fire Department on New Haven Road is the designated emergency shelters for the Town of Prospect. The Senior Center on Center Street is designated as a warming center. Both facilities have auxiliary generators for

emergency power and both are readily accessible from the center of town. The Fire Department facility has an overall capacity of approximately 300, and the Senior Center has an overall capacity of about 175. Both facilities have working kitchens. The Town Offices building can also be considered for sheltering purposes on an as-needed basis.

These buildings have been designated as public shelter facilities by meeting specific ARC guidelines. Amenities and operating costs of the designated shelters including expenses for food, cooking equipment, emergency power services, bedding, etc., are the responsibilities of the community and generally are not paid for by the ARC. The police and fire departments staff the shelters. Other municipal buildings, such as the Public Works garage, are not considered to be shelters but can serve as important emergency supply distribution centers. This facility does not currently have a generator and the town is interested in pursuing an HMGP grant to obtain standby power.

In case of an extended power outage, it is anticipated that 10-20% of the population would relocate, although not all of those relocating would necessarily utilize the shelter facilities. Many communities only intend to use these facilities on a temporary basis for providing shelter until hazards such as hurricanes diminish. Regionally-located mass care facilities operated and paid for by the American Red Cross may be available during recovery operations when additional sheltering services are necessary.

Town officials have also indicated that the Community School on Center Street may be purchased from the Regional School District #16 in the future. If purchased, the school will be converted to a community center and will also become a town shelter.

Communications

It is important to note that effective January 1, 2008, the Town of Prospect was in the southeast corner of Region 5 of the Connecticut Emergency Medical Service regions. Thus, it is important that Prospect institute emergency notification systems compatible with those of Region 5 and Region 2 to the east and south. Region 5 will contain most of the COGCNV municipalities.

When the first HMP was developed, COGCNV was investigating the possibilities of instituting an emergency notification system in the area to further enhance emergency response. Prospect now subscribes to the CodeRED notification system.

Transportation

The Town of Prospect has no hospitals or medical centers; instead, most residents use the facilities in nearby Waterbury. As a means of accessing these facilities or evacuating the area, Prospect has convenient access on two state routes that function as major transportation arteries. Route 69, which runs north-south through the center of Prospect, provides access to Waterbury to the north and Bethany towards the south. Route 68 runs east-west through the center of Prospect and provides access to Naugatuck to the west

and Cheshire to the east. Although there are no interstate highways within the town, I-84 can be accessed via Route 69 in Waterbury - located about four miles from the Town center - or via Route 68 east to Route 70 west in Cheshire. Route 8, a major north-south transportation artery in the CNV region, can be accessed via Route 68 west approximately four miles west from the Town center.

Public Water System

Water service is a critical component of hazard mitigation, especially in regards to fighting wildfires. It is also necessary for everyday residential, commercial, and industrial use. The Town of Prospect has been encouraging the extension of public water mains as a part of new subdivisions. This is discussed further in Section 9.0.

Sanitary Sewer System

The Town's municipal sewer system is an often overlooked critical facility. While most of the municipal sewer lines are gravity-driven, there are areas of the Town that require pumping stations to deliver sewerage from local sewer lines to the municipal sewer system. Such stations that do not have emergency power generation present additional problems for residents during extended power outages, such as at Boulder Brook Court. This is discussed in more detail in Section 6.5.

# 3.0 FLOODING

## 3.1 Setting

According to FEMA, most municipalities in the United States have at least one clearly recognizable flood-prone area around a river, stream, or large body of water. These areas are outlined as Special Flood Hazard Areas (SFHA) and delineated as part of the National Flood Insurance Program (NFIP). Flood-prone 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 include ponding, poor drainage, inadequate storm sewers, clogged culverts or catch basins, sheet flow, obstructed drainageways, sewer backup, or overbank flooding from small streams.

In general, flooding affects a small area of Prospect with moderate to frequent regularity. The primary drainage basins in Prospect are the Ten Mile River, Beacon Hill Brook, Fulling Mill Brook, Beaver Pond Brook, and Willow Brook. A thorough discussion of these drainage areas is included in Section 2.5. Only a few areas are impacted by overflow from the major river and brook systems with moderate regularity, but these areas are generally limited to areas adjacent to the rivers. Localized nuisance flooding along tributaries is a more common problem resulting from inadequate drainage and other factors. The frequency of flooding in Prospect is considered likely to highly likely depending on the source of the flooding, but damage from flooding is only limited or infrequent.

## 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 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; and
  - 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 100-year 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 (previously known as the "100-year" 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 the 1% annual chance floodplain has a 26% change of suffering flood damage during the term of a 30-year mortgage. The 0.2% annual chance floodplain (previously known as the "500-year" floodplain) indicates areas of moderate flood hazard.

Prospect has consistently participated in the NFIP since 1977 and plans to continue participating. SFHAs in Prospect are delineated on Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS). These maps demonstrate areas within Prospect that

are vulnerable to flooding. The FIRMs were published on February 4, 1977 and updated on May 16, 1995. The FIS was originally published on May 16, 1995.

FEMA commenced the Flood Map Modernization program for New Haven County, Connecticut in August 2007 when the initial HMP was under development. The "Map Mod" program enabled a more accurate representation of SFHAs in Prospect. The current New Haven County FIS and FIRM panels were effective December 17, 2010. This HMP update is the first to be developed subsequent to the effective date of the current FIS and FIRM panels.

Refer to Figure 3-1 for the areas of Prospect susceptible to flooding based on FEMA flood zones. Table 3-1 describes the various zones depicted on the FIRM panels for Prospect.

**TABLE 3-1**
**FIRM Zone Descriptions**

| Zone | Description |
|---|---|
| A | An area inundated by 100-year flooding, for which no base flood elevations (BFEs) have been determined. |
| AE | An area inundated by 100-year flooding, for which BFEs have been determined. |
| Area Not Included | An area that is located within a community or county that is not mapped on any published FIRM. |
| X | An area that is determined to be outside the 100- and 500-year floodplains. |
| X500 | An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from 100-year flooding. |

In some areas of Prospect, flooding occurs from heavy rains with a much higher frequency than those mapped by FEMA. This nuisance flooding occurs from heavy rains with a much higher frequency than 100-year and 500-year events, 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. These areas are discussed in Sections 3.3 and 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 500-year flood event on a tributary may only contribute to a 50-year flood event downstream. This is due to the distribution of rainfall and the greater hydraulic capacity of the downstream channel to convey floodwaters. For example, while the 1955 floods (See Section 3.3 below) have been estimated to be a 50- to 500-year flood across all streams in Connecticut, the floods were less than 10-year flood events on the Quinnipiac River in Wallingford. Dams and other flood control

structures can also reduce the magnitude of peak flood flows, as occurs on the Naugatuck River, the Quinnipiac River, and their tributaries.

The recurrence interval level of a precipitation event also generally differs from the recurrence interval level of the associated flood. For example, on April 16, 1996, six inches of rain fell in 18 hours in New Haven County. This was classified as a greater than 50-year frequency storm, but caused an approximately 25-year flood event on the Quinnipiac River in Wallingford. According to the National Climatic Data Center (NCDC), this flood event caused $1.5 million in property damage in New Haven County.

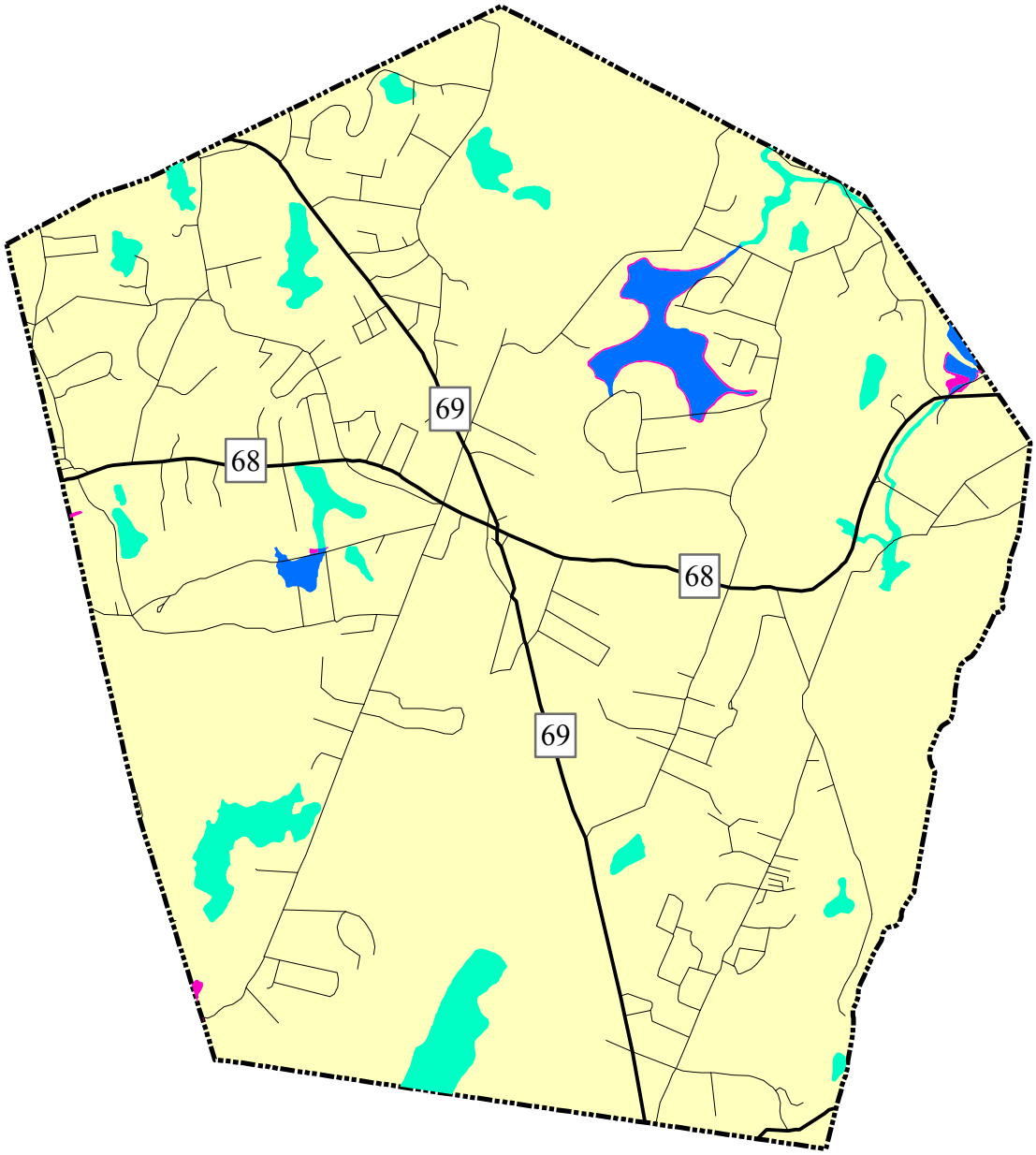
Another example would be of tropical storm Floyd in 1999, which caused rainfall on the order of a 250-year event while flood frequencies were less than a 10-year event on the Quinnipiac River in Wallingford. Flood events can also be mitigated or exacerbated by in-channel and soil conditions, such as low or high flows, or a deep or shallow water table, as can be seen in the following historic record.

## 3.3 Historic Record

In every season of the year throughout its recorded history, the Town of Prospect has experienced various degrees of flooding. Melting snow combined with early spring rains have 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.

Major historic floods have occurred in Prospect in March 1936, January and September 1938, January 1949, and August and October 1955. In terms of damage to the Town of Prospect, the most severe of these was damage associated with the September 1938 hurricane and flood.

The flood of record at the USGS gauge on the Quinnipiac River in Wallingford was recorded on June 6, 1982, when the instantaneous discharge reached 8,200 cubic feet per second. This exceeded the 500-year flood for the area. This is the flood of record for many waterways in the Prospect area and was calculated to have a recurrence interval ranging from 100 to 500 years on streams in Prospect. The rainfall gauge in South Cheshire recorded a 4-day rainfall of 13.0 inches from June 4 to June 7, and the runoff from this non-tropical storm was compounded by the heavy rains that had fallen the previous week. The damage of this storm event prompted a massive reconstruction effort of the Town's drainage system.




**Legend**

- Prospect Boundary
- State Routes
- Local Roads

**Flood Zones**

- 1% Annual Chance of Flooding w/o Elevations
- 1% Annual Chance of Flooding with Elevations
- 0.2% Annual Chance of Flooding

**SOURCE(S):**
"Town Boundary", "State Routes", "Streets" CT DEEP, FEMA Flood Zones DFRIM 2010

**Figure 3-1: FEMA Flood Zones in Prospect**

**LOCATION:**
**Prospect, CT**

N

**Prospect Natural Hazard Mitigation Plan Update**

**MXD:** P:\1014-49\Design\GIS\Maps\Prospect\2013_Figure3-1FEMAFlood.mxd

**Map By:** JDW
**MMI#:** 1014-49
**Original:** 07/05/2013
**Revision:** 7/25/2013
**Scale:** 1 inch = 0.75 mile

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The following are descriptions of additional, more recent examples of floods in and around the Town of Prospect as described in the NCDC Storm Events Database, and based on correspondence with municipal officials.

- September 16, 1999: Torrential record rainfall (five to ten inches) produced by Tropical Storm Floyd caused widespread urban, small stream, and river flooding. Fairfield County was declared a disaster area, along with Litchfield and Hartford Counties. Initial cost estimates for damages to the public sector was $1.5 million for those three counties. These estimates do not account for damages to the private sector and are based on information provided by the Connecticut Office of Emergency Management. Serious wide-spread flooding of low-lying and poor drainage areas resulted in the closure of many roads and basement flooding across Fairfield, New Haven, and Middlesex Counties.

- October 2005: Although the consistent rainfall of October 7-15, 2005 caused flooding and dam failures in most of Connecticut (most severely in northern Connecticut), the precipitation intensity and duration was such that only minor flooding occurred in Prospect. Town personnel reported that no roads needed to be closed during this extended rain event.

- April 22-23, 2006: A sustained heavy rainfall caused streams to overtop their banks and drainage systems to fail throughout New Haven County. Rainfall amounts of approximately five inches occurred in nearby Cheshire, and stream stages were believed to approximate the ten-year recurrence interval.

- June 2, 2006: Torrential rainfall from slow-moving thunderstorms caused flash flooding across parts of northern New Haven County during the late afternoon and early evening. Up to eight inches of rainfall in three hours was recorded in northwestern Prospect, causing Raudis Pond to overtop Clark Hill Road. Town personnel reported that this pond had not flooded the road in over 50 years. The 36-inch pipes downstream of Raudis Pond near the intersection of Route 68 and Clark Hill Road backed up and water flooded the road to a depth greater than the top of the nearby fire hydrant. Firefighters rescued two people from two vehicles that became stuck in the flood. Marks Brook also washed out part of Straitsville Road in southwestern Prospect. This storm caused an estimated four million dollars in damage to nearby Waterbury.

- May 27, 2008: Strong thunderstorms in advance of a cold front crossed the tri-state area on May 27th producing isolated flash flooding in New Haven County. In nearby Waterbury, a newly renovated Burger King was flooded on Thomaston Avenue causing $600,000 in property damage.

- August 29, 2011: Tropical Storm Irene produced heavy rainfall between five and 10 inches within a 12-hour period. The rainfall resulted in widespread flash flooding and

river flooding across the northwest part of New Haven County, and a major disaster declaration was declared (FEMA-4023-DR).

In Prospect, Tropical Storm Irene caused power outages that lasted approximately three days. Flooding on Putting Green Lane occurred due to a culvert that washed out and twin pipes that were clogged. Currently, there is no culvert at this location and the town anticipates replacing the pipes with a box culvert within the next ten years. Less than $50,000 in FEMA reimbursements were requested following this storm.

Flooding due to inadequate drainage is a minor problem in the Town of Prospect due to the use of oversized culverts and drainage systems, but some areas of flood risk still remain.

## 3.4 Existing Capabilities

The Town of Prospect has in place a number of measures to prevent flood damage. These include regulations, codes, and ordinances preventing encroachment and development near floodways.

The Prospect Zoning Regulations were most recently revised to August 1, 2011. Section 4.13 addresses floodplains and flood damage prevention, and references the FIS and FIRM that were effective on December 17, 2010. This is essentially the local articulation of the NFIP regulations. Section 4.13.6 provides specific standards. New or substantially improved residential and nonresidential structures must be elevated to or above the base flood elevation; freeboard is not required in Prospect. Other sections of interest include:

- Section 4.13.3 explains that a Special Permit is required by the Planning and Zoning Commission for all development within the Flood Hazard Area prior to the commencement of any development activities.

- Section 4.13.5.8 addresses compensatory storage and states that the water holding capacity of the floodplain, except those areas which are tidally influenced, shall not be reduced. Any reduction caused by filling, new construction or substantial improvements involving an increase in footprint to the structure, shall be compensated for by deepening and/or widening of the floodplain.

- Section 4.13.5.9 addresses equal conveyance and states that within the floodplain, encroachments resulting from filling, new construction or substantial improvements involving an increase in footprint of the structure are prohibited unless the applicant provides certification by a registered professional engineer demonstrating that such encroachments shall not result in any (0.00 feet) increase in flood levels.

The Prospect Subdivision Regulations were most recently revised to March 1, 2013. Subsection 5 of these regulations notes that no existing watercourse may be altered or

relocated except where channel alterations area necessary for protective flood control or proper road design. Subsection 26 of these regulations note that all subdivision proposals must be consistent with the need to minimize flood damage; all public utilities serving subdivisions must be constructed and located to minimize flood damage; all subdivision proposals must have adequate drainage provided to reduce exposure to flood hazards; and all subdivision proposals must show base flood elevation and boundaries in Zone A Flood Hazard Areas.

In summary, developments in floodplains are regulated during the zoning and land subdivision application processes.

Other regulations, codes, and ordinances that apply to flood hazard mitigation include:

- ***Earth Excavation Standards*** (Section 3.7.6 of Prospect Zoning Regulations). This regulates excavation and fill that occurs in floodplains.
- ***Planned Congregate Elderly Housing*** (Section 4.2 of Prospect Zoning Regulations). Subsection 2.3.8 outlines that drainage systems in such developments will be designed to avoid downstream flooding.
- ***Earth Excavation, Deposition, and Re-grading Standards*** (Section 4.11.3 of Prospect Zoning Regulations). This section notes that no excavation, deposition, and re-grading shall be made that would reduce the final elevation below floodplain, change the area of the floodplain, or expose groundwater unless it is determined that no pollution or silting of existing watercourses will result and any necessary permits have been obtained from the Prospect Inland Wetlands Commission.
- ***Site Plan Elements*** (Section 11.5 of Prospect Zoning Regulations). These regulations note that site plans must show specifications and materials proposed for flood-proofing, where applicable, and the location of the regulatory flood protection elevation, established wetland boundaries and boundaries of other flood-prone areas.
- ***General Regulations*** (Section IV of Prospect Subdivision Regulations).
- ***Inland Wetlands and Watercourses Regulations***. This document defines in detail the Town of Prospect's regulations regarding development near wetlands, watercourses, and water bodies that are sometimes coincident with flood management zones.

In terms of new developments, the Town of Prospect primarily mitigates flood damage and flood hazards by restricting building activities inside flood-prone areas. All existing watercourses are to be impacted minimally or not at all while maintaining the existing flood carrying capacity. These regulations rely primarily on the FEMA defined 100-year flood elevations to determine flood areas.

The Town of Prospect uses the 100-year flood delineations from the FIRM and FIS delineated by FEMA as the official maps and report for determining special flood hazard areas. Except for certain agricultural and open space uses, a special permit must be issued for any development located in flood hazard areas. No fill or encroachment is permitted in the floodway which would impair its ability to convey floodwaters unless

such activity is fully offset by stream improvements. Special permit uses include public and private beaches, docks, boat launching areas, and golf courses, provided no accessory uses except for sanitary facilities are located in the flood hazard area. Permeable surfaces must be used for all parking areas in flood hazard areas.

There are also provisions for public service corporation use and municipal land use, and for single family lots which are partially within the flood hazard area. The lowest floor of all dwellings and subsurface sewage disposal facilities must be elevated to above the 100-year flood elevation and drainage from such facilities must be away from the flood hazard area. The Prospect Inland Wetlands Commission also reviews new developments and existing land uses on and near wetlands and watercourses.

**The Town of Prospect is a member of the Connecticut Association of Flood Managers (CAFM) and as such, receives quarterly newsletters and notification about special trainings and conferences. This membership will enhance the town's capabilities with regard to flood management.**

Public Works and Drainage

The Prospect Department of Public Works is in charge of the maintenance of the Town's drainage systems, and performs clearing of bridges and culverts and other maintenance as needed. The Town currently has a Storm Water Management Program in accordance with the National Pollution Discharge Elimination System (NPDES) storm water regulations and the Connecticut DEP Phase II Storm Water Program. The Town policy since the 1982 flood event and following a 1983 drainage study is to oversize all culverts and bridges in order to pass greater storm events than projects require. This policy has greatly reduced the occurrence of flooding throughout the Town.

Natural Resource Protection

The Prospect POCD (2002) summarized several goals used by the Town in approving changes in land use. The following guidelines all promote flood hazard mitigation:

- Continue to regulate designated inland wetlands and waterways to prevent their filling or degradation;
- Monitor the potential disposition or reuse of water supply lands and advocate their maintenance as public or utility company lands, and cooperate with land trusts and other advocacy groups to maintain these areas as woodlands;
- Review and revise the zoning ordinance to increase the minimum lot size on undeveloped lands within a public water supply watershed to two acres;
- Ensure stormwater management practices in new developments that include minimizing the use of impervious surfaces and encourage infiltration as a means to control run-off;
- Continue requirement of Soil Erosion and Sedimentation Plans; and

- Continue restriction of development within floodplains and flood hazard areas as identified by the FEMA mapping.

The updated POCD (2014) lists the same types of guidelines and objectives, and is therefore consistent with this hazard mitigation plan. The updated POCD became effective on February 1, 2014. In particular, Goal #6 of the updated POCD is *"Protection of Steep Slopes, Inland Wetlands & Floodplains: Certain topographic features present severe limitations on the suitability of sites for urban development. Steep slopes, inland wetlands and floodplains should be avoided as development locations."*

The three recommended actions for this goal are:

- "Continue to regulate inland wetlands and waterways to prevent their filling and degradation;
- Continue requirement of Soil Erosion and Sedimentation Plans; and
- Continue restriction of development within floodplains and flood hazard areas as identified by FEMA mapping."

The updated POCD also supports the town's Open Space Plan that was adopted in 2010.

Structural and Other Projects

Structural flood protection measures existing in Prospect include oversized culverts and the absence of headwalls. All new subdivisions must use box culverts, as twin culverts are no longer allowed. According to the Town of Prospect FIS, there are no major structural flood protection measures existing in Prospect, and none are planned for the future.

Emergency Operations Plan

The Town of Prospect Emergency Operations Plan notes that floods can occur during any season of the year and that a stock of sandbags is kept by the Town as a mitigation measure. The plan outlines steps to be taken by Town personnel to mitigate further flood damage and conduct recovery operations. This plan also covers any other disasters which may affect the Town of Prospect.

Warnings and Communications

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. The Town of Prospect can access the National Weather Service

website at http://weather.noaa.gov/ to obtain the latest flood watches and warnings before and during precipitation events.

In summary, many of Prospect's capabilities to mitigate for flooding and prevent loss of life and property not significantly changed since the initial hazard mitigation plan was adopted. However, the Zoning and Subdivision regulations were recently revised and updated.

## 3.5 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to flooding within the Town. Major land use classes and critical facilities within these areas are identified. According to the FEMA FIRMs, 411 acres of land in Prospect are located within the 100-year flood boundary. In addition, indirect flooding occurs near streams and rivers throughout Prospect due to inadequate drainage and other factors. Specific areas susceptible to flooding were identified by Town personnel and observed by Milone & MacBroom, Inc. staff during a field visit on June 28, 2006. According to records provided by the Connecticut DEEP, repetitive loss properties and severe repetitive loss properties are not located in Prospect.

The waterways in Prospect are mostly small streams and brooks significant for water supply and conservation purposes, but are not recreational resources. There are no widespread floodplains associated with the relatively small waterways in Prospect. The principal flood hazard zones tend to be associated with wetlands and water bodies at headwater locations. Despite the Town policy of over-sizing drainage culverts, there are still some areas of Town prone to roadway flooding. These areas are described below.

Gramar Avenue – Currently, Gramar Avenue is reportedly the most persistent problem in town. Oxford General Industries is repeatedly flooded. The town plans to install more drainage in the industrial park and will direct water back toward Route 68.

Boulder Brook – A detention basin in a new subdivision was breached during the spring 2006 storms and has since been repaired.

Clark Hill Road – According to Town personnel, the June 2, 2006 storm caused Raudis Pond to overtop Clark Hill Road for the first time in fifty years. The outflow from this pond contributed to flooding downstream at Route 68.

Corrine Drive – Drainage pipes on this road where overwhelmed during the spring 2006 storms due to the channelization of overland flow in ATV paths. The Town plans to perform riprap work on the unnamed streams in the Corinne Drive area and attempt to restrict ATV access to Town property to prevent further erosion.

Plank Road – Three brooks surround the Town landfill in the northeastern part of Prospect and drain to Cheshire. Downstream of the landfill, the streams combine to form Mountain Brook and it continues east towards Plank Road. The culvert for Mountain

Brook under Plank Road is undersized and flooding has impacted nearby septic fields. While the backups have never been severe enough to flood the upstream landfill, the Town plans to increase the culvert size to accommodate higher flows.

Roaring Brook Road – The culvert for Roaring Brook under Roaring Brook Road near Norm's Pony Farm is too small and often floods the road. The Town of Prospect is currently in negotiations to obtain property in the surrounding area to increase the culvert size. This area of Roaring Brook is a protected water company land belonging to the Regional Water Authority.

Route 68 – A culvert flowing under Route 68 between the former Public Works garage and Plank Road is undersized. This tributary to Ten Mile River flows over the road two to three times per year.

Route 68 near Spring Road – The June 2, 2006 storm caused the 36-inch pipe to be overwhelmed and flood Route 68. Town personnel reported that the flooding was deep enough to submerge a nearby fire hydrant. The Town plans to petition the state to increase the size of this culvert to be able to withstand a greater than 100-year flood event.

Salem Road – The 36-inch pipe located approximately 800 feet west of Pondview Drive occasionally backs up due to beavers damming the culvert. The resultant flooding reaches four septic fields near Connecticut Water Company Lands. The Town regularly pulls down the beaver dams (without harming the beavers) to prevent leachate from reaching protected water company lands.

Terry Road – The 15-inch pipe carrying flow from Turkey Hill to the Waterbury Reservoir was overwhelmed in the spring 2006 storms. The Town replaced the 15-inch pipe with a 30-inch pipe set at a lower elevation and set riprap in the surrounding area. The riprap embankment is designed to provide 0.5 acres of additional storage should the 30-inch pipe ever be overwhelmed.

Critical Facilities and Emergency Services

No critical facilities are regularly impacted by flooding in the Town of Prospect. In terms of critical infrastructure, Route 68, a major west-east thoroughfare, and Straitsville Road, a well-utilized southwest to central Prospect thoroughfare, have both been inundated by occasional flooding.

Other Concerns

Town officials have also expressed concerns with the Emerald Ash Borer which according to the Connecticut DEEP "is a small, green beetle that belongs to a large family of

beetles known as the buprestids, or metallic wood boring beetles. Because the larval EAB feeds on the phloem and cambium of the tree, and because its numbers in an area tend to build up rapidly, infestation by EAB usually leads to the death of trees that are infested, often within 2-3 years."

According to a May 31, 2013 article in the Ridgefield Press, "this destructive insect was first detected in Connecticut in the town of Prospect in July 2012 and was subsequently found in eight other towns, all in New Haven County, as part of surveys conducted by Agricultural Experiment Station, The Department of Energy and Environmental Protection (DEEP), and the University of Connecticut Cooperative Extension or from reports by the public."

The other eight towns are Naugatuck, Bethany, Beacon Falls, Waterbury, Cheshire, Oxford, Middlebury, and Hamden. Emerald ash borer has also been identified in Dutchess County, N.Y., Berkshire County, Mass., and Merrimack County, N.H.

Many ash trees are located within the town of Prospect and are therefore, town officials are concerned with potential flooding impacts due to dead Ash trees that may obstruct rivers and drainageways. However, the associated hazards could also include wind damage, as the ash trees are more vulnerable.

### 3.5.1 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.

HAZUS was utilized to perform a basic analysis to generate potential damages in Prospect from a 1% annual chance riverine flood event simultaneously occurring along Fulling Mill Brook, Mountain Brook, and Tenmile River. Hydrology and hydraulics for the streams and rivers were generated using the Flood Information Tool within HAZUS-MH. The data utilized included the New Haven County DFIRM data as well as the Connecticut LiDAR 10-foot Digital Elevation Model based on LiDAR collected in the year 2000. HAZUS-MH output is included in Appendix E. The following paragraphs discuss the results of the HAZUS-MH analysis.

The FEMA default values were used for each of the town's census blocks in the HAZUS simulation. Approximately $756 million of total building replacement value were estimated to exist within the town of Prospect. Of that total, the HAZUS 1% annual chance riverine flood event estimates a total building-related loss of $0.44 million. A summary of the default building values is shown in Table 3-2.

**TABLE 3-2**
***HAZUS-MH* Flood Scenario – Basic Information**

| Occupancy | Dollar Exposure (2006 USD) |
|---|---|
| Residential | $ 592,998,000 |
| Commercial | $ 92,066,000 |
| Other | $ 71,415,000 |
| **Total** | **$ 756,479,000** |

The *HAZUS-MH* simulation estimates that during a 1% annual chance flood event, no buildings will be damaged in the town from flooding. It should be noted *HAZUS* provides only an estimation of losses and may not reflect actual damages.

*HAZUS-MH* utilizes a subset of critical facilities known as "essential facilities" that are important following natural hazard events. These include two schools and one police station. The software noted that under the 1% annual chance flood event, no essential facilities would suffer damage.

The *HAZUS-MH* simulation estimated that a total of 16 tons of debris would be generated by flood damage for the 1% annual chance flood scenario. It is estimated that 1 truckload (at approximately 25 tons per truck) will be required to remove the debris. The debris is may consist of the following:

- Finishes (drywall, insulation, etc.) comprise 12 tons;
- Structural material (wood, brick, etc.) comprise 2 tons;
- Foundation material (concrete slab, concrete block, rebar, etc.) would comprise the remaining 2 tons.
- Tree limbs and debris

*HAZUS-MH* calculated the potential sheltering requirement for the 1% annual chance flood event. The model estimates that 21 households will be displaced due to flooding. Displacement includes households evacuated from within or very near to the inundated areas. Of these households, 27 people are projected to seek temporary shelter in public shelters.

*HAZUS-MH* also calculated the predicted economic losses due to the 1% annual chance flood event. Economic losses are categorized as either building-related losses or 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. 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.

- A total of $0.44 million of building-related losses is expected. Building losses account for the building structure, contents, and inventory. As such, residential losses accounted for a total of $0.37 million, commercial losses totaled $0.04 million, and other (municipal and industrial) losses totaled $0.05 million.

The HAZUS-MH results are generally consistent with conditions in Prospect in that minimal damage is expected during the 1% annual chance flood event. However, it should be noted that impacts from drainage-related flooding problems, which are not addressed by HAZUS, have been identified as having the most impact on flooding in Prospect.

## 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*.

### 3.6.1 Prevention

**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.**

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 ordinances. It also occurs when land is prevented from being developed through the use of conservation easements or conversion of land into open space.

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:

- 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.

**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.**

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.

Reductions in floodplain area can only be accomplished through revised FEMA-sponsored engineering studies or Letters of Map Change (LOMC).

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.

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 of the stream in the lower reaches of the overall watershed, the peak discharge from the site will occur later in the storm event, which will more closely coincide with the peak discharge of the stream, thus adding more flow during the peak discharge during any given storm event. Due to its geography, Waterbury contains a range of upper to lower portions of watersheds.

Developers should be required to demonstrate whether detention or retention will be the best management practice for stormwater at specific sites in regards to the position of each project site in the surrounding watershed.

Drainage System Maintenance: An effective drainage system must be continually maintained to ensure efficiency and functionality. Maintenance should include programs to clean out blockages caused by overgrowth and debris. Culverts should be monitored, and repaired and improved when necessary. The use of Geographic Information System (GIS) technology would greatly aid the identification and location of problem areas.

Education and Awareness: Other prevention techniques include the promotion of awareness of natural hazards among citizens, property owners, developers, and local officials. 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.

The Town of Prospect Inland Wetlands Commission (IWC) administers the wetland regulations and the Prospect Planning and Zoning Commission (PZC) administers the Zoning and Subdivision regulations. The wetlands regulations are not really used to regulate floodplain development; this mainly occurs as part of the PZC review. The Zoning Enforcement Officer is charged with ensuring that development follows the floodplain management regulations.

Based on the above guidelines and the existing roles of the IWC, the PZC, and the Zoning Enforcement Officer, as a *preventive* mitigation measure a checklist could be developed that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to the proposed project. This would streamline the permitting process and ensure maximum education of a developer or applicant. Town officials have indicated that the regulations have been updated and essentially accomplish the same thing.

### 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 repetitive loss properties would provide the greatest benefit to residents 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 that property.

- ***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 100-year flood level. 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 localized property improvements such as barriers, floodwalls, and earthen berms***. Such structural projects can be used to prevent shallow flooding and are described in Section 3.3.6.

- ***Performing structural improvements to 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.

> **<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.**

  - ***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 above the first floor level. If considered, furniture and electrical appliances should be elevated above the 1% annual chance flood elevation.

  - ***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.

All of the above *property protection* mitigation measures may be useful for Town of Prospect residents to prevent damage from flooding.

### 3.6.3 Emergency Services

A pre-disaster 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; and
- Emergency protective measures, such as an Emergency Operations Plan outlining procedures for the mobilization and position of staff, equipment, and resources to facilitate evacuations and emergency flood-water control.
- 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.

Based on the above guidelines, a number of specific proposals for improved *emergency services* are recommended to prevent damage from inland and nuisance flooding. These are common to all hazards in this plan, and are listed in Section 10.1.

### 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.

Based on the above guidelines, a number of specific proposals for improved *public education* are recommended to prevent damage from inland and nuisance flooding. These are common to all hazards in this plan, and are listed in Section 10.1.

### 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. Acquisition of heavily damaged structures (particularly repetitive loss properties) after a flood may be an economical and practical means to accomplish this. 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 flooding include:

- ❑ Pursue additional open space properties in floodplains by purchasing repetitive loss properties and other floodprone structures and converting the parcels to open space;
- ❑ Pursue the acquisition of additional municipal open space properties as discussed in the *Plan of Conservation and Development*;
- ❑ 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 often recommended.

Based on the above guidelines, the following specific *structural* mitigation measures were previously recommended to prevent damage from flooding:

- Continue to restrict vehicular access to Town property to prevent ATV use.
- Increase the size of the Plank Road culvert to prevent the flooding of nearby septic fields.
- Increase the size of the culvert for Roaring Brook on Roaring Brook road. If necessary, consider raising the elevation of the road to accommodate the larger culvert.
- Petition the state to increase the size of the culvert under Route 68 near the Public Works Garage.
- Petition the state to increase the size of the 36-inch culvert under Route 68 near Spring Road to pass a greater than 100-year flood event.
- Perform a Master Drainage Study for the Town, including a full-scale inventory of culvert conditions.
- Institute a comprehensive catch basin maintenance program.
- Continue participating in the Connecticut DEP Stormwater Management Program.
- Continue over-sizing culverts and drainage structures.

## 3.7 Status of Mitigation Strategies and Actions

The proposed mitigation strategies for addressing flooding are listed below with commentary regarding the status of each.

**TABLE 3-3**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| *Prevention* | |
| Streamline the permitting process and ensure maximum education of a developer or applicant. Develop a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to the proposed project. This list could be provided to an applicant at any Town department. | Complete; town regulations have been updated and cover flood damage prevention. |
| Urge or petition FEMA to more critically evaluate Letter of Map Amendment (LOMA) and LOMC applications that are received such that redevelopments do not potentially cause increased flooding to other properties. | This has not been a problem in Prospect and the strategy is hereby removed. |
| Consider joining FEMA's community rating system. | The town is not interested in joining at this time and the action is no longer needed. |
| Continue to require Flood Hazard Area, subdivision, and commercial and industrial zoning permit applications to provide needed flood data. | This is ongoing and the action can be removed because it is a capability. |
| Consider requiring buildings constructed in floodprone areas to be protected to the highest recorded flood level, regardless of being within a defined SFHA. | Applications in flood hazard areas are not common, and the action can be deleted. The normal permitting process is followed. |
| New buildings should be designed and graded to shunt drainage away from the building. | This is part of the building code and can be deleted. |
| When possible, assist with the Map Mod program to ensure an appropriate update to the Flood Insurance Study, Flood Insurance Rate Maps, and Flood Boundary and Floodway Maps. | This is not needed, as Map Mod is complete and the DFIRMs are effective. |
| After Map Mod has been completed, consider restudying local flood prone areas and produce new local-level regulatory floodplain maps using more exacting study techniques, including using more accurate contour information to map flood elevations provided with the FIRM. | Development in areas of flood risk is rare. Furthermore, areas of risk did not appreciably change during the MapMod process. Therefore, this activity would have little benefit and it is not needed. |
| *Property & Natural Resource Protection* | |
| Pursue the acquisition of additional municipal open space properties inside SFHAs and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use. | None acquired to date. Lack of funding and property availability have been barriers to acquisition of open space in SFHAs; strategy is carried forward. |
| Selectively pursue conservation objectives listed in the Plan of Conservation and Development, including the protection of riparian zones. | This is ongoing and the strategy can be removed because it is a capability. |
| Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains. | This is ongoing and the strategy can be removed because it is a capability. |

| Strategy or Action | Status |
|---|---|
| *Structural Projects* | |
| Commission a comprehensive Town-wide stormwater management system study. This study should include a culvert and catch basin maintenance and replacement schedule and include mathematical models that developers can use to compare existing to proposed conditions. Update this Study with a minimum frequency of every five years. | Drainage problems in the town are understood but located in several different locations, so a town-wide study would not be helpful at this time. This strategy will be deleted. |
| Continue to restrict vehicular access to Town property to prevent ATV use. | Partly accomplished but more progress is desired; strategy is carried forward. |
| Increase the size of the Plank Road culvert to prevent the flooding of nearby septic fields. | There is a rocky valley in this area and blasting would be required. Lack of funding has been a barrier to this action. This action is being carried forward. |
| Increase the size of the culvert for Roaring Brook on Roaring Brook road. If necessary, consider raising the elevation of the road to accommodate the larger culvert. | This is not complete but the town is still interested. Lack of funding has been a barrier to this action. This action is carried forward. |
| Petition the state to increase the size of the culvert under Route 68 near the Public Works Garage. | This is not complete but the town is still interested. Engaging CT DOT has been postponed as other priorities have been addressed. The action is carried forward. |
| Petition the state to increase the size of the 36-inch culvert under Route 68 near Spring Road to pass a greater than 100-year flood event. | This is not complete but the town is still interested. Engaging CT DOT has been postponed as other priorities have been addressed. The action is carried forward. |
| Continue participating in the Connecticut DEEP Stormwater Management Program. | This is ongoing and the strategy can be removed because it is a capability. |
| Continue over-sizing culverts and drainage structures. | This is ongoing and the strategy can be removed because it is a capability. |
| Continue to investigate reports of localized flooding problems to determine the cause and an appropriate solution. Set milestones for eliminating recurring localized flooding areas. | This is ongoing and the strategy can be removed because it is a capability. |

Portions of the above strategies and actions have been carried forward and are listed in the table of strategies in Appendix A. One new strategy has been identified through the process of updating this plan:

- Conduct drainage improvements along Gramar Avenue, specifically in the vicinity of Oxford General Industries which repeatedly floods.
- Replace the two twin pipes along Putting Green Lane with a box culvert to alleviate flooding impacts.
- Continue to work with CT DEEP and the Connecticut Agricultural Experiment Station in order to manage the Emerald Ash Borer in Prospect. [this action applies to multiple hazards]

# 4.0 HURRICANES

## 4.1 Setting

Hazards associated with tropical storms and hurricanes include winds, heavy rains, and flooding. While only a small area of Prospect is 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 Prospect. A hurricane striking Prospect is considered a possible event in any given year that could cause critical damage to the Town and its infrastructure.

## 4.2 Hazard Assessment

Hurricanes are a class of tropical cyclones which are defined by the National Weather Service as 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 (1-minute average) surface wind near the center of the storm. These categories are: Tropical Depression (winds less than 39 mph), Tropical Storm (winds 39-74 mph, inclusive) and Hurricanes (winds at least 74 mph).

The geographical 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 less susceptible to hurricane wind damages than coastal areas in Connecticut; however, the heaviest rainfall often occurs inland. Therefore, inland areas are most vulnerable to flooding along roadways, lakes, and streams 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

**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.**

and is predicated only on surface wind speeds. The following descriptions are from the 2014 *Connecticut Natural Hazard Mitigation Plan Update*.

- **Category One Hurricane:** Sustained winds 74-95 mph (64-82 kt). Minimal Damage: Damage is primarily to shrubbery, trees, foliage, and unanchored mobile homes. No real damage occurs in building structures. Some damage is done to poorly constructed signs.

- **Category Two Hurricane:** Sustained winds 96-110 mph (83-95 kt). Moderate Damage: Considerable damage is done to shrubbery and tree foliage, some trees are blown down. Major structural damage occurs to exposed mobile homes. Extensive damage occurs to poorly constructed signs. Some damage is done to roofing materials, windows, and doors; no major damage occurs to the building integrity of structures.

- **Category Three Hurricane:** Sustained winds 111-130 mph (96-113 kt). Extensive damage: Foliage torn from trees and shrubbery; large trees blown down. Practically all poorly constructed signs are blown down. Some damage to roofing materials of buildings occurs, with some window and door damage. Some structural damage occurs to small buildings, residences and utility buildings. Mobile homes are destroyed. There is a minor amount of failure of curtain walls (in framed buildings).

- **Category Four Hurricane:** Sustained winds 131-155 mph (114-135 kt). Extreme Damage: Shrubs and trees are blown down; all signs are down. Extensive roofing material and window and door damage occurs. Complete failure of roofs on many small residences occurs, and there is complete destruction of mobile homes. Some curtain walls experience failure.

- **Category Five Hurricane:** Sustained winds greater than 155 mph (135 kt). Catastrophic Damage: Shrubs and trees are blown down; all signs are down. Considerable damage to roofs of buildings. Very severe and extensive window and door damage occurs. Complete failure of roof structures occurs on many residences and industrial buildings, and extensive shattering of glass in windows and doors occurs. Some complete buildings fail. Small buildings are overturned or blown away. Complete destruction of mobile homes occurs.

## 4.3 Historic Record

Through research efforts by NOAA's 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 (1851-2012), 2 Category Three Hurricanes, 8 Category Two Hurricanes, 11 Category One Hurricanes, 54 tropical storms, and 8

tropical depressions have tracked within a 150 nautical mile radius of Waterbury, Connecticut. This location was chosen for its prominence in the COGCNV region. The representative storm strengths were measured as the peak intensities for each individual storm passing within the 150-mile radius. The 21 hurricanes noted above occurred in August and September as noted in Table 4-1.

**TABLE 4-1**
**Tropical Cyclones by Month within 150 Nautical Miles of Waterbury Since 1851**

| **Category** | **May** | **June** | **July** | **Aug.** | **Sept.** | **Oct.** | **Nov.** |
|---|---|---|---|---|---|---|---|
| Tropical Depression | None | 1 | 1 | 3 | 1 | 1 | None |
| Tropical Storm | 2 | 7 | 4 | 11 | 16 | 11 | 2 |
| One | None | None | 1 | 2 | 7 | 2 | None |
| Two | None | None | None | 3 | 6 | None | None |
| Three | None | None | None | None | 2 | None | None |
| **Total** | **2** | **8** | **6** | **19** | **32** | **14** | **2** |

A description of the more recent tropical cyclones near Prospect follows:

The most devastating hurricane to strike Connecticut, and believed to be the strongest hurricane to hit New England in recorded history, was believed to be a Category 3 hurricane. 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. The hurricane made landfall at Long Island, New York and moved quickly northward over Connecticut into northern New England.

The majority of damage was caused from storm surge and wind damage. Surges of 10 to 12 feet were recorded along portions of the Long Island and Connecticut Coast, and heavy winds flattened forests, destroyed nearly 5,000 cottages, farms, and homes, and damaged an estimated 15,000 more throughout New York and southern New England. Overall, the storm left an estimated 700 dead and caused physical damages in excess of $300 million (1938 United States dollars (USD)).

The "Great Atlantic Hurricane" hit the Connecticut coast in September 1944. This Category 3 hurricane brought rainfall in excess of six inches to most of the state and rainfall in excess of eight to ten inches in Fairfield County. Most of the wind damage from this storm occurred in southeastern Connecticut.

Another Category 3 hurricane, Hurricane Carol, struck in August of 1954 shortly after high tide and produced storm surges of 10 to 15 feet in southeastern Connecticut. 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 were estimated at 461 million

dollars (1954 USD), and 60 people died as a direct result of the hurricane. Western Connecticut was largely unaffected by Hurricane Carol due to the compact nature of the hurricane.

The following year, back-to-back hurricanes Connie and Diane caused torrential rains and record-breaking floods in Connecticut. Hurricane Connie was a declining tropical storm when it hit Connecticut in August of 1955, producing heavy rainfall of four to six inches across the state. The saturated soil conditions exacerbated the flooding caused by Diane five days later, a Category 1 hurricane and the wettest tropical cyclone on record for the Northeast. Diane produced 14 inches of rain in a 30-hour period, causing destructive flooding conditions along nearly every major river system in the state. The Mad and Still Rivers in Winsted, the Naugatuck, the Farmington, and the Quinebaug River in northeastern Connecticut caused the most damage. The flood waters caused over 100 deaths, left 86,000 unemployed, and caused an estimated 200 million dollars in damages (1955 USD). For comparison, the total property taxes levied by all Connecticut municipalities in 1954 amounted to 194.1 million dollars.

Hurricane Bob was a Category Two Hurricane when its center made landfall in Rhode Island in August of 1991. The hurricane caused storm surge damage along the Connecticut coast but was more extensively felt in Rhode Island and Massachusetts. Heavy winds were felt across eastern Connecticut with gusts up to 100 mph, light to moderate tree damage, and the storm was responsible for six deaths in the state. Total damage in southern New England was approximately $680 million (1991 USD).

Tropical Storm Floyd in September 1999 produced widespread flooding and high winds (sustained at 50 knots) that caused power outages throughout New England and at least one death in Connecticut.

Tropical Storm Irene in August 2011 produced five to 10 inches of rainfall across western Connecticut resulting in widespread flash flooding and river flooding. Local wind gusts exceeded 60 miles per hour. The combination of strong winds and saturated soil led to numerous downed trees and power outages throughout the region. Power outages averaged about three days in Prospect, and the town submitted just under $50,000 in public assistance reimbursements to FEMA following Irene.

Hurricane Sandy struck the Connecticut shoreline as a Category 1 Hurricane in late October 2012, causing power outages for 600,000 customers and at least $360 million in damages in Connecticut. The town of Prospect submitted a total of $33,000 in public assistance reimbursement to FEMA. However, damages were moderate to minor, and the main impacts were from downed pine trees. The local utility company, Connecticut Light and Power (CL&P) worked overnight in Prospect and power outages lasted only one day.

## 4.4 Existing Capabilities

Existing mitigation measures appropriate for flooding have been discussed in Section 3. These include ordinances, codes, and regulations that have been enacted to minimize flood damage. In addition, various structures exist to protect certain areas, including dams and riprap.

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 Prospect is 100 miles per hour. Prospect 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 miles per hour. 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.

Tall and older trees and branches may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. The Town has an annual program for private landowners who request tree removal, and performs necessary roadside cutting and tree removal on a case by case basis. CL&P also trims trees near power lines every three years. The Town has a tree company on call to remove trees downed during storms. The Town of Prospect's policy is to remove trees whenever they may be a threat to roadways or aboveground utilities and put 30-foot cutbacks along new roads to mitigate possible outages. All utilities in new subdivisions must be located underground whenever possible in order to mitigate storm-related damages.

CL&P was under intense scrutiny after storms Irene and Alfred in 2011. The utility has reportedly done an adequate job trimming trees since 2011. Trimming has reportedly helped avoid significant outages in a few recent high wind events. However, the Town of Prospect has expressed concern with the ash trees as they have been dying and are becoming a potential risk.

The Public Works Department has s staffs of eight that are responsible for 60.2 miles of roads throughout Prospect. Following Tropical Storm Irene, the town removed debris from local roads during the cleanup efforts.

During emergencies, Prospect has two designated emergency shelters, the Fire Department on New Haven Road, and the Senior Center on Center Street. Both facilities have auxiliary generators for emergency power and both are readily accessible from the center of town. The Fire Department facility has an overall capacity of approximately 300, and the Senior Center has an overall capacity of about 175. Both facilities have working kitchens. The Town Offices building can also be considered for sheltering purposes on an as-needed basis. As hurricanes generally pass an area within a day's time, additional shelters can be set up after the storm as needed for long-term evacuees.

In the past, some residents have reportedly had difficulty reaching shelters. As a result, the town has widened roads such as Summit Road to allow for better emergency access. This is an example of the town increasing capabilities when necessary.

The Town relies on radio and television to spread information on the location and availability of shelters. Prior to severe storm events, the Town ensures that warning/notification systems and communication equipment is working properly, and prepares for the possible evacuation of impacted areas.

In summary, many of Prospect's capabilities to mitigate for wind damage and prevent loss of life and property have improved since the initial hazard mitigation plan was adopted. Furthermore, CL&P has increased its capabilities relative to tree and tree limb maintenance near utility lines.

## 4.5 Vulnerabilities and Risk Assessment

The previous HMP noted that "it is generally believed that New England is long overdue for another major hurricane strike." Subsequent to the adoption of the plan, Tropical Storm Irene and Superstorm Sandy struck Connecticut and neighboring states in 2011 and 2012, respectively.

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, NY. 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 |

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."

According to the 2014 *Connecticut Natural Hazard Mitigation Plan Update*, 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 which can accompany the hazard. As shown in Table 4-2, NOAA estimates that the return period for a Category Two or Category Three storm to be 39 years and 68 years, respectively.

The 2014 *Connecticut Natural Hazard Mitigation Plan Update* 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 future that may be of greater frequency and intensity than in the past.

Tropical Cyclone Vulnerability

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.

The Town of Prospect is vulnerable to hurricane damage from wind and flooding, and from any tornadoes accompanying the storm. Areas of known and potential flooding

problems are discussed in Section 3.0, and tornadoes are discussed in Section 5.0. The entire Town is also vulnerable to wind damage. Hurricane-force winds can easily destroy poorly constructed buildings and mobile homes. 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), 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 can also start electrical fires, so adequate fire protection is important.

Factors that influence vulnerability to tropical cyclones in the town include building codes currently in place, and local zoning and development patterns and the age and number of structures located in highly vulnerable areas of the community.

The mobile home park on Cook Road is particularly vulnerable to Category 4 and 5 hurricanes because the homes are not anchored. The mobile home park residents also had trouble getting to the shelters because the state roads in Prospect are a low priority for the CT DOT during winter storms (Section 6.0).

Prospect is expected to experience moderate population growth in the coming years. Areas of growth and development increase the community'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 codes.

Town-owned critical facilities do not 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. However, newer critical facilities are more likely to meet current building code requirements and are therefore considered to be the most resistant to wind damage even if they are not specifically wind-resistant. Older facilities are considered to be more susceptible to wind damage.

As the Town of Prospect is not affected by storm surge, hurricane sheltering needs have not been calculated by the Army Corps of Engineers for the Town. It is assumed that sheltering need will be based upon areas damaged 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. During extended power outages, it is believed that only 10% to 20% of the affected population of Prospect will relocate.

HAZUS-MH Simulation

In order to quantify potential hurricane damage, HAZUS-MH simulations were run for historical and probabilistic storms that could theoretically affect Prospect. 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 C 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 Prospect. These two storm tracks produced the highest winds to affect Prospect out of all the hurricanes in the HAZUS-MH software.

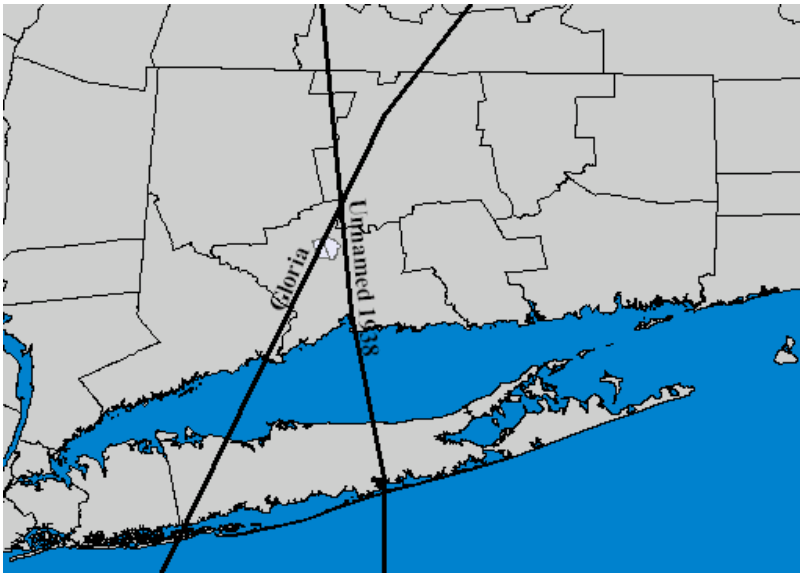



***Figure 4-1: Historical Hurricane Storm Tracks***

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 Prospect. 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 58 mph, with overall damages increasing with increasing wind speed.

**TABLE 4-3**
**HAZUS-MH 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 | 43 | None | None | None | None | None |
| 20-Years | 58 | 1 | None | None | None | 1 |
| 50-Years | 77 | 17 | None | None | None | 17 |
| Gloria (1985) | 81 | 29 | 1 | None | None | 30 |
| 100-Years | 90 | 133 | 6 | None | None | 139 |
| 200-Years | 101 | 404 | 41 | 1 | 1 | 447 |
| Unnamed (1938) | 108 | 661 | 107 | 6 | 4 | 778 |
| 500-Years | 113 | 874 | 196 | 18 | 12 | 1,100 |
| 1000-Years | 122 | 1,134 | 394 | 70 | 47 | 1,645 |

**TABLE 4-4**
**HAZUS-MH 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 | 1 | None | None | None | None |
| 50-Years | 18 | None | None | None | 18 |
| Gloria (1985) | 31 | 1 | None | None | 32 |
| 100-Years | 138 | 7 | None | None | 145 |
| 200-Years | 420 | 44 | 2 | 1 | 467 |
| Unnamed (1938) | 701 | 118 | 8 | 4 | 831 |
| 500-Years | 926 | 216 | 22 | 12 | 1,176 |
| 1000-Years | 1,206 | 443 | 83 | 48 | 1,780 |

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 90 mph. Minor damage to schools occurs at wind speeds of approximately 101 mph and greater with loss of use to all schools.

**TABLE 4-5**
**HAZUS-MH Hurricane Scenarios – Essential Facility Damage**

| Return Period or Storm | Emergency Operations Center (1) | Police Stations (1) | Schools (3) |
|---|---|---|---|
| 10-Years | None or Minor | None or Minor | None or Minor |
| 20-Years | None or Minor | None or Minor | None or Minor |
| 50-Years | None or Minor | None or Minor | None or Minor |
| Gloria (1985) | None or Minor | None or Minor | None or Minor |
| 100-Years | None or Minor | None or Minor | None or Minor |
| 200-Years | None or Minor | None or Minor | Minor damage/loss of use all schools |
| Unnamed (1938) | None or Minor | None or Minor | Minor damage/loss of use all schools |
| 500-Years | None or Minor | None or Minor | Minor damage/loss of use all schools |
| 1000-Years | None or Minor | None or Minor | Minor damage/loss of use all schools |

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 structure-related.

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

| Return Period or Storm | Brick / Wood | Reinforced Conc. / Steel | Eligible Tree Debris | Other Tree Debris | Total |
|---|---|---|---|---|---|
| 10-Years | None | None | None | None | None |
| 20-Years | None | None | None | None | None |
| 50-Years | 57 | None | None | None | 57 |
| Gloria (1985) | 96 | None | 320 | 659 | 1,075 |
| 100-Years | 284 | None | 700 | 3,510 | 5,401 |
| 200-Years | 847 | None | 2,177 | 4,786 | 7,810 |
| Unnamed (1938) | 1,623 | None | 4,174 | 9,104 | 14,901 |
| 500-Years | 2,657 | None | 6,832 | 14,867 | 24,356 |
| 1000-Years | 5,605 | None | 11,911 | 26,035 | 43,551 |

Table 4-7 presents the potential sheltering requirements based on the various wind events simulated by HAZUS. The predicted sheltering requirements for wind damage are

relatively minimal for wind events less than 101 mph. Larger wind events are expected to require significant shelter usage. In addition, it is likely that hurricanes will also produce heavy rain and flooding that will increase the overall sheltering need in Prospect.

**TABLE 4-7**
**HAZUS-MH 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 |
| 50-Years | None | None |
| Gloria (1985) | None | None |
| 100-Years | None | None |
| 200-Years | 1 | None |
| Unnamed (1938) | 8 | 2 |
| 500-Years | 20 | 3 |
| 1000-Years | 76 | 14 |

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-MH 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 | $1,610 | $1,610 | $10 | $1,620 |
| 50-Years | $762,270 | $821,140 | $1,080 | $822,220 |
| Gloria (1985) | $1,164,000 | $1,213,230 | $7,010 | $1,220,230 |
| 100-Years | $2,514,580 | $2,867,760 | $149,560 | $3,017,320 |
| 200-Years | $6,711,600 | $7,450,220 | $552,000 | $8,002,230 |
| Unnamed (1938) | $13,448,630 | $15,201,060 | $1,421,430 | $16,622,490 |
| 500-Years | $23,102,170 | $26,389,950 | $2,878,640 | $29,268,590 |
| 1000-Years | $53,638,270 | $61,745,790 | $7,065,150 | $68,810,940 |

Losses are minimal for storms with return periods of less than 20-years (58 mph) but increase rapidly as larger storms are considered. For example, a reenactment of the 1938 hurricane would cause approximately $16.62 million in wind damages to Prospect. 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 Prospect. 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 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 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.

### 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:

- Continue Town-wide tree limb inspection and maintenance programs to ensure that the potential for downed power lines in diminished.
- Continue location of utilities underground in new developments or as related to redevelopment. Develop a phased approach to replacing aboveground utility lines with underground utility lines, taking advantage of opportunities such as streetscaping projects.
- Continue to review the currently enacted Emergency Operations Plan for the Town and update when necessary.

### 4.6.2 Property Protection

Many people 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. Tree wardens may conduct 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 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 and evacuation routes prior to a hurricane event, as well as potential measures to mitigate personal property damage.

### 4.6.4 Emergency Services

The Emergency Operation Plan of the Town of Prospect includes guidelines and specifications for communication of hurricane warnings and watches, as well as for a call for evacuation. The public needs to be made aware in advance of a hurricane event of evacuation routes and the locations of public shelters. In addition, Prospect emergency personnel should identify and prepare additional facilities for evacuation and sheltering needs. The Town should also review its mutual aid agreements and update as necessary to ensure help is available as needed.

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. These infrastructure improvements will allow for small areas of the power grid to be isolated and powered by emergency generators, such as those where supermarkets and gas stations are located. Prospect is not currently interested in participating in such a program but may be in the future.

### 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.
- Code plus 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 Connecticut, 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 Status of Mitigation Strategies and Actions

Strategies and actions described in Section 3.7 for the mitigation of flooding are also pertinent to mitigating tropical storm or hurricane related flooding, and are not repeated here. The prior mitigation strategies and actions for mitigation of hurricane and tropical storm winds are listed below with commentary regarding the status of each.

**TABLE 4-9**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| Increase tree limb maintenance and inspections, especially along Route 68, Route 69, and other evacuation routes. | The town has done this and the strategy has become part of the town's overall capabilities for tree maintenance. |
| Continue outreach to residents warning of dangerous trees on their properties. | The town has done this and the strategy has become part of the town's overall capabilities for tree maintenance. |
| Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas. | The town has done this and the strategy has become part of the town's overall capabilities. |
| Review potential evacuation plans to ensure timely migration of potential shelterees from all areas of Prospect. | The town has done this and the strategy has become part of the town's overall capabilities. |

One new strategy has been identified through the process of updating this plan; it applies to multiple hazards but is particularly applicable to wind hazards:

- Acquire standby power supplies for critical facilities that do not have generator such as the Public Works building.

# 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 Prospect. 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 Prospect 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 Prospect 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 each year that could cause significant damage to a small area.

## 5.2 Hazard Assessment

Heavy wind including tornadoes and downbursts, lightning, heavy rain or hail, and flash floods are the primary hazards associated with summer storms. Riverine flooding and flash flooding caused by heavy rainfall was covered in Section 3.0 of this plan and will not be discussed in detail here.

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:

- 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, rope-like 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.

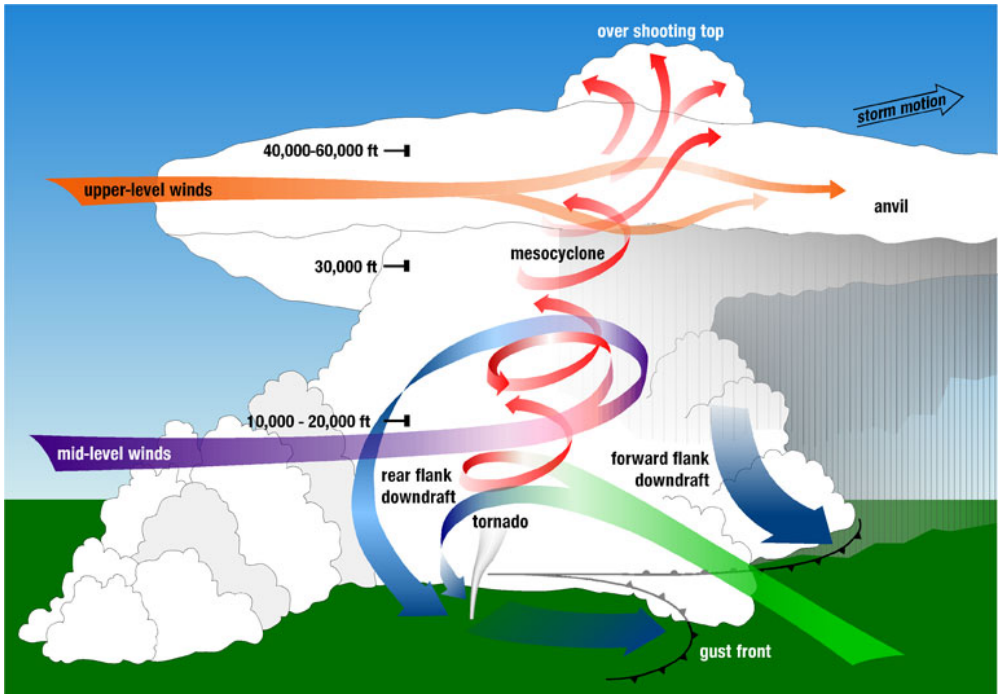
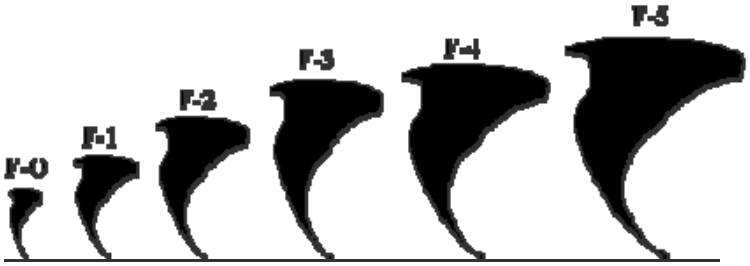



***Figure 5-1: Anatomy of a Tornado. Image from NOAA National Severe Storms Laboratory.***

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.




***Fujita Tornado Scale. Image courtesy of FEMA.***

**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 of 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 web site, 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 F-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 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 Watertown is discussed in Section 5.4. Tornadoes are most likely to occur in Connecticut in June, July, and August of each year

Lightning

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.

*Image courtesy of NOAA.*

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 41 people per year died and an average of 262 people were injured from lightning strikes in the United States from 2000 to 2009. 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.

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 four deaths and an average of 47 injuries per year in the United States from 2000 to 2009. 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 Litchfield and Hartford counties, followed by New Haven and Fairfield counties, and then Tolland, Middlesex, Windham, and finally New London County. Prospect is located in northern New Haven County. 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 Prospect through July 2013 based on the Wikipedia list.

**TABLE 5-3**
**Tornado Events Near Prospect From 1648 to July 2013**

| Date | Location | Fujita Tornado Scale | Property Damage | Injuries / Deaths |
|---|---|---|---|---|
| July 23, 1995 | Prospect | F0 | Trees uprooted, a 45-foot semi-trailer was tossed nearly 200 yards. | NR |
| July 3, 1996 | Waterbury (north of Prospect) | F2 | NR | NR |
| May 24, 1962 | Northern New Haven and Southern Hartford Counties (11 miles) | F3 | 200 buildings destroyed, 600 damaged, $4,000,000 in damages | 1 death, 50 injured |
| July 29, 1972 | Downtown Waterbury | F3 / F2 | Factory unroofed, houses damaged | 2 injured |
| July 3, 1996 | Downtown Waterbury | F1 | Damage to high school | NR |

NR = Not Reported

Thunderstorms occur on 18 to 35 days each year in Connecticut. Only 17 lightning-related fatalities occurred in Connecticut between 1959 and 2009. Hail is often a part of such thunderstorms. A limited selection of summer storm damage in the area, taken from the NCDC Storm Events database, is listed below:

- September 9, 1994 – Thunderstorms produced damaging winds which downed a few trees in Danbury and numerous trees and power lines in Cheshire, just east of Prospect. In addition a couple of homes were seriously damaged by fire after being struck by lightning.

- August 11, 1998 – An isolated severe thunderstorm moved southeast across Naugatuck, just west of Prospect. The storm produced a wet microburst that caused high winds and heavy rain. High winds caused about a 3/4-mile wide area of widespread damage to trees from Highland Ave. to Woodland (about 1 and 1/2 miles in length). Two people (one adult and one child) were injured when a large tree fell on and crushed their second-floor porch on High Street. The adult and child were pinned under rubble. The adult suffered from serious injuries (broken hip and arm and dislocated elbow).

- May 18, 2000 –Severe thunderstorms swept southeast across the region, it produced damaging wind gusts, "mainly" small hail, heavy rain and lightning. Spotters reported downed trees, tree limbs, and wires in Waterbury. Hail around 0.5 inches in diameter was reported in Naugatuck.

- October 29, 2003 – A severe thunderstorm produced damaging winds that knocked down a tree on Payne Road in Bethany, just south of Prospect.

- June 16, 2007 – Severe thunderstorms produced brief damaging winds and large hail across parts of Fairfield and New Haven Counties. Large tree limbs were downed.

- June 8, 2008 – Numerous severe thunderstorms developed as a weak upper level trough interacted with a hot and humid airmass across the region. Strong downburst winds were characteristic of many of the storms. Trees and wires were downed in Prospect.

- May 27, 2010 – A hot and humid airmass allowed for isolated severe thunderstorm development during the evening hours on the 26th. A strong backdoor cold front then sparked numerous severe thunderstorms across the area through the overnight hours. A 70 foot tall oak tree was downed in Naugatuck.

- July 1, 2012 – A passing cold front and upper level shortwave triggered multiple severe thunderstorms across Southern Connecticut. Large hail, up to "hen-egg" in size, was reported in Cheshire.

## 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.

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.

**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 town 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, tornadoes, lightning, and hail are employed in Prospect. Continued location of utilities underground is an important method of reducing wind damage to utilities and the resulting loss of services. The Connecticut Building Codes include guidelines for Wind Load Criteria that are specific to each municipality, as explained in Section 4.0. The building codes also address the proper grounding of structures to reduce lightning damage. In addition, specific mitigation measures address debris removal and tree trimming.

In the Town of Prospect, the local electric utility (Connecticut Light & Power) is responsible for tree branch removal and maintenance above and near power lines. The Department of Public Works (DPW) has the responsibility of maintaining trees on municipal property. The DPW is also responsible for trimming over roadways, and DPW staff routinely monitor for downed tree limbs during storms. The Town of Prospect maintains a tree service to remove trees downed during storms. The Town also approaches residents on a case-by-case basis when trees and branches on their property look hazardous.

Municipal responsibilities relative to tornado mitigation and preparedness include:

- Developing and disseminating emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- Identify and designate appropriate shelter space in the community that could potentially withstand tornado impact.
- Periodically test and exercise tornado response plans.
- Put emergency personnel on standby at tornado 'watch' stage.
- Utilize CodeRED as needed to warn residents of watches and warnings.

In summary, many of Prospect's capabilities to mitigate for wind damage and prevent loss of life and property have improved since the initial hazard mitigation plan was adopted, such as the use of CodeRED. Furthermore, CL&P has increased its capabilities relative to tree and tree limb maintenance near utility lines.

## 5.5 Vulnerabilities and Risk Assessment

*Description* – According to the 2014 *Natural Hazard Mitigation Plan Update*, New Haven County has a moderate to high risk of tornado activity based on historical occurrences. By virtue of its location in New Haven County, the Town of Prospect has a moderate to high potential to experience tornado damage. In addition, 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 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. 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 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, more deaths from lightning occur on the East Coast than elsewhere, according to FEMA. 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 Prospect 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 Prospect 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 Prospect 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. According to municipal emergency personnel, Prospect experiences frequent straight-line winds such as microbursts.

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 the downburst from a

thunderstorm, and have no associated rotation. Prospect is particularly susceptible to damage from high winds due to its high elevation and heavily treed landscape.

Heavy winds can take down trees near power lines, leading to the start and spread of electrical fires. Such fires can be extremely dangerous during the summer months during dry and drought conditions. Most downed power lines in Prospect are detected quickly and any associated fires are quickly extinguished. However, it is important to have adequate water supply for fire protection to ensure this level of safety is maintained.

The mobile home park on Cook Road is particularly vulnerable to tornadoes because the homes are not anchored. The existence of this park was one of the reasons Summit Road was recently widened to allow for increased access to the emergency shelters.

Similar to the discussion for hurricanes in Section 4.6, there are no critical facilities 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 3.6.

*Loss Estimates* – The town reports that the typical cost to respond to downed branches and wires from a localized severe thunderstorm is upwards from $400; this is based on two public works staff. The 2014 Connecticut Natural Hazard Mitigation Plan provides annual estimated losses on a countywide basis for several hazards. Based on the population of Prospect relative to New Haven County, the annual estimated loss is $883 for thunderstorms and $92,197 for tornadoes. The figure for tornadoes is based on their infrequent occurrence.

*Summary* – The entire community is at relatively equal risk for experiencing damage from summer storms and tornadoes. Based on the historic record, only one severe thunderstorm has resulted in costly damages in Prospect. Most damages are relatively site-specific and occur to private property (and therefore are paid for by private insurance). For municipal property, the budget for tree removal and minor repairs may need to be adjusted from time to time to address storms. Given the limited historic record for damaging tornado events, an estimate of several million dollars in damage may be reasonable for an EF2 tornado striking Prospect, and with a greater damage amount to be expected should an EF3 or stronger tornado strike.

## 5.6 Potential Mitigation Strategies and Actions

Strategies and actions described in Section 4.6 for wind are applicable to thunderstorms and tornadoes as well.

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 community shelters.
- Recommendations to better protect from tornado damage for your business, community, and home. This includes construction and design guidelines for business and homes, as well as guidelines for creating and identifying shelters.
- Ways to better protect property from wind damage.
- Ways to protect property from flooding damage.
- Construction of safe rooms within homes.

**More information is available at:**

FEMA – http://www.fema.gov/library/
NOAA – http://www.nssl.noaa.gov/NWSTornado/

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

Warnings are critical to mitigating damage from hail, lightning, and tornadoes. These hazards can appear with minimal warning such that the ability to quickly notify a large area is critical. The community alert system should be utilized to inform the public when severe weather events may occur. Thus, the implementation of an emergency notification system would be beneficial in warning residents of an impending tornado. 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. This fact was evidenced most recently by the severe storm which struck Lake County, Florida on February 2, 2007. This powerful storm included several tornadoes and struck at about 3:15 AM. According to National Public Radio, local broadcast stations had difficultly warning residents due to the lack of listeners and viewers and encouraged those awake to telephone warnings into the affected area.

## 5.7 Status of Mitigation Strategies and Actions

The prior mitigation strategies and actions for mitigation related to winds, hail, tornadoes, and downbursts are listed below with commentary regarding the status of each.

**TABLE 5-6**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| Increase tree limb maintenance and inspections, especially along Route 68, Route 69, and other evacuation routes. | The town has done this and the strategy has become part of the town's overall capabilities for tree maintenance. |
| Continue outreach regarding dangerous trees on private property. | The town has done this and the strategy has become part of the town's overall capabilities for tree maintenance. |
| Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas. | The town has done this and the strategy has become part of the town's overall capabilities. |

| Strategy or Action | Status |
|---|---|
| Continue to require compliance with the amended Connecticut Building Code for wind speeds. | The town has done this and the strategy has become part of the town's overall capabilities. |
| Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards. | The town has done this and the strategy has become part of the town's overall capabilities. |
| Ensure adequate notification systems exist to provide Cook Road mobile home residents with as much warning of an approaching tornado as possible. | The town utilizes the CodeRED emergency notification system and this has become part of the town's overall capabilities. |

Future editions of this plan will revisit the potential for replacing overhead utilities with underground utilities. The following new strategy listed in Section 4.7 is also applicable to the hazards associated with thunderstorms:

- Acquire standby power supplies for the critical facilities that do not have generators such as the Public Works building.

# 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 Prospect. However, unlike summer storms, winter events and the hazards that result (wind, snow, and ice) have more widespread geographic extent. The entire Town of Prospect is susceptible to winter storms. In general, winter storms are considered highly likely to occur each year, and the hazards that result (nor'easter winds, snow, and blizzard conditions) are expected to have a significant effect over a large area of the Town.

## 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, and 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. Due to higher altitudes, damage in Prospect may be more severe that in neighboring communities.

- **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 1st and April 1st 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 which have a snow accumulation of more than six inches in 12 hours, or more than 12 inches in a 24-hour period.

Impacts from severe winter weather can become dangerous and a threat to people and property. Most winter weather events occur between December and March. Winter weather may include snow, sleet, freezing rain, and cold temperatures. According to NOAA, winter storms were responsible for the death of 33 people per year from 2000 to 2009. 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.

> 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.

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Connecticut experiences at least one severe winter storm every five years, although a variety of small and medium snow and ice storms occur nearly every winter. The likelihood of a nor'easter occurring in any given winter is therefore considered high, and the likelihood of other winter storms occurring in any given winter is very high.

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. RSI differs from NESIS in that it uses a more refined geographic area to define the population impact. NESIS had used the population of the entire two-thirds of the United States in evaluating impacts for all storms whereas RSI has refined population data into six regions. The result is 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 196 of the most notable historic winter storms to impact the Northeast have been analyzed and categorized by RSI through March 2013.

## 6.3 Historic Record

A total of 16 extreme, crippling, and major winter storms have occurred in Connecticut during the past 30 years. One is listed for each of the years 1983, 1987, 1993, 1994, 1996, 2003, 2005, 2006, and 2007. More alarmingly, four are listed in the calendar year 2010 and two in 2011.

Considering nor'easters only, 11 major winter nor'easters have occurred in Connecticut during the past 30 years (in 1983, 1988, 1992, 1996, 2003, 2006, 2009, 2010, two in 2011, and 2013).

According to the NCDC, there have been 134 snow and ice events in the state of Connecticut between 1993 and April 2010, causing over $18 million in damages. Notably, heavy snow in December 1996 caused $6 million in property damage. Snow removal and power restoration for a winter storm event spanning March 31 and April 1, 1997 cost $1 million. On March 5, 2001, heavy snow caused $5 million in damages, followed by another heavy snow event four days later that caused an additional $2 million in damages.

Catastrophic ice storms are 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. However, winter storm Alfred from October 29-30, 2011 had an ice precipitation component to it. Although wet snow was the major problem, ice mixed in along and just

to the north of the shoreline which slickened roadways and led to additional weight build-up on trees and utility lines and other infrastructure.

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. An ice storm in November 2002 that hit Litchfield and western Hartford Counties resulted in $2.5 million in public sector damages.

Additional examples of recent winter storms to affect New Haven County selected from the NCDC database include:

- East Coast Winter Storm, March 13-14, 1993 – A powerful storm carrying with it record low barometric pressure readings hit the state with blizzard conditions. Gale force winds accompanied by snow drifts several feet deep closed businesses, hindered travel, and forced residents to lose power. Federal aid was given to the state for snow removal.

- Heavy Snow, January 21, 2001 – Heavy snow and a period of sleet and freezing rain changing to snow impacted the region. In Seymour, a total of eight inches were reported, while nearby Bridgeport received a total of approximately six inches.

- Heavy Snowstorm, March 12, 2005 – Snow fall rates reached in excess of two inches per hour at several locations in the region. Storm snowfall amounts ranged from approximately five to nine inches. In Ansonia, a reported snowfall total of 8.1 inches fell while nearby Derby reported 6.3 inches and Seymour reported 7.8 inches.

- Blizzard, December 26-27, 2010 – An intense low pressure system moved across the region with bands of heavy snow with embedded thunderstorms and significant winds. The powerful blizzard brought the area 10 to 18 inches of snow with sustained winds of 25 to 40 mph with gusts in excess of 60 mph. The storm made all forms of travel extremely difficult to nearly impossible and service on Metro North and Amtrak lines were suspended due to high snow drift.

- Heavy Snow, January 11-12, 2011 – Very heavy snow developed across the region, producing snowfall rates of three to four inches per hour and snow totals ranging from 15 to 30 inches in southern Connecticut. The highest snowfall totals were seen across northern portions of Fairfield and New Haven counties.

- Heavy Snow Storm, January 26-27, 2011 – A period of moderate to heavy snow moved through the region, producing two to five inches before a second round of precipitation, consisting of very heavy snow, moved across the area. This system boasted snowfall rates of three to four inches per hour over a four to six hour period which raised snow totals to 12-20" of snow throughout much of the region.

The winter storms of January and February 2011 are listed as the 18th and 19th storms in the NESIS ranking. These storms produced snow, sleet, freezing rain, strong gusty winds, severely low temperatures, and coastal flooding. Snowfall totals for winter 2010-2011 in Connecticut averaged around 70 inches.

The snowfall, sleet, freezing rain, and rain that affected Connecticut during the 2010-2011 winter season proved to be catastrophic for a number of buildings. With severely low temperatures coupled with the absence of the removal of snow and ice buildup from roofs of buildings in Connecticut, numerous roofs collapsed during the winter season.

Using media reports, a list of roof/building collapses and damage due to buildup of frozen precipitation was compiled. The list (Table 6-2) includes 76 locations that span over a month of time from January 12, 2011 to February 17, 2011. No properties are listed in Prospect. However, town officials noted that private homes experienced roof collapses. In order to limit impacts to municipal buildings, the town shoveled the schools and public building roofs.

**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 |

| Address | Municipality | Date | Description |
|---|---|---|---|
| 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 |
| 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 |

| Address | Municipality | Date | Description |
|---|---|---|---|
| 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 |

As a result of the roof and building collapses, significant and widespread damage to property took place. The overall storm impacts and damages of the winter 2010-2011 storms resulted in Presidential Disaster Declaration 1958-DR for Connecticut.

Later that year, Winter Storm Alfred (October 29-30, 2011) dumped up to 32 inches of snow and caused over 600,000 electrical customers in Connecticut to lose power for a significant amount of time. The entire state dealt with wet snow and ice and statewide power outages affecting Connecticut for a week or longer. The storm was unique in that much of the foliage had yet to fall from trees, which provided more surface area for snow to land and stick, therefore making the trees significantly heavier than if the storm was to occur when trees had lost their foliage. The storm resulted in the death of eight people in Connecticut, four from carbon monoxide poisoning. In all, approximately 90 shelters and 110 warming centers were opened state-wide. The overall storm impacts and damages resulted in another Presidential Disaster Declaration for Connecticut.

As a result of Winter Storm Alfred, Prospect experienced power outages that lasted up to seven days. Reportedly, power had to be restored to the town of Cheshire first. The town shelters were open and occupied for five days and the Fire House was open to provide residents with showers. The power outages caused the local supermarket to have to throw out food that had spoiled. The town utilized the CodeRED emergency notification system throughout this storm and found it very helpful.

A fierce nor'easter (dubbed "Nemo" by the Weather Channel) in February 2013 brought blizzard conditions to most of the Northeast, producing snowfall rates of five to six inches per hour in parts of Connecticut. Many areas of Connecticut experienced more than 40 inches of snowfall, and the storm caused more than 700,000 power outages. All

roads in Connecticut were closed for two days. This storm was ranked as a "Major" storm by NESIS. The overall storm impacts and damages resulted in yet one more Presidential Disaster Declaration for Connecticut. The Town's public assistance reimbursement request for Nemo was $106,000 and the town is expecting a 75% reimbursement.

## 6.4 Existing Capabilities

Existing programs applicable to 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, sand and salt trucks; tree-trimming to protect power lines; and other associated snow removal and response preparations.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important for municipalities to budget fiscal resources towards snow management. The Town ensures that all warning/notification and communications systems are ready before a storm, and ensures that appropriate equipment and supplies are in place and in good working order. The Town also prepares for the possible evacuation and sheltering of some populations which could be impacted by the upcoming storm (especially the elderly and special needs persons).

Prospect has 11 plow routes, which are reprioritized for fire and emergency access on a case by case basis during storms. The Connecticut Department of Transportation (DOT) plows Routes 68 and 69, but the state plow trucks tend to prioritize Routes 8 and 84. The Town of Prospect has widened Summit and Plank Roads to accommodate fire trucks and other emergency vehicles during winter storms. The Town stores sand and salt mix at Public Works on Route 68 which it rations to the DOT so they don't have to return to Watertown to re-supply (and it keeps them in the Town). The state replenishes any amount of sand/salt mix they take.

The town found it necessary to remove snow from municipal facilities and school roofs in January-February 2011. As a result of this experience, the town has been careful to watch for conditions that may lead to damage from snow loads.

In summary, Prospect's capabilities to mitigate for winter storm damage and prevent loss of life and property have improved since the initial hazard mitigation plan was adopted, such as the increasing attention to removing snow from buildings. The improved capabilities have resulted largely from the snow events that occurred from 2011 through 2013.

## 6.5 Vulnerabilities and Risk Assessment

*Description* – Based on the historic record in Section 6.3, Connecticut experiences at least one major nor'easter approximately every four years, although a variety of minor and

moderate snow and ice storms occur nearly every winter. According to the 2014 *Connecticut Natural Hazard Mitigation Plan Update*, Connecticut residents can expect at least two or more severe winter weather events per season, including heavy snow storms, 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 Hazard Mitigation Plan Update*, recent climate change studies predict a shorter winter season for Connecticut (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 the impact such storms have on the residents, roads, and utilities in the State.

As mentioned for summer storms, the heavily treed landscape in close proximity to densely populated residential areas in the Town of Prospect poses problems in relation to blizzard condition 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 ice freezing water pipes in basements.

In addition, winter storms present additional problems for motorists all over the state. As the population of Connecticut and its dependence on transportation continues to increase, the vulnerability of the state to winter storms also increases. There is a high propensity for traffic accidents during heavy snow and even light icing events. Roads may become impassable, inhibiting the ability of emergency equipment to reach trouble spots and the accessibility to medical and shelter facilities. Stranded motorists, especially senior and/or handicapped citizens, are at particularly high risk of injury or death during a blizzard. After a storm, snow piled on the sides of roadways can inhibit line of sight and reflect a blinding amount of sunlight, making driving difficult. When coupled with slippery road conditions, poor sightlines and heavy glare create dangerous driving conditions.

A few areas in the Town of Prospect have been identified by Town personnel as having problems with ice during the winter months. An unnamed tributary flowing under Route 68 near the Public Works Garage sometimes backs up and floods the road, causing icing in winter. This area is locally known as "Accident Alley" due to the road having a sharp turn, a steep grade, and is frequently covered in black ice due to poor drainage on the hillside. Icing has also historically been a problem along Terry Road. The dense pine trees have been cut back to allow more sunlight through, improving the rate of ice melt.

Icing is also a serious problem along Route 69 from the center of Town to the Bethany line. This is the primary road running from Waterbury to New Haven without nearby

alternatives. During a recent winter, it had to be completely shut down to clear snow, ice, and accidents.

The altitude of the Town exacerbates the damage caused by ice storms. The ice storm of 2002 broke so many tree limbs in and around Prospect that some subdivisions were without power for three days. Extended power outages are a particular problem for the Boulder Brook Court subdivision as it relies on an electrically driven pumping station to pump local sewage up-gradient to the municipal sewer system. There is no emergency generator at this pumping station, so power outages render the sewer system in this subdivision inoperable.

Drifting snow is not as large a problem in Prospect as other areas, but it still occurs. This problem is addressed through municipal plowing efforts.

*Loss Estimates* – The 2014 Connecticut Natural Hazard Mitigation Plan provides annual estimated losses on a countywide basis for several hazards. Based on the population of Prospect relative to New Haven County, the annual estimated loss is $68 for severe winter storms. The low figure is likely influenced by the difficulty in separating typical winter storm costs from those associated with extreme events. Nevertheless, the town's public assistance reimbursements for the last three winter storm disasters were significant:

- January/February 2011: $36,117 (reimbursement)
- Winter Storm Alfred, October 2011: $457,666 (reimbursement)
- Winter Storm Nemo, February 2013: $79,500 (reimbursement)

*Summary* – The entire community is at relatively equal risk for experiencing damage from winter storms, although some areas may be more susceptible. Many damages are relatively site-specific and occur to private property (and therefore are paid for by private insurance), while repairs for power outages is often widespread and difficult to quantify to any one municipality. For municipal property, the budget for plowing and minor repairs is generally adequate to handle winter storm damage, although the plowing budget is often depleted in severe winters. In particular, the heavy snowfalls associated with the winter of 2010-2011 drained the local plowing budget and raised a high level of awareness of the danger that heavy snow poses to roofs, as did the snow associated with Winter Storm Alfred in October 2011 and storm Nemo in February 2013.

## 6.6 Potential Mitigation Strategies and Actions

Winter storm mitigation measures must also address blizzard, snow, and ice hazards. These are emphasized below. Note that structural projects are generally not applicable to hazard mitigation for wind, blizzard, snow, and ice hazards.

### 6.6.1 Prevention

Cold air, wind, snow, and ice can not be prevented from impacting any particular area. Thus, mitigation should be focused on property protection and emergency services (discussed below) and prevention of damage as caused by breakage of tree limbs.

Previous strategies 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 Prospect should continue to be placed underground where possible. This can occur in connection with new development and also in connection with redevelopment work. Underground utilities cannot be damaged by heavy snow, ice, and winter winds.

### 6.6.2 Property Protection

Property can be protected during winter storms through the use of shutters, storm doors, and storm windows. Where flat roofs are used on structures, snow removal is important as the heavy load from collecting snow may exceed the bearing capacity of the structure. Heating coils may be used to remove snow from flat roofs, and pipes should be adequately insulated to protect against freezing and bursting. All of these recommendations should apply to new construction, although they may also be applied to existing buildings during renovations. Finally, as recommended in previous sections, compliance with the amended Connecticut Building Code for wind speeds is necessary.

> FEMA has produced a Snow Load Safety Guidance Document available at http://www.fema.gov/media-library/assets/documents/29670?id=6652

Where flat roofs are used on structures, snow removal is important as the heavy load from collecting snow may 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 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 plan. 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 in Connecticut. 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. Communities should consider the use of such staggered openings and closings to mitigate congestion during and after severe weather events if traffic conditions warrant.

### 6.6.4 Emergency Services

Emergency services personnel and departments such as Police and Fire should identify areas which may be difficult to access during winter storm events and devise contingency plans to continue servicing those areas during moderate storms.
Plowing routes should continue to prioritize access to and from critical facilities. Residents should be made aware of the plow routes in order to plan how to best access critical facilities, perhaps by posting the general routes on the Town website. 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 also be advertised and their locations known to the public prior to a storm event. Finally, mutual aid agreements with surrounding municipalities should be reviewed and updated as necessary to ensure help will be available when needed.

## 6.7 Status of Mitigation Strategies and Actions

The prior mitigation strategies associated with winds were addressed in earlier sections of this plan. Previous strategies and actions for snow and ice are listed below with commentary regarding the status of each.

**TABLE 6-3**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| Petition the State Department of Transportation to construct drainage improvements to reduce road icing on Routes 68 and 69. | This is in progress and the strategy will be carried forward. Engaging CT DOT has been postponed as other priorities have been addressed. |
| Increase tree limb maintenance and inspections, especially in the downtown areas. | The town has done this and the strategy has become part of the town's overall capabilities for tree maintenance. |
| Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas. | The town continues to require this and the strategy has become part of the town's overall capabilities. |
| Review evacuation plans to ensure timely migration of potential shelterees from all areas of Prospect. | The town has done this and the strategy has become part of the town's overall capabilities. |
| Post a list of Town snow-plowing routes and sheltering facilities in the Town Hall and on the Town's website so residents can best plan how to access critical facilities during a winter storm event. | Staffing resources are extremely limited, which has hindered progress. However, the actions will be carried forward. |
| Provide education and outreach materials to property owners on how to protect property through the use of shutters and storm windows, the importance of removing snow from flat | This is done through the use of the CodeRED system and the strategy has become part of the town's overall capabilities. |

| | |
|---|---|
| roofs, and the importance of insulating pipes adequately to protect from freezing and bursting. | |
| Provide public educational materials that focus on safety tips and reminders to individuals about how to prepare for cold weather. | The town has done this and the strategy has become part of the town's overall capabilities. |
| Encourage two modes of egress into every neighborhood by the creation of through streets. | The town encourages dead end streets and therefore this strategy can be removed. |
| Pursue funding for an emergency generator at the Boulder Brook Court sewer pumping station. | The pump station is a critical facility and a generator is necessary. However, there will be logistical challenges to work with the association and funding sources have been limited. Therefore this will be carried forward. *[this action applies to multiple hazards]* |

Portions of the above strategies and actions have been carried forward and are listed in the table of strategies in Appendix A. One two new strategy has been identified during the development of this plan update.

- ❑ Develop a plan to prioritize snow removal from the roof of critical facilities and other municipal buildings each winter. Ensure adequate funding is available in the Town budget for this purpose.

# 7.0 EARTHQUAKES

## 7.1 Setting

The entire Town of Prospect is susceptible to earthquakes. However, even though earthquakes have the potential to affect any place in the Town, the effects may be felt differently in some areas based on the type of geology. In general, damaging earthquakes are considered a hazard that is unlikely to occur, but that may cause significant effects to a large area of the Town if one occurred.

## 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 phone 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 is 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 which have a common calibration. The magnitude of an earthquake is thus represented by a single, instrumentally determined value recorded by a seismograph, which record 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 micro-earthquakes, 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.

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 being intra-plate 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. 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 destroyed. Object 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 Northeast States Emergency Consortium and the Weston Observatory at Boston College, there were 139 recorded earthquakes in Connecticut between 1668 and 2011. 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 is provided below, based on information provided in USGS documents, the Weston Observatory, the 2014 *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.
- 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, New Haven, and Meriden, Connecticut.
- An Intensity V earthquake was reported in Stamford in March of 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.

- On March 11, 2008 there was a 2.0 magnitude earthquake 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 on September 8, 2012. Dozens of residents reported feeling the ground move, but 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.
- The most recent earthquake to strike Connecticut was a magnitude 2.7 beneath the town of Deep River on August 14, 2014.

A magnitude 5.8 earthquake 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.

## 7.4 Existing Capabilities

The Connecticut Building Codes include design criteria for buildings specific to municipality, as adopted by the Building Officials and Code Administrators (BOCA). These include the seismic coefficients for building design in the Town of Prospect. The Town has adopted these codes for new construction and they are enforced by the Town Building Inspector.

Due to the infrequent nature of damaging earthquakes, land use policies in the Town of Prospect do not directly address earthquake hazards. However, as noted in Section 3.4, the updated POCD became effective on February 1, 2014 with the following text for Goal #6: *"Protection of Steep Slopes, Inland Wetlands & Floodplains: Certain topographic features present severe limitations on the suitability of sites for urban development. Steep slopes, inland wetlands and floodplains should be avoided as development locations."*

Prospect's capabilities to mitigate for earthquake damage and prevent loss of life and property have not necessarily changed since the initial hazard mitigation plan was adopted, although the State's building code has been updated and the town has incorporated those changes.

## 7.5 Vulnerabilities and Risk Assessment

According to the USGS, Connecticut is at a low risk for experiencing a damaging earthquake. The USGS has determined that the State of Connecticut has a 10% chance that at some point in a 50-year period an earthquake would cause peak acceleration (ground shaking) values of 4% to 8% of the force of gravity. To appreciate why these values of ground shaking are expressed as a percentage of the force of gravity, note that it requires more than 100% of the force of gravity to throw objects up in the air.

In terms of felt effects and damage, ground motion at the level of several percent of gravity corresponds to the threshold of damage to buildings and houses (an earthquake intensity of approximately V). For comparison, reports of "dishes, windows and doors disturbed" corresponds to an intensity of about IV, or about 2% of gravity. Reports of "some chimneys broken" correspond to an intensity of about VII, or about 10% to 20% of gravity. According to the USGS National Seismic Hazard Mapping Project, an earthquake impacting the Town of Prospect has a 2% chance of exceeding a peak acceleration of 14-16% of the force of gravity in a 50-year period.

According to the State of Connecticut Department of Emergency Management, the chance that a damaging earthquake of magnitude 5.0 or greater will occur within the state in any one year is 5%. The odds of an earthquake of magnitude 6.0 are about one in 300 each year. Therefore, the Town of Prospect is unlikely to experience a damaging earthquake in any given year. This belief is reinforced by the historical record presented in Section 7.3.

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. 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, especially the finer textured soils. When liquefaction occurs, the strength of the soil decreases and the ability of soil to support building foundations or bridges is reduced. Increased shaking and liquefaction can cause greater damage to buildings and structures, and a greater loss of life.

As explained in Section 2.3, portions of the Town of Prospect are underlain by sand and gravel. Figure 2-5 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 certain types of new construction. The areas that are not at increased risk during an earthquake due to unstable soils are the areas in Figure 2-5 underlain by glacial till.

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. Dam failure can also pose a significant threat to developed areas during an earthquake. For this Plan, dam failure has been addressed separately in Section 8.0.

> 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 value stems from the fact that Connecticut has a large building inventory that would be damaged in a severe earthquake and takes into account the lack of damaging earthquakes in the historical record.

According to the 2014 Connecticut Natural Hazard Mitigation Plan Update, 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 an 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.

Nevertheless, 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 Waterbury 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 Waterbury.

Because a damaging earthquake would likely affect a large area beyond Waterbury, it is likely that the community may not be able to receive regional aid for a few days. It is important for municipal facilities and departments to have adequate backup plans and backup supplies to ensure that restoration activities may begin and continue until outside assistance can be provided.

HAZUS-MH Simulations

The 2014 *Connecticut Natural Hazard Mitigation Plan Update* utilizes four "maximum plausible" earthquake scenarios (three historical, one potential) within HAZUS-MH to generate potential earthquake risk to the State of Connecticut. These same four scenarios were simulated within HAZUS-MH (using the default year 2000 building inventories and census data) to generate potential damages in Prospect. 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 Prospect. Note that potentially greater impacts could also occur.

Table 7-2 presents the number of residential buildings (homes) damaged by the various earthquake scenarios, while Table 7-3 presents the total number of buildings damaged by each earthquake scenario. A significant percentage of building damage is to residential buildings, while other building types include agriculture, commercial, education, government, industrial, 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 7-2**
**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 | 372 | 100 | 10 | None | 482 |
| Portland – 5.7 | 418 | 118 | 13 | 1 | 550 |
| Stamford – 5.7 | 110 | 20 | 1 | None | 131 |
| East Haddam – 6.4 | 568 | 187 | 31 | 5 | 791 |

**TABLE 7-3**
**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 | 411 | 121 | 14 | 1 | 547 |
| Portland – 5.7 | 460 | 145 | 19 | 2 | 626 |
| Stamford – 5.7 | 122 | 24 | 2 | None | 148 |
| East Haddam – 6.4 | 623 | 237 | 46 | 8 | 914 |

The HAZUS simulations consider a subset of critical facilities termed "essential facilities" which are important during emergency situations. As shown in Table 7-4, minor damage to essential facilities is expected for each earthquake scenario.

**TABLE 7-4**
**HAZUS-MH Earthquake Scenarios – Essential Facility Damage**

| Epicenter Location and Magnitude | Fire Station (1) | Police Stations (1) | Schools (3) |
|---|---|---|---|
| Haddam – 5.7 | Minor damage (65% functionality) | Minor damage (65% functionality) | Minor damage (65% functionality) |
| Portland – 5.7 | Minor damage (63% functionality) | Minor damage (63% functionality) | Minor damage (64% functionality) |
| Stamford – 5.7 | Minor damage (84% functionality) | Minor damage (84% functionality) | Minor damage (84% functionality) |
| East Haddam – 6.4 | Minor damage (53% functionality) | Minor damage (53% functionality) | Minor damage (53% functionality) |

Table 7-5 presents potential damage to utilities and infrastructure based on the various earthquake scenarios. The HAZUS-MH software assumes that the Prospect transportation network and utility network includes the following:

- Highway: 1 major roadway bridge and 7 important highway segments;
- 1 Bus Facility;
- A potable water system consisting of 114 total kilometers of pipelines;
- A waste water system consisting of 68 total kilometers of pipelines and; and
- A total of 45 kilometers of natural gas lines

As shown in Table 7-5, highway bridges, the rail facility, and the bus facility are predicted to experience minor damage under each earthquake scenario. While water, sewer, and gas lines are expected to have leaks and breaks, no loss of potable water or electrical service is expected. No displacement of people due to fire is expected.

**TABLE 7-5**
**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 ($0.10 million to bus facility) | 4 leaks and 1 break in potable water system ($0.02 million), 2 leaks and 1 break in waste water system ($0.01 million), and 1 leak in natural gas system (<0.01 million), No loss of service expected. Total damage: Approximately $0.03 million. | Fire damage will displace no people. |
| Portland – 5.7 | Minor damage to transportation infrastructure ($0.12 million to bus facility) | 5 leaks and 1 break in potable water system ($0.02 million) 2 leaks and 1 break in waste water system ($0.01 million), and 1 leak in natural gas system (<0.01 million). No loss of service expected. Total damage: Approximately $0.04 million. | Fire damage will displace no people. |
| Stamford – 5.7 | Minor damage to transportation infrastructure ($0.3 million to bus facility) | 1 leak in potable water system (<$0.01 million). Total damage: Approximately $0.01 million. | Fire damage will displace no people. |

| Epicenter Location and Magnitude | Transportation Network | Utilities | Fire Damage |
|---|---|---|---|
| East Haddam – 6.4 | Minor damage to transportation infrastructure ($0.78 million to bridges and $0.15 million to bus facility) | 11 leaks and 3 major break in potable water system ($0.05 million), 6 leaks and 1 major break in waste water system ($0.03 million) and 2 leaks in natural gas system ($0.01 million). No loss of service expected. Total damage: Approximately $0.09 million. | Fire damage will displace no people. |

Table 7-6 presents the estimated tonnage of debris that would be generated by earthquake damage during each HAZUS-MH scenario. As shown in Table 7-6, debris is expected for three of the four earthquake scenarios, with the East Haddam earthquake scenario generating the most debris in the community.

**TABLE 7-6**
**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 | 1,160 | 840 | 2,000 | 80 |
| Portland – 5.7 | 1,650 | 1,350 | 3,000 | 120 |
| Stamford – 5.7 | None | None | None | None |
| East Haddam – 6.4 | 3,080 | 3,920 | 7,000 | 280 |

Table 7-7 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 7-5) are necessary for only the East Haddam earthquake 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 7-7**
**HAZUS-MH Earthquake Scenarios – Shelter Requirements**

| Epicenter Location and Magnitude | Number of Displaced Households | Short Term Sheltering Need (Number of People) |
|---|---|---|
| Haddam – 5.7 | 1 | None |
| Portland – 5.7 | 1 | None |
| Stamford – 5.7 | None | None |
| East Haddam – 6.4 | 3 | 2 |

Table 7-8 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 7-8**
**HAZUS-MH Earthquake Scenarios – Casualty Estimates**

| Epicenter Location - Magnitude | 2 AM Earthquake | 2 PM Earthquake | 5 PM Earthquake |
|---|---|---|---|
| Haddam – 5.7 | 2 (Level 1) | 2 (Level 1) | 2 (Level 1) |
| Portland – 5.7 | 2 (Level 1) | 2 (Level 1) | 2 (Level 1) |
| Stamford – 5.7 | None | None | None |
| East Haddam – 6.4 | 4 (Level 1)<br>1 (Level 2) | 5 (Level 1)<br>1 (Level 2) | 5 (Level 1)<br>1 (Level 2) |

The East Haddam scenario indicated both Level 1 and Level 2 casualty estimates. All other earthquake scenarios cause only minor injuries or no injury at all.

Table 7-9 presents the total estimated losses and direct economic impact that may result from the four earthquake scenarios created for Prospect 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 a hurricane, 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 7-5.

**TABLE 7-9**
**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 | $10,180,000 | $1,990,000 | $12,160,000 |
| Portland – 5.7 | $12,410,000 | $2,480,000 | $14,890,000 |
| Stamford – 5.7 | $1,710,000 | $350,000 | $2,060,000 |
| East Haddam – 6.4 | $22,310,000 | $5,240,000 | $27,550,000 |

The maximum simulated damage considering direct losses and infrastructure losses is approximately $27.55 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, this analysis demonstrates that earthquake damage presents a potential hazard to Prospect. Additional infrastructure not modeled by HAZUS-MH, such as water treatment plants, sewer pumping stations, and water storage tanks, could be affected by an earthquake.

## 7.6 Potential Mitigation Strategies and Actions

As earthquakes are difficult to predict and can affect the entire Town of Prospect, potential mitigation can only include adherence to building codes, education of residents, and adequate planning.

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

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 facilities. 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.

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.

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 (such as water and sewer lines), utilizing flexible piping where possible, and installing shutoff valves and emergency connector hoses where water mains 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 Status of Mitigation Strategies and Actions

The prior mitigation strategies associated with earthquakes are listed below with commentary regarding the status of each.

**TABLE 7-10**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| Consider preventing new residential development in areas prone to collapse. | This is ongoing and the strategy can be removed because it is a capability. |
| As suggested in the Plan of Conservation and Development, continue restricting or preventing residential development on or below steep slopes (slopes exceeding 30%). | This is ongoing and the strategy can be removed because it is a capability. |
| Continue to require adherence to the state building codes. | This is ongoing and the strategy can be removed because it is a capability. |
| Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs. | Partly completed by ensuring that some functions have backup facilities, but additional action is desired, this strategy will be carried forward. |

One of the above strategies has been carried forward and is listed in the table of strategies in Appendix A. One new strategy has been identified through the process of updating this plan. While the Fire House and 911 Center have extra braces to prevent damage other buildings such as the library do not. Therefore, the town may consider bracing systems and assets inside all critical facilities. This could help protect IT systems, important records and files, libraries, and department-specific assets such as mechanical equipment.

# 8.0 DAM FAILURE

## 8.1 Setting

Dam failures can be triggered suddenly, with little or no warning, 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, dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. With nine registered dams and potentially several other minor dams in the Town, dam failure can occur almost anywhere in Prospect. While flooding from a dam failure generally has a limited geographic extent, the effects are potentially catastrophic. Fortunately, a major dam failure is considered only a possible natural hazard event in any given year.

## 8.2 Hazard Assessment

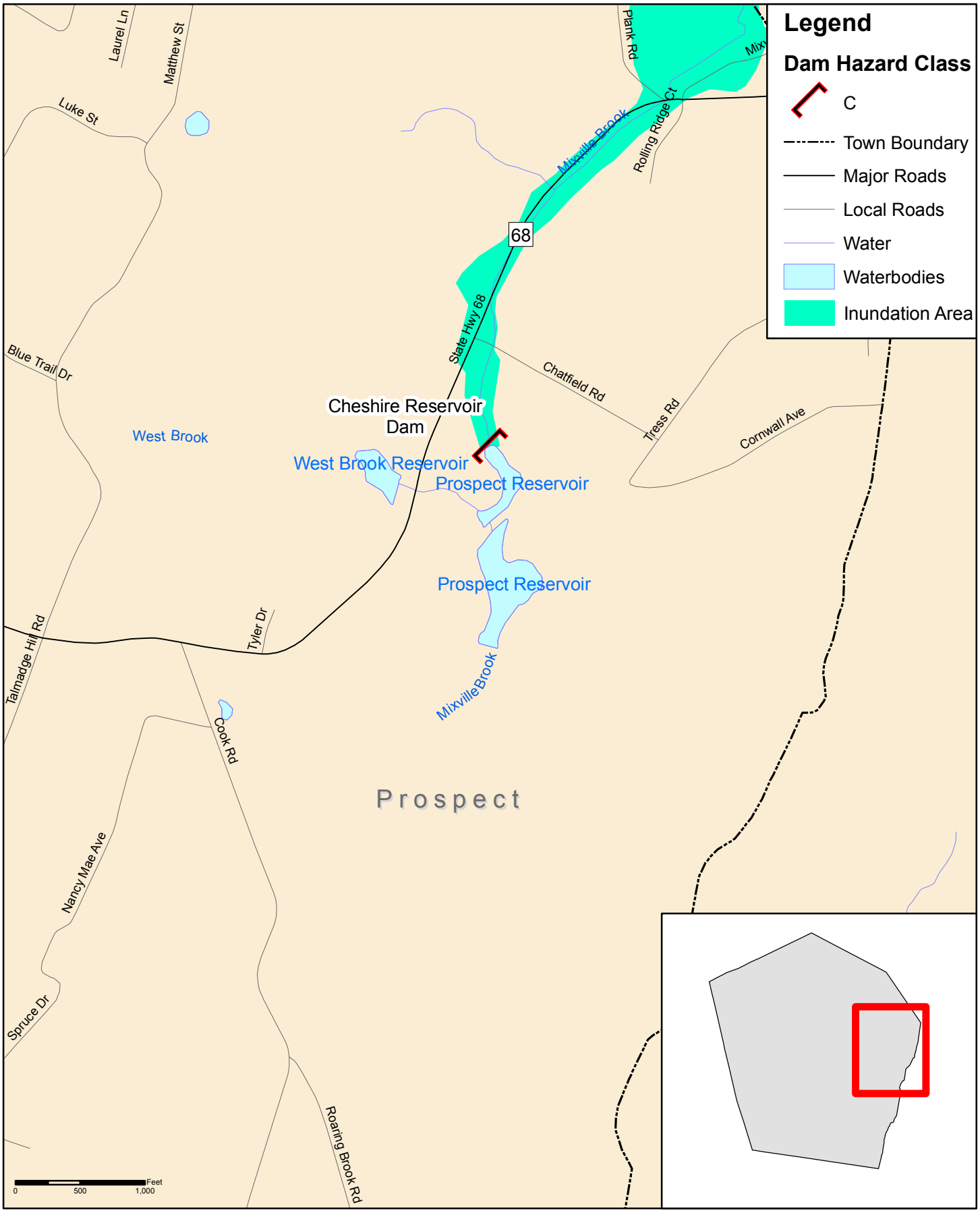
The Connecticut DEP administers the statewide Dam Safety Program, and designates a classification to each state-registered dam based on its potential hazard.

- *Class AA* dams are negligible hazard potential dams that upon failure would result in no measurable damage to roadways, land 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.

This section deals primarily with the possible effects of failure of Class C dams. Failure of a class C dam has the potential for loss of life and property damage totaling millions of dollars.

There are nine registered dams (Table 8-1) in the Town of Prospect, of which two are Class A, three are Class B, two are Class C, and two are undefined. The two Class C dams in Prospect are the Cheshire Reservoir Dam in the eastern part of town (Figure 8-1) and the Waterbury Reservoir Dam #2 in the northwestern part of town (Figure 8-2). The Moody Reservoir Dam, a Class B dam, is depicted in Figure 8-3.

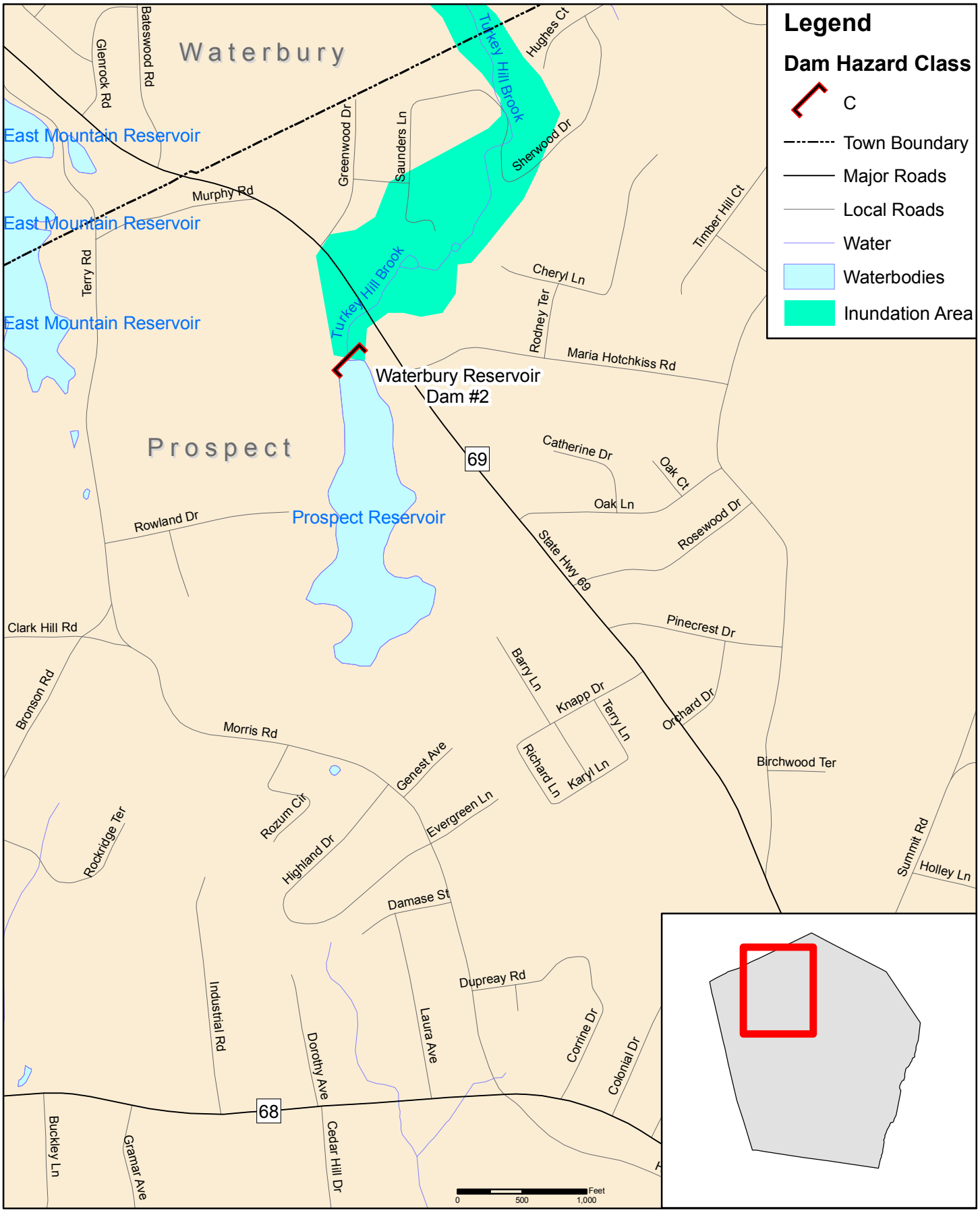
# Figure 8-1: High Hazard Dams in Prospect




Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10/06.
"Hydrography", "Dams", "Town Boundary", DEP
"Inundation Area", Dam Failure Analysis – Limits of Potential Flooding – Prospect Dam, New Haven Water Company, 1981
For general planning purposes only. Delineations may not be exact.
January 2008

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

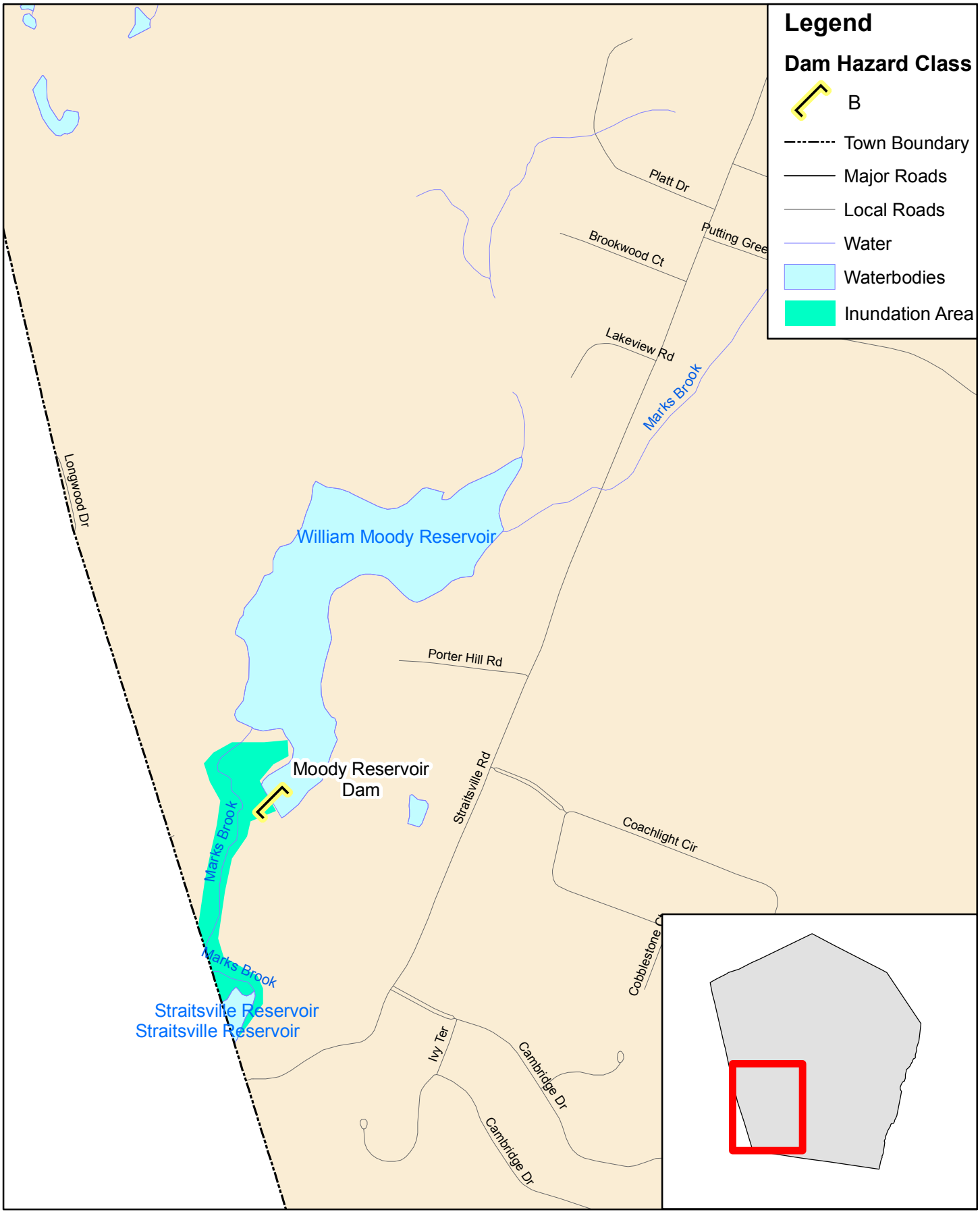
# Figure 8-2: High Hazard Dams in Prospect




Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10/06.
"Hydrography", "Dams", "Town Boundary", DEP
"Inundation Area", Dam Failure Analyses - Limits of Potential Flooding for Waterbury Reservoir No. 2 Dam, City of Waterbury, 1995
For general planning purposes only. Delineations may not be exact.
January 2008

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

# Figure 8-3: High Hazard Dams in Prospect




Source: "Roads", GDT
"Hydrography", "Dams", "Town Boundary", DEP
"Inundation Area", Moody Reservoir Dam Emergency Operations Plan, Connecticut Water Company, 1994
For general planning purposes only. Delineations may not be exact.
January 2008

0 500 1,000 Feet

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**TABLE 8-1**
**Dams Registered with the DEEP in the Town of Prospect**

| Number | Name | Class |
|---|---|---|
| 11501 | Cheshire Reservoir Dam | C |
| 11502 | Waterbury Reservoir Dam #2 | C |
| 11503 | Moody Reservoir Dam | B |
| 11504 | Reilly Pond Dam | BB* |
| 11505 | Salem Road Pond Dam | BB* |
| 11506 | Brooks Pond Dam | A |
| 11507 | Passaro Pond Dam | A |
| 11508 | Beer Pond Dam | - |
| 11509 | West Brook Reservoir Dam | - |

*Formerly Class B, but have been recently reclassified as not being significant hazard dams

## 8.3 Historic Record

Approximately 200 notable dam and reservoir failures occurred worldwide in the twentieth century. More than 8,000 people died in these disasters. The following are the two most catastrophic dam failures in Connecticut's recent history:

- 1963: Failure of the Spaulding Pond Dam in Norwich caused six deaths and six million dollars in damage.
- 1982: Failure of the Bushy Hill Pond Dam in Deep River caused 50 million dollars in damages.

More recently, the NCDC reports that flash flooding on April 16, 1996 caused three small dams in Middletown and one in Wallingford to breach. 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.

**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 | DEP |
| 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 | Meriden |
| ----- | ABB Pond Dam | Bloomfield | -- | Minor Damage | Private |
| 4905 | Springborn Dam | Enfield | BB | Minor Damage | DEP |
| 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 | DEP |

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 January 1, 2009, state dam safety programs reported 132 dam failures and 434 incidents requiring intervention to prevent failure.

No major dam failures have occurred in the Town of Prospect. Waterbury Reservoir Dam #2 is located on Route 69 in the northwest part of Town and was most recently repaired in 1999. A new cap for the dam wall was installed, the earthen embankment was regraded, and the spillway was lowered. The dam was again lowered in 2005 by six feet to reduce pressure on the dam. This reservoir is not currently used by the City of Waterbury for water supply.

According to the Dam Safety Division of the DEEP, the Town of Prospect lowered the water behind the Cheshire Reservoir Dam to perform repairs in October 2006. The repairs were performed to improve the safety and reliability of the structure, to remove the abandoned treatment building, and to make the structure easier to maintain. The spillway walls and steps were reconstructed, and erosion protection was installed to safely pass one-half the probable maximum flood. This reservoir is not currently used by the Town of Prospect for water supply.

## 8.4 Existing Capabilities

The Dam Safety Section of the 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.

The dam safety statutes are codified in Section 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 which govern the registration, classification, and inspection of dams. Dams must be inventoried by the owner with the DEEP, according to Connecticut Public Act 83-38.

> Dams permitted by the DEEP must be designed to pass the 100-year 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 100-year rainfall event.

Dam Inspection Regulations require that nearly 700 dams in Connecticut be inspected annually. The DEEP currently performs inspections of those dams which pose the greatest potential threat to downstream persons and properties, and also performs inspections as complaints are registered.

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 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 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.

Owners of Class C dams have traditionally been required to maintain Emergency Operation Plans (EOPs). Guidelines for dam EOPs were published by DEEP in 2012, creating a uniform approach for development of EOPs. As dam owners develop EOPs using the new guidance, DEEP anticipates that the quality of EOPs will improve, which will ultimately help reduce vulnerabilities to dam failures. The Town of Prospect is responsible for maintaining the plan for Cheshire Reservoir and the City of Waterbury is responsible for maintaining the plan for Waterbury Reservoir #2. Neither reservoir is currently used as a water supply. In addition, the Connecticut Water Company maintains an Emergency Operations Plan for the Moody Reservoir Dam.

Important dam safety program changes are underway 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.

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.

Town officials have indicated that the Cheshire Reservoir dam was rebuilt in the last few years and the spillway on the Waterbury Reservoir was lowered by five feet. These are examples of the dam owners exercising their own capabilities with regard to their dams.

Prospect's capabilities to mitigate for dam failure and prevent loss of life and property have increased since the initial hazard mitigation plan was adopted, mainly as a result of recent statewide legislative actions described above. In the next few years, dam safety programs will continue to strengthen.

## 8.5 Vulnerabilities and Risk Assessment

By definition, failure of Class C dams may cause catastrophic loss of life and property. Of the two Class C dams in the Town of Prospect, the failure of Waterbury Reservoir Dam #2 would have a higher impact on the residents and infrastructure of the Town of Prospect. However, the failure of either dam would also have significant impacts downstream beyond the Town of Prospect. These impacts are described below for the two Class C dams. Inundation areas associated with dam failures are included on Figure 8-1, Figure 8-2, and Figure 8-3.

Cheshire Reservoir Dam

Cheshire Reservoir is owned and operated by the Town of Prospect. It covers a surface area of approximately 6.9 acres. The outflow from Cheshire Reservoir is the headwaters for the Ten Mile River. The area downstream of Cheshire Reservoir slopes steeply to the northeast and is primarily undeveloped. The stream passes the Department of Public Works and the Veterans of Foreign Wars along Route 68 before reaching a residential area at the bottom of Plank Road. The Ten Mile River is then impounded as Mixville Pond in Cheshire.

A dam failure at Cheshire Reservoir would send a torrent of water down the Ten Mile River. No critical facilities in Prospect lie within the inundation area (Figure 8-1). Significant erosion would occur along the river channel that follows Route 68 and the bridges over the river at Chatfield Road, the nearby unnamed road, and the VFW would likely be undermined. Peak flood depths would likely overtop the unnamed road, Chatfield Road, and portions of Route 68. The Ten Mile River culvert under Route 68 near Plank Road would likely only sustain minor damage. The sudden increase in water levels could cause Mixville Pond Dam, another Class C dam, to fail. A subsequent failure of Mixville Pond Dam would cause a significant amount of additional damage to infrastructure and residential and industrial properties downstream in the Towns of Cheshire and Southington, including possible damage to critical facilities.

Waterbury Reservoir Dam #2

Waterbury Reservoir #2 is owned by the City of Waterbury. It is the headwaters of Turkey Hill Brook, a tributary of Beaver Pond Brook in Waterbury. The area downstream of Waterbury Reservoir Dam #2 in Prospect is lightly developed, consisting of some commercial buildings along Route 69 and primarily of single-family residential houses along Sherwood Road. Turkey Hill Brook drains north down a steep gradient into

the City of Waterbury before entering Beaver Pond Brook and eventually the Mad River. No critical facilities in Prospect lie within this area (Figure 8-2).

According to the DEEP Dam Safety Division, the 1998 Dam Failure Analysis states that a dam failure at Waterbury Reservoir Dam #2 at the top of the dam elevation would flood Route 69 to a depth of eight feet. Turkey Hill Brook downstream of Route 69 to Beaver Hill Brook would experience flood depths of five to ten feet. In Waterbury, the commercial areas nearby the confluence of Turkey Hill Brook and Beaver Hill Brook and local streets along Beaver Pond Brook would be inundated between two and nine feet. Downstream of Interstate 84, flood depths would be between one and nine feet. Flooding would not overtop Interstate 84. A failure of the Waterbury Reservoir has the potential to cause widespread flooding damage to the infrastructure and residential, commercial, and industrial areas in the Town of Prospect and the City of Waterbury. Some critical facilities in Waterbury may also be affected by the failure of this dam.

Loss Estimates

The failure of Cheshire Reservoir Dam would cause flooding along Tenmile River. This river was specifically analyzed by HAZUS and therefore dam failure losses can be approximated by losses estimated for the 1% annual chance flood. Estimated losses include eight tons of debris to remove, three households displaced, one person seeking shelter, building-related losses of $150,000, and no business interruption losses. These low figures are consistent with the rural nature of the river's floodplain in Prospect.

The failure of Waterbury Reservoir Dam #2 would cause flooding along Turkey Hill Brook. This brook was not specifically analyzed by HAZUS and therefore damages for the 1% annual chance flood were not estimated by the program. Given the potential damage described above (failure of Waterbury Reservoir Dam #2 would flood Route 69 to a depth of eight feet; Turkey Hill Brook downstream of Route 69 to Beaver Hill Brook would experience flood depths of five to ten feet), losses could be in the upper $100,000s for roadway damage alone. With private property damages added, losses in Prospect would like be several million dollars.

## 8.6 Potential Mitigation Strategies and Actions

Preventive measures associated with dam failure include semi-annual or annual inspections of each dam. Dam inspections in the State of Connecticut are required to be conducted by a licensed professional engineer. In addition, local communities should maintain a dialogue with Connecticut DEEP regarding the development of EAPs 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. Some of this will be forthcoming with the recent legislation.

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 as well as by including potential inundation areas in 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 100-year and 500-year floodplains described in Section 3 could be utilized to provide approximate failure inundation areas for the notification database.

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.

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, and maintaining upstream dams such that sequential failures do not occur.

With regard to the Cheshire Reservoir Dam, the Town of Prospect should work with the South Central Connecticut Regional Water Authority to update the Emergency Operations Plan for the dam, and prepare a new dam failure analysis if appropriate. The Town of Prospect should work with the City of Waterbury to ensure that proper maintenance is being performed on Waterbury Reservoir Dam #2, and that the Emergency Operations Plan and Dam Failure Analysis are up to date. The Town should continue to encourage the owners of the dams and the Connecticut DEP to conduct regular inspections, with maintenance performed as required to keep the dams in safe and functional order. The Town should also consider implementing an inspection program of any low and minor hazard dams it owns.

The Town of Prospect should also consider implementing an emergency notification system. Such a system would combine database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas or specific groups of people such as emergency responder teams. This technology could be used to warn downstream residents of an impending dam failure.

## *8.7 Status of Mitigation Strategies and Actions*

The prior mitigation strategies associated with dam failure are listed below with commentary regarding the status of each.

**TABLE 8-3**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| Continue to require or conduct regular inspections of all Class C dams, with upkeep and maintenance as required for keeping such dams in safe and functional order. | The state legislature passed an Act in 2013 to require owners of high and significant hazard dams to inspect their facilities and prepare inundation mapping and EAPs. This action is being addressed by the CT DEEP. |
| Consider implementing Town inspections of Class A, AA, B, and BB dams. | In accordance with the recent legislation, the town will defer to DEEP with regard to inspections of Class B and BB dams. The town does not own any of these dams. |
| Work with the Connecticut DEEP to ensure that the owners of Class C dams have up to date Emergency Operations Plans and Dam Failure Analyses. Copies of these documents should be made available at the Town Hall for reference and public viewing. | The town looks forward to receiving copies of EAPs as they are developed per the recent state legislation. These two actions have been carried forward (to two separate line items in Appendix A) to allow DEEP more time to work with dam owners and allow dam owners more time to file EAPs. |

Portions of the above strategies and actions have been carried forward and are listed in the table of strategies in Appendix A. New strategies have not been identified. With the legislature passed in 2013, dam assessment and management capabilities will continue to increase in the state. The next edition of this plan will revisit dams and discuss the outcomes of the legislation and any new regulations administered by the Connecticut DEEP.

# 9.0 WILDFIRES

## 9.1 Setting

The ensuing discussion about wildfires is focused on the undeveloped wooded, shrubby, or grassland areas of Prospect, along with low-density suburban type development found at the margins of these areas known as the wildland interface. Structural fires in higher density areas of the Town are not considered.

The Town of Prospect is a low-risk area for wildfires. Wildfires are of particular concern in wooded areas and other areas with poor access for fire-fighting equipment. Figure 9-1 presents a wildfire risk area with associated acreages for the Town of Prospect. Hazards associated with wildfires include property damage and loss of habitat. Wildfires of any type are considered a likely event each year, but should they occur are generally contained to a small range with limited damage to non-forested areas.

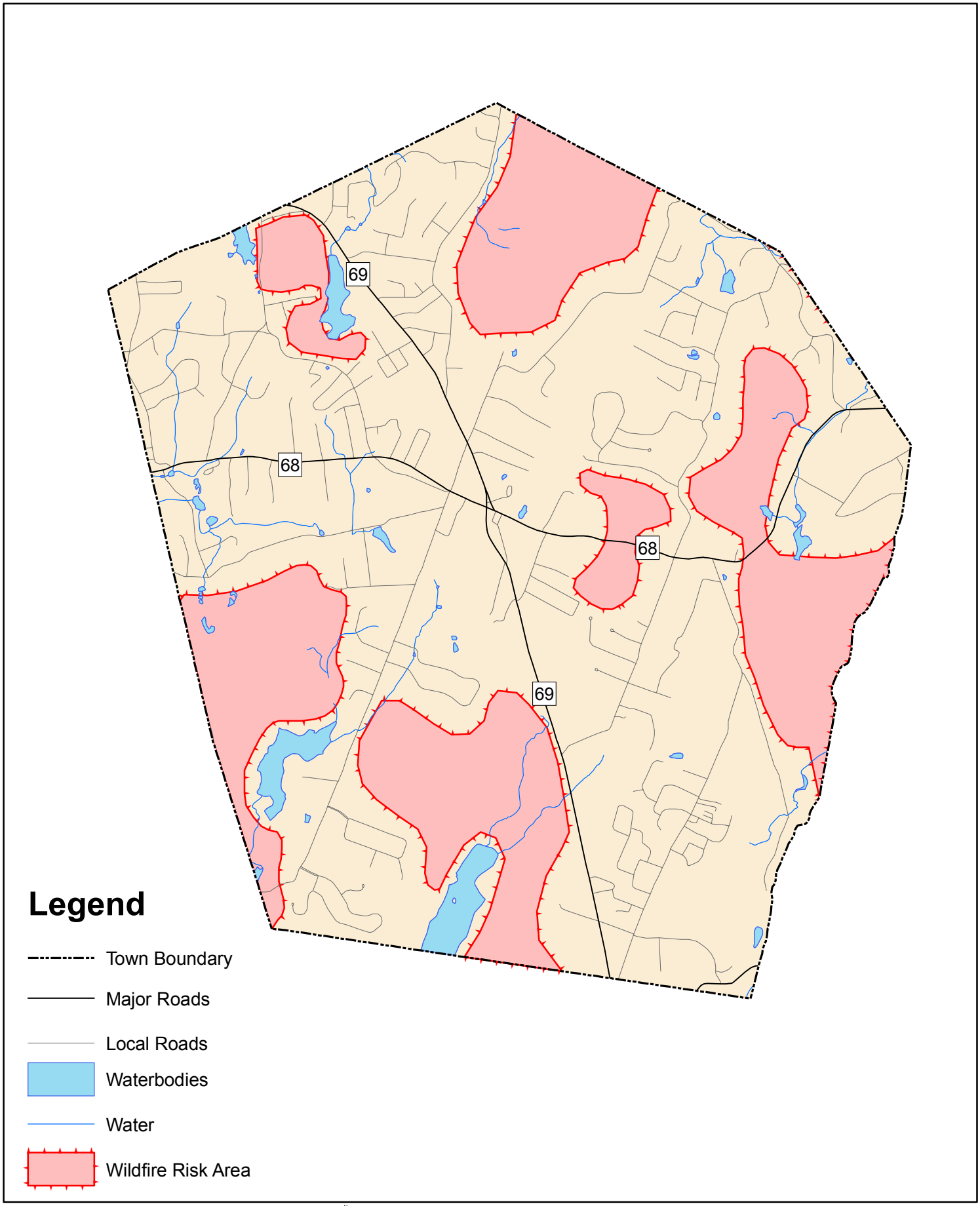
## 9.2 Hazard Assessment

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." 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. 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

# Figure 9-1: Prospect Wildfire Risk Areas




Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10/06.
"Town Boundary", "Hydrography", DEP
"Wildfire Areas", COGCNV
For general planning purposes only. Delineations may not be exact.
January 2008

N W E S

0 0.5 1 Miles

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- 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.

- 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 fire fighting 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. The Connecticut DEEP Forestry Division estimates the wildland fires burn approximately 1,300 acres per year.

The 2014 *Connecticut Natural Hazard Mitigation Plan Update* states that in seven of the eight counties in Connecticut, the primary cause of wildland fires is unknown. The secondary cause is identified as incendiary (arson) and debris burning.

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 3,448 acres of land burned in Connecticut from 2002 through 2012 due to 2,334 non-prescribed wildfires, an average of 1.5 acres per fire and 313 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 |
|---|---|---|---|---|---|
| 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** | **2,334** | **3,448** | **85** | **913** | **4,361** |

*Source: National Interagency Fire Center*

Traditionally, the highest forest fire danger in Connecticut occurs in the spring from mid-March to mid-May. The worst wildfire year in Connecticut since 1994 occurred during the extremely hot and dry summer of 1999. Over 1733 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, and a wildfire in 1986 in the Mattatuck State Forest in the nearby Town of Watertown, CT burned 300 acres.

The Town of Prospect reports that few wildfires have occurred since the adoption of the previous HMP.

## 9.4 Existing Capabilities

Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. The Town of Prospect has a four-wheel drive brush truck capable of accessing remote fires, and several pumpers can carry extra lines of hose to supplement the range of this truck.

Unlike wildfires on the west coast of the United States where the fires are allowed to burn toward development and then stopped, the Prospect Fire Department goes to the fires. This proactive approach is believed to be effective for controlling wildfires. The fire department has some water storage capability, but primarily relies on the Connecticut Water Company's (CWC) water service or other water sources. Most of the area of Prospect has water service that includes fire protection hydrants. Other areas use dry hydrants and fire ponds. The availability of fire-fighting water speeds the containment time for most fires occurring in the Town.

The Town of Prospect encourages developers to extend water mains as part of their construction process. Three major water main projects occurred during 2007. The Town extended an eight-inch water main 4,000 feet along Cambridge Drive and Ivy Terrace. A private developer extended a 12-inch water main 6,196 feet along Scott Road and Oak Lane, and the Connecticut Water Company extended a 12-inch water main 6,660 feet along Straitsville Road and Salem Road. In addition, two new dry hydrants were installed.

Education is also an important element of existing mitigation. The Prospect Fire Department website (http://www.prospectfire.org) provides links to other websites that promote education on fire prevention and safety.

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 NWS 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. However, the Town of Prospect does not currently allow open burning. If the town allows it in the future, the State’s program will be followed.

Aside from moderate changes in State policy, the town's capabilities to mitigate for wildfires and prevent loss of life and property have not changed significantly since the initial hazard mitigation plan was adopted. The town will continue to evaluate whether capabilities need to be strengthened in the future.

## 9.5 Vulnerabilities and Risk Assessment

Wildfires can occur anywhere and at any time in undeveloped or 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 DEP, the actual forest fire risk in Connecticut is low due to several factors. First, the overall incidence of forest fires is very low. 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. Finally, trained fire fighters at the local and state level are readily available to fight fires in the state, and inter-municipal cooperation on such instances is common.

Based on 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 most extreme wildfire recorded in the past 20 years that burned 300 acres. Given the availability of fire-fighting water in the Town, including the use of dry hydrants and fire ponds, and long-standing mutual aid assurances the Town Fire Department has with neighboring communities, it is believed that these average and severe values are applicable to the Town as well.

The wildfire risk areas presented in Figure 9-1 were defined as being contiguous wooded areas greater than 50 acres in size that have limited access. These areas are generally associated with wooded water company lands and each area borders residential sections of the Town. Therefore, residents on the outskirts of these risk areas are the most vulnerable to fire, heat, and smoke effects of wildfires.

Despite having a large amount of forest/urban interface, the overall risk of wildfires occurring in the Town of Prospect is also considered to be low. Such fires fail to spread far due to speed of detection and strong fire response. As most of the Town has fire-fighting water available nearby, a large amount of water can be made readily available for fire fighting equipment. The Town also has the support of the local water companies to provide access to their extensive watershed lands in case of a wildfire.

Recall from Figures 2-7 and 2-8 that elderly, linguistically isolated, and disabled populations reside in the Town of Prospect. In comparing these figures with the wildfire risk areas presented in Figure 9-1, it is possible that several hundred of the population impacted by a wildfire could consist of the elderly, up to 40 could consist of linguistically isolated households, and several hundred with disabilities could reside near wildfire impact areas. Thus, it is important for the Prospect Fire Department to be prepared to assist these special populations during a wildfire emergency.

Water company lands are considered at greatest risk for developing a larger wildfire due to their undeveloped nature and limited access for fire-fighting equipment. Should a wildfire occur, it seems reasonable to estimate that the average area to burn would be five acres, consistent with the state average during long period of drought. In the case of an extreme wildfire during a long drought on watershed lands, it is estimated that up to 200 acres could burn before containment due to the limited access of those lands. Residential areas bordering such lands would also be vulnerable to wildfire, but would likely be more impacted by heat and smoke than by structure fires due to the strong fire response in the Town.

*Loss Estimates* – The 2014 Connecticut Natural Hazard Mitigation Plan provides annual estimated losses on a countywide basis for several hazards. Based on the population of Prospect relative to New Haven County, the annual estimated loss is $611 for wildfires. This is considered reasonable for wildfires experienced in Prospect.

## 9.6 Potential Mitigation Strategies and Actions

Potential mitigation measures for wildfires include a mixture of prevention, education, and emergency planning. Although educational materials are through the Fire Department, they should be made available at other municipal offices as well. 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.

Water system improvements are an important class of potential mitigation for wildfires and will remain important in Prospect. However, few improvements are believed necessary at the present time.

## 9.7 Status of Mitigation Strategies and Actions

The prior mitigation strategies associated with wildfires are listed below with commentary regarding the status of each.

**TABLE 9-2**
**Status of Previous Strategies and Actions**

| Strategy or Action | Status |
|---|---|
| The Town should continue to encourage the CWC to extend the public water supply systems into areas within growth boundaries that require water for fire protection. | CWC must extend its system as funding allows, and as these extensions fit into its overall capital improvement program. This strategy is in progress and will be carried forward. |
| The Town should continue to assist the CWC in identifying and upgrading those portions of the public water supply systems that are substandard from the standpoint of adequate pressure and volume for fire-fighting purposes. | CWC must upgrade its system as funding allows, and as these upgrades fit into its overall capital improvement program. This strategy is in progress and will be carried forward. |
| Innovative solutions to fire protection should be explored where it is not feasible to extend a conventional water system. One example of a fire protection solution would be the use of fire ponds and dry hydrants. This task would be best designated to the Department of Public Works. | The town currently utilizes dry hydrants and tanks and this approach has been effective. |
| Continue to promote inter-municipal cooperation in fire fighting efforts. | This is ongoing and part of the town's capabilities. |
| Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment. | This is ongoing and part of the town's capabilities. |
| Review subdivision applications to ensure new neighborhoods and driveways are properly sized to allow access of emergency vehicles. | Applications are reviewed by the Fire Marshal. Therefore, this strategy is now part of the town's capabilities. |
| Provide outreach programs including tips on how to properly manage burning and campfires on private property. | This is ongoing and part of the town's capabilities. |
| Patrol Town-owned open space and parks to prevent unauthorized campfires. | This is ongoing and part of the town's capabilities. |
| Distribute copies of a booklet such as "Is Your Home Protected from Wildfire Disaster? – A Homeowner's Guide to Wildfire Retrofit" when developers and homeowners pick up or drop off applications in the Building Department. | Other publications are available to the public. This strategy will be removed. |
| Enforce regulations and permits for open burning. | The town does not allow open burning. This strategy will be deleted. |
| Continue to place utilities underground. | This is ongoing and part of the town's capabilities. |

Most of the above strategies and actions are already ongoing and are part of the town's capabilities. One new strategy for wildfire mitigation has resulted from the development of this plan.

- ❑ Consider identifying elevated wildfire risk areas and ensure that the appropriate methods are in place to reduce this risk.

# 10.0 MITIGATION STRATEGIES AND ACTIONS

## 10.1 Additional Strategies

Strategies that are applicable to a small number of hazards were discussed in the applicable subsections of Sections 3.0 through 9.0. For example, placing utilities underground is a strategy for hurricane, summer storm, winter storm, and wildfire mitigation. A remaining class of "all-hazard" strategies is applicable to all hazards, because it includes actions for improving public safety and planning for emergency response. Instead of repeating these strategies in each of this Plan, these are described below.

Prospect has made great progress with most of the all-hazard strategies described in the previous HMP. Preparedness and disaster-related information is continuously provided in municipal facilities, and the town subscribes to the CodeRED notification system. The town's EOP is reviewed annually and updated as needed. These previous strategies are now considered capabilities.

Two new all-hazard actions are proposed in this plan:

- Acquisition and installation of additional standby power supplies (generators). Several critical facilities require standby power supplies. Consider, for example, that power outages caused by storms Irene, Sandy, and Alfred caused outages at some of the town's facilities. The town would prefer to avoid these situations going forward.
- Continue to work with CT DEEP and the Connecticut Agricultural Experiment Station in order to manage the Emerald Ash Borer in Prospect. [this action was introduced in Chapter 3 in the context of flooding due to concerns about obstructed waterways, but it also applies to wind hazards].

## 10.2 Summary of Proposed Strategies and Actions

Strategies and actions have been presented throughout this document in individual sections as related to each natural hazard. 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. The STAPLEE method was used in the previous HMP.

Overview of the STAPLEE Prioritization Process

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 the region 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 each community to administer future mitigation or emergency response actions?
  - Costs: Does each community have the capability (staff, technical experts, and/or funding) to implement the action, or can it be readily obtained? Can the community 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 community 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? Should the considered action 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" 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" 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 (x2) in the final sum of scores.
- The total benefit score and cost score for each mitigation strategy were 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 suggested action is presented in Appendix A. Page 1 of the STAPLEE matrix lists all of the strategies and actions from the previous edition of this HMP with commentary for each, plus new strategies and actions. The commentary in the matrix is based on the status of each as presented in the applicable sections of chapters 3 through 10. Page 2 lists only those previous strategies that are carried forward plus the new strategies and actions. Page 2 of the STAPLEE matrix presents the summary of scores. The highest scoring is determined to be of more importance economically, socially, environmentally, and politically and, hence, prioritized over those with lower scoring. In addition, structural projects were also evaluated qualitatively. Note that the scoring system inherently favors actions that have minimal incremental costs, such as modifying regulations (which is accomplished by existing municipal personnel and commissions).

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

Calculation of cost estimates for actions 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 action is therefore listed as "minimal", "low", "intermediate", or "high" on the STAPLEE matrix. These identifiers are defined as follows:

- "Low" costs only include printing, copying, or meetings of personnel. Direct expenditures are expected to be less than $1,000 (staff time is not included).
- "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.

## 10.3 Priority Strategies and Actions

The STAPLEE scores were used to prioritize the suggested mitigation strategies and actions. The highest ranking actions are listed below. The town plans to prioritize these actions with the scores above 6.0 in the next few years:

- Continue to work with CT DEEP and the Connecticut Agricultural Experiment Station in order to manage the Emerald Ash Borer.
- Continue to restrict vehicular access to Town property to prevent ATV use.
- Work with the Connecticut DEEP to ensure that each Class C dam has an up to date EOP/EAP, O&M Manual, and Dam Failure Analyses.
- Improve drainage from Route 68 to reduce flooding of Oxford General Industries at the corner of Gramar Road and Route 68.

## 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 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 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 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.S. Fire Administration**

**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 Prospect is authorized to update this hazard mitigation plan as described below and guide it through the FEMA approval process.

*Local Coordinator* – As individual recommendations of the hazard mitigation plan are implemented, they must be implemented by the municipal departments that oversee these activities. The Office of the Mayor and the Public Works Department in the Town of Prospect will primarily be responsible for developing and implementing selected projects, although other departments such as Office of the Land Use Inspector and the Fire Department will oversee or jointly oversee some projects. **A "local coordinator" will be selected as the primary individual in charge. This will be the Mayor.**

*Implementation* – Appendix A incorporates an implementation strategy and schedule, detailing the responsible department and anticipated time frame for the specific recommendations listed throughout this document.

Upon adoption, the Plan will be made available to all Town departments and agencies as a planning tool to be used in conjunction with existing documents. It is expected that revisions to other Town plans and regulations, such as the Plan of Conservation and Development, department annual budgets, and the Zoning and Subdivision Regulations, will reference this plan and its updates. The local coordinator and the Office of the Mayor will be responsible for ensuring that the actions identified in this plan are incorporated into ongoing Town planning activities, and that the information and requirements of this plan are incorporated into existing planning documents within five years from the date of adoption or when other plans are updated, whichever is sooner.

The local coordinator Office of the Mayor will be responsible for assigning appropriate Town officials to update the POCD, Zoning Regulations, Subdivision Regulations, Wetlands Regulations, and Emergency Operations Plan to include the provisions in this plan. Should a general revision be too cumbersome or cost prohibitive, simple addendums to these documents will be added that include the provisions of this plan.

The POCD and the Emergency Operations Plan are the two documents most likely to benefit from the inclusion of the Plan in the Town's library of planning documents. In particular, the POCD was updated in 2013-2014 with an effective date of February 1, 2014. Elements of the town's initial hazard mitigation plan were incorporated into some of the goals of the updated POCD. For example as noted in Section 3.4 of this HMP, Goal #6 of the updated POCD is *"Protection of Steep Slopes, Inland Wetlands & Floodplains: Certain topographic features present severe limitations on the suitability of sites for urban development. Steep slopes, inland wetlands and floodplains should be avoided as development locations."* The three recommended actions for this goal are:

- "Continue to regulate inland wetlands and waterways to prevent their filling and degradation;
- Continue requirement of Soil Erosion and Sedimentation Plans; and
- Continue restriction of development within floodplains and flood hazard areas as identified by the Federal Emergency management Agency (FEMA) mapping."

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 in this plan. This will primarily include the annual budget and capital improvement projects lists maintained and updated by the Town Public Works Department. Actions from the initial hazard mitigation plan were not directly incorporated into the previous capital improvement plan, but the town plans to make a better effort to incorporate some of the applicable actions from this update to the next capital improvement plan.

## 11.2 Progress Monitoring and Public Participation

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 associated with specific actions. Examples include structural projects. This will ensure that the suggested actions remain viable and appropriate. The worksheet in Appendix C will be filled out for specific project-related actions as appropriate. This worksheet is taken from the *Local Mitigation Planning Handbook.*

The local coordinator will be responsible for obtaining a current list of repetitive loss properties (RLPs) in the community each year. This list is available from the 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. The town understands that it currently does not include any RLPs within its boundaries.

*Annual Reporting and Meeting* – The local coordinator will be responsible for holding 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 be reviewed also. A

meeting should be conducted in March or April of each year, at least two months before the annual application cycle for grants under the HMA program[1]. 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.

*Post-Disaster Reporting and Metering* – Subsequent to federally-declared disasters in the State of Connecticut for New Haven 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 the town's web site and the COGCNV website.

## 11.3 Updating the Plan

The town will update the hazard mitigation plan if a consensus to do so is reached by the Town Council of Prospect or at least once every five years. Updates to this HMP will be coordinated by the local coordinator. The town 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 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 plan update is being developed; the assistance of COGCNV may be solicited from time to time for this purpose.

Table 11-1 presents a schedule to guide the preparation for the plan update and then the actual update of the plan. The schedule assumes that the current version of this plan was adopted in February 2015 and will therefore expire in February 2020.

[1] PDM and FMA applications are typically due to the State in the summer of any given year.

**Table 11-1**
**Schedule for Hazard Mitigation Plan Update**

| Month and Year | Tasks |
|---|---|
| February 2016 | Annual meeting to review plan content and progress |
| February 2017 | Annual meeting to review plan content and progress |
| February 2018 | Annual meeting to review plan content and progress |
| June 2018 | Ensure that funding for the plan update is included in the fiscal year 2018-2019 budget |
| December 2018 | Secure consultant to begin updating the plan, or begin updating in-house |
| February 2019 | Annual meeting to review plan content and progress |
| August 2019 | Forward draft updated plan to State for review |
| October-December 2019 | Process edits from State and FEMA and obtain the Approval Pending Adoption (APA) |
| February 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, local business leaders, community and neighborhood group leaders, relevant private and non-profit interest groups, and the neighboring municipalities will be solicited for representation, including the following:

- COGCNV
- City of Waterbury
- Town of Cheshire
- Town of Bethany
- Town of Naugatuck

The project action worksheets prepared by the local coordinator and annual reports described above 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, adding suggested actions as new hazard effects arise, or modifying hazard vulnerabilities as land use changes. For instance, several prior actions were removed from the HMP while preparing this update because they had become institutionalized capabilities, they were successfully completed, or they were subsumed by more specific local or State actions.

## 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.

Response & Recovery Division

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.

**Natural Hazards Center**
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.

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# APPENDIX A
# STAPLEE MATRIX

| Part 1: Previous Strategiesand Actions for Prospect | Associated Report Sections | | | | | | | Category | Status | Explanation/Comment | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inland Flooding | Hurricanes | Summer Storms and Tornadoes | Winter Storms | Earthquakes | Dam Failure | Wildfires | 1. Prevention<br>2. Property Protection<br>3. Natural Resource Prot.<br>4. Structural Projects<br>5. Public Information<br>6. Emergency Services | Is the strategy in the prior edition of the plan? | | |
| **ALL HAZARDS** | | | | | | | | | | | |
| Dissemination of informational pamphlets regarding natural hazards to public locations | x | x | x | x | x | x | x | 1,2,5 | Yes | Continuously provided in library and senior center | Remove |
| Implementation of an emergency notification system | x | x | x | x | x | x | x | 1,2,5 | Yes | CodeRED is used in Prospect | Delete |
| Continue to review and update Emergency Operations Plan, at least once annually | x | x | x | x | x | x | x | 1 | Yes | Last updated in 2011 | Remove |
| **FLOODING - Prevention** | | | | | | | | | | | |
| Streamline the permitting process to ensure maximum education of developer or applicant | x | x | x | x | x | | x | 1 | Yes | Land Use official is responsible for this | Delete |
| Petition FEMA to more critically evaluate Letters of Map Amendment and Letters of Map Change Applications to prevent flooding increases | x | x | x | x | | x | | 1 | Yes | Only a few have been submitted and processed in the last few years | Delete |
| Consider joining FEMA's Community Rating System | x | x | x | x | | | | 1 | Yes | Not cost effective; few NFIP policies in town | Delete |
| Continue to require Flood Hazard Area, subdivision, and commercial and industrial permits applications to provide needed flood data | x | x | x | x | | x | | 1 | Yes | Land Use official is responsible for this | Remove |
| Require new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of SFHA | x | x | x | x | | | | 1,2 | Yes | Applications in flood hazard areas are not common | Delete |
| Require that new buildings be designed and graded to shunt drainage away from the building | x | x | x | x | | | | 1,2 | Yes | This is part of the building code and can be deleted | Delete |
| Assist with the Map Mod Program | x | x | x | x | | x | | 1 | Yes | Complete | Delete |
| Use the Town two-foot contour maps to develop more exact regulatory flood maps using FEMA flood elevations | x | x | x | x | | | | 1 | Yes | Detailed topo is not available; development in SFHAs is minimal | Delete |
| **FLOODING - Property and Natural Resource Protection** | | | | | | | | | | | |
| Acquire open space properties within SFHAs and set aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use | x | x | x | x | | x | | 2,3 | Yes | Open space has been acquired but not in SFHAs | Carry forward |
| Selectively pursue conservation objectives listed in the Plan of Conservation & Development, including the protection of riparian zones | x | x | x | x | | | | 3 | Yes | This occurs as part of land use applications | Remove |
| Continue to regulate development in protected and sensitive areas, including steep slopes, wetlands, and floodplains | x | x | x | x | x | x | x | 3 | Yes | This occurs as part of land use applications | Remove |
| **FLOODING - Structural Projects** | | | | | | | | | | | |
| Commission a Town-wide stormwater management system study, including mathematical models for developers. Update every five years. | x | x | x | x | | x | | 1,4 | Yes | No longer believed necessary | Delete |
| Investigate reports of localized flooding problems to determine cause and appropriate solution. Set goals for eliminating recurring localized flood areas | x | x | x | x | | | | 4 | Yes | This is done as needed | Carry forward |
| Continue to restrict vehicular access to Town property to prevent ATV use | x | x | x | x | | | x | 2,3,4 | Yes | This is an ongoing problem that requires attention | Carry forward |
| Increase the size of the Plank Road culvert to prevent the flooding of nearby septic fields | x | x | x | x | | | | 2,4 | Yes | Not completed; carry forward | Carry forward |
| Increase the size fo the culvert for Roaring brook on Roaring Brook road. If necessary, raise the level of the road to accommodate | x | x | x | x | | | | 2,4 | Yes | Not completed; carry forward | Carry forward |
| Petition the state to increase the size of the culvert under Route 68 near the Public Works garage to reduce flooding/icing | x | x | x | x | | | | 4 | Yes | Not completed; carry forward | Carry forward |
| Petition the state to increase the size of the 36-inch culvert under Route 68 near Spring Road to pass a greater than 100-year storm event | x | x | x | x | | | | 4 | Yes | Not completed; carry forward | Carry forward |
| Continue participating in the Connecticut DEP Stormwater Management Program | x | x | x | x | | | | 3 | Yes | The town is compliant per EPA/DEEP regulations | Remove |
| Continue oversizing culverts and drainage structures | x | x | x | x | | x | | 2 | Yes | The town routinely requires oversizing | Remove |
| Improve drainage from Route 68 to reduced flooding of Oxford General Industries at the corner of Gramar Road and Route 68 | x | x | x | | | | | 4 | No | New strategy | New strategy |
| Replace undersized culverts at Putting Green Lane | x | x | x | | | | | 4 | No | New strategy | New strategy |
| **WIND DAMAGE RELATED TO HURRICANES, SUMMER STORMS, AND WINTER STORMS** | | | | | | | | | | | |
| Increase tree limb inspections and maintenance, especially along evacuation routes | | x | x | x | x | | | 1,2 | Yes | Inspections and maintenance have increased | Remove |
| Continue outreach regarding dangerous trees on private property | | x | x | x | x | | | 1,2 | Yes | Progress continues; carry forward | Remove |
| Continue to require that utilities be placed underground in new developments and pursue funding to move them underground in existing areas | x | x | x | x | | x | x | 2 | Yes | True for new developments; little interest for existing overhead lines | Remove |
| Continue to require compliance with the amended Connecticut Building Code for wind speeds | | x | x | x | | | | 2 | Yes | This is part of the building code and can be deleted | Delete |
| Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards | | x | x | x | | | | 1 | Yes | The building official does this | Delete |
| Ensure adequate notification systems exist to provide Cook Road mobile home residents with as much warning of an approaching tornado as possible | | | x | | | | | 2,4 | Yes | CodeRED is used in Prospect | Delete |
| Acquire standby power supplies for critical facilities such as the Public Works building that do not have generators | | | | | | | | | No | New Strategy | New Strategy |

| Part 1: Previous Strategiesand Actions for Prospect | Associated Report Sections | | | | | | | Category | Status | Explanation/Comment | Outcome |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Inland Flooding | Hurricanes | Summer Storms and Tornadoes | Winter Storms | Earthquakes | Dam Failure | Wildfires | 1. Prevention<br>2. Property Protection<br>3. Natural Resource Prot.<br>4. Structural Projects<br>5. Public Information<br>6. Emergency Services | Is the strategy in the prior edition of the plan? | | |
| **WINTER STORMS** | | | | | | | | | | | |
| Petition the State DOT to construct drainage improvements to reduce icing on Routes 68 and 69 | x | x | x | x | | | | 1,4 | Yes | This is in progress; carry forward | Carry forward |
| Compile and post a final list of plowing routes, prioritizing egress to shelters and critical facilities | | | | x | | | | 5 | Yes | This is in progress; carry forward | Carry forward |
| Complete and disseminate evacuation plan to ensure timely evacuation of shelterees from all areas of Prospect | x | x | x | x | x | x | x | 1,5 | Yes | This is in progress; carry forward | Carry forward |
| Provide educational materials to property owners regarding using shutters, storm windows, pipe insulators, and removing snow from flat roofs | | x | x | x | | | | 2,5 | Yes | CodeRED is used to warn of heavy snow and roof risks | Remove |
| Provide educational materials with safety tips and reminders regarding cold weather | | | | x | | | | 1,5 | Yes | Continuously provided in library and senior center | Delete |
| Encourage two modes of egress into every neighborhood by the creation of through streets | x | x | x | x | x | x | x | 1 | Yes | Town allows dead-end roads; delete | Delete |
| Fund the purchase of an emergency power generator at the Boulder Brook Court sewer pumping station | | x | x | x | | | | | Yes | This is a critical facility; carry forward | Carry forward |
| Deevlop a plan to priortize snow removal from the roof of critical facilites and other municipal buildings each winter | | | | | | | | | No | New Strategy | New Strategy |
| **EARTHQUAKES** | | | | | | | | | | | |
| Consider preventing new residential development in areas prone to collapse | | | | | x | | | 1 | Yes | Land Use official is responsible for this | Delete |
| Consider preventing residential development in areas on or below steep slopes (slopes exceeding 30%) as per the Plan of Conservation & Development | | | | | x | | | 1 | Yes | Land Use official is responsible for this | Remove |
| Continue to require adherence to the state building codes | | x | x | x | x | | | 1 | Yes | This is part of the building code and can be deleted | Delete |
| Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs | | x | x | x | x | | | 1 | Yes | All critical facilities except one have standby power | Carry forward |
| Consider adding braces to at-risk faciities inside municipal buildings, such as shelves in the library | | | | | x | | | 1 | No | New strategy | New strategy |
| **DAM FAILURE** | | | | | | | | | | | |
| Continue to encourage DEP and dam owners of Class C dams to inspect their dams and perform or require upkeep and maintenance as needed | x | | | | | x | | 2,4 | Yes | DEEP responsibility | Delete |
| Consider implementing Town inspections of municipally owned Class A, AA, and BB dams | x | | | | | x | | 2,4 | Yes | The town does not own any dams; delete | Delete |
| Work with the Connecticut DEP to ensure that each Class C dam has an up to date EOP, O&M Manual, and Dam Failure Analyses | x | | | | | x | | 1 | Yes | This has not been completed; carry forward | Carry forward |
| Have copies of the Class C dam EOPs and Dam Failure Analyses on file at the Town Hall for public viewing | | | | | | x | | 5 | Yes | This has not been completed; carry forward | Carry forward |
| **WILDFIRES** | | | | | | | | | | | |
| Encourage the Connecticut Water Company extend/upgrade the public water supply systems into areas requiring water for fire protection | | | x | | | | x | 4 | Yes | This is in progress; carry forward | Carry forward |
| Explore other fire protection solutions when water main extensions are not feasible, such as the use of fire ponds | | | x | | | | x | 4 | Yes | Cisterns with dry hydrants are required | Remove |
| Continue to promote inter-municipal cooperation in fire-fighting efforts | | | x | | | | x | 1 | Yes | Complete and ongoing | Remove |
| Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment | | | | | | | x | 5 | Yes | Complete and ongoing | Remove |
| Distribute copies of "Is Your Home Protected from Wildfire Disaster?" booklet in the Building Department | | | | | | | x | 2,5 | Yes | Delete; this information is not needed | Delete |
| Consider having Police and Fire Departments review subdivision applications to ensure proper access for emergency vehicles | x | x | x | x | x | x | x | 1 | Yes | Complete and ongoing | Remove |
| Provide outreach programs that include tips on how to properly manage burning and campfires on private property | | | | | | | x | 5 | Yes | Open burning is no longer allowed | Delete |
| Patrol Town-owned open space and parks to prevent campfires | | | | | | | x | 3 | Yes | Complete and ongoing | Remove |
| Enforce regulations and permits for open burning | | | | | | | x | 1,3 | Yes | Open burning is no longer allowed | Delete |
| Consider identifying elevated wildfire risk areas and ensure that the appropriate methods are in place to reduce this risk | | | | | | | | | No | New Strategy | New Strategy |

Carry forward: strategy is carried forward to the updated plan
Delete: strategy may be deleted from the plan because it has been completed or is no longer applicable or necessary
Remove: activity is ongoing and will continue in its current capacity and level of effort, so the strategy has been moved to a separate list
New strategy: strategy was not in the last edition of the plan

| | Part 2: Current Strategies and Actions for Prospect | Category<br>1. Prevention<br>2. Property Protection<br>3. Natural Resource<br>4. Structural Projects<br>5. Public Information<br>6. Emergency Services | Responsible Department[1] | Timeframe | Cost<br>Low = Minimal[2]<br>Intermediate = <$100,000<br>High = >$100,000 | Potential Funding Sources[3] | Weighted STAPLEE Criteria[4] – Benefits | | | | | | | | Costs | | | | | | | | Total STAPLEE Score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Social | Technical (x2) | Administrative | Political | Legal | Economic (x2) | Environmental | **STAPLEE Subtotal** | Social | Technical (x2) | Administrative | Political | Legal | Economic (x2) | Environmental | **STAPLEE Subtotal** | |
| | **ALL HAZARDS** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Acquire standby power for critical facilities, such as the Public Works garage | 6 | PW | 7/2015-6/2016 | Intermediate | HMA*, STEAP | 1 | 1 | 1 | 1 | 1 | 1 | 0 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 2 | Fund the purchase of an emergency power generator at the Boulder Brook Court sewer pumping station | 6 | Mayor | 7/2016-6/2017 | Intermediate | HMA*, STEAP | 1 | 1 | 1 | 1 | 1 | 1 | 0 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 3 | Continue to work with CT DEEP and the Connecticut Agricultural Experiment Station in order to manage the Emerald Ash Borer | 3 | PW | 7/2015-6/2016 | Low | Municipal/OB, State | 1 | 1 | 1 | 1 | 1 | 1 | 1 | **9.0** | 0 | 0 | 0 | 0 | 0 | -0.5 | 0 | **-1.0** | ***8.0*** |
| | **FLOODING** | | | | | | | | | | | | | | | | | | | | | | |
| 4 | Pursue the acquisition of additional open space properties within SFHAs | 3 | Mayor | 7/2015-6/2019 | High | Prospect Land Trust | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 5 | Continue to restrict vehicular access to Town property to prevent ATV use | 2 | PW | 7/2015-6/2016 | Low | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0 | 1 | **7.0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | ***7.0*** |
| 6 | Continue oversizing culverts and drainage structures | 2,4 | PW | 7/2015-6/2019 | High | Municipal/CIP | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 7 | Increase the size of the Plank Road culvert to prevent the flooding of nearby septic fields | 2,4 | PW | 7/2016-6/2017 | High | Municipal/CIP, HMA* | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 8 | Increase the size of the culvert for Roaring brook on Roaring Brook road. If necessary, raise the level of the road to accommodate | 2,4 | PW | 7/2016-6/2017 | High | Municipal/CIP, HMA* | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| 9 | Petition the state to increase the size of the culvert under Route 68 near the former Public Works garage to reduce flooding/icing | 2,4 | PW | 7/2015-6/2018 | High | CT DOT | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 1 | **7.5** | 0 | 0 | -0.5 | 0 | 0 | -1 | 0 | **-2.5** | ***5.0*** |
| 10 | Petition the state to increase the size of the 36-inch culvert under Route 68 near Spring Road to pass a greater than 100-year storm event | 2,4 | PW | 7/2015-6/2018 | High | CT DOT | 1 | 1 | 1 | 1 | 0.5 | 0.5 | 1 | **7.5** | 0 | 0 | -0.5 | 0 | 0 | -1 | 0 | **-2.5** | ***5.0*** |
| 11 | Improve drainage from Route 68 to reduce flooding of Oxford General Industries at the corner of Gramar Road and Route 68 | 2,4 | PW | 7/2016-6/2017 | High | Municipal/CIP, HMA* | 1 | 1 | 1 | 1 | 0.5 | 1 | 1 | **8.5** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.5*** |
| 12 | Replace and increase the capacity of the undersized culverts at Putting Green Lane | 2,4 | PW | 7/2016-6/2017 | High | Municipal/CIP, HMA* | 1 | 1 | 1 | 1 | 1 | 0.5 | 1 | **8.0** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***6.0*** |
| | **WIND DAMAGE RELATED TO HURRICANES AND SUMMER STORMS; WINTER STORMS** | | | | | | | | | | | | | | | | | | | | | | |
| 13 | Increase tree limb inspections and maintenance, especially along evacuation routes | 6 | PW | 7/2016-6/2017 | High | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0.5 | 0 | **7.0** | 0 | 0 | -0.5 | 0 | 0 | -0.5 | 0 | **-1.5** | ***5.5*** |
| 14 | Continue outreach regarding dangerous trees on private property | 2 | PW | 7/2015-6/2016 | High | Municipal/OB | 1 | 1 | 1 | 1 | 0.5 | 0 | 0 | **5.5** | 0 | 0 | -0.5 | 0 | 0 | -0.5 | 0 | **-1.5** | ***4.0*** |
| 15 | Compile and post a final list of plowing routes, prioritizing egress to shelters and critical facilities | 5 | EMS | 7/2015-6/2016 | Low | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0 | 0 | **6.0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | ***6.0*** |
| 16 | Complete and disseminate evacuation plan to ensure timely evacuation of shelterees from all areas of Prospect | 5 | EMS | 7/2016-6/2017 | Low | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0 | 0 | **6.0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | ***6.0*** |
| | **EARTHQUAKES** | | | | | | | | | | | | | | | | | | | | | | |
| 17 | Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs | 6 | EMS | 7/2016-6/2019 | Low | Municipal, EOC, STEAP | 1 | 1 | 1 | 1 | 1 | 0 | 0 | **6.0** | 0 | 0 | 0 | 0 | 0 | -0.5 | 0 | **-1.0** | ***5.0*** |
| 18 | Consider adding braces to at-risk faciities inside municipal buildings, such as shelves in the library | 6 | PW | 7/2017-6/2018 | Intermediate | Municipal, EOC, STEAP | 1 | 1 | 1 | 0.5 | 1 | 0.5 | 0 | **6.5** | 0 | 0 | 0 | 0 | 0 | -0.5 | 0 | **-1.0** | ***5.5*** |
| | **DAM FAILURE** | | | | | | | | | | | | | | | | | | | | | | |
| 19 | Work with the Connecticut DEEP to ensure that each Class C dam has an up to date EOP/EAP, O&M Manual, and Dam Failure Analyses | 4 | PW | 7/2015-6/2016 | High | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0 | 1 | **7.0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | ***7.0*** |
| 20 | Place copies of the Class C dam EOPs/EAPs and Dam Failure Analyses on file at the Town Hall for public viewing | 5 | PW | 7/2015-6/2016 | Low | Municipal/OB | 1 | 1 | 1 | 1 | 1 | 0 | 0 | **6.0** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **0.0** | ***6.0*** |
| | **WILDFIRES** | | | | | | | | | | | | | | | | | | | | | | |
| 21 | Consider identifying elevated wildfire risk areas and ensure that the appropriate methods are in place to reduce this risk | 2 | Fire Department | 7/2017-6/2018 | Low | Municipal/OB | 1 | 1 | 1 | 1 | 0.5 | 0 | 0 | **5.5** | 0 | 0 | -0.5 | 0 | 0 | -0.5 | 0 | **-1.5** | ***4.0*** |
| 22 | Continue to assist Connecticut Water Company in identifying and upgrading portions of the public water supply system | 2 | Fire Department | 1/2016-12/2019 | Low | Connecticut Water Co. | 1 | 1 | 1 | 1 | 0.5 | 1 | 0 | **7.5** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***5.5*** |
| 23 | Encourage the Connecticut Water Company extend/upgrade the public water supply systems into areas requiring water for fire protection | 6 | Fire Department | 1/2016-12/2019 | Intermediate | Connecticut Water Co. | 1 | 1 | 1 | 1 | 0.5 | 1 | 0 | **7.5** | 0 | 0 | 0 | 0 | 0 | -1 | 0 | **-2.0** | ***5.5*** |

Notes:

NOTES
1. Departments:
   EMS = Emergency Management Services
   PW = Department of Public Works
2. Low = To be completed by staff or volunteers where costs are primarily printing, copying, or meetings and costs are less than $10,000; Moderate = Costs are less than $100,000; High = Costs are > than $100,000.
3. Funding sources:
   Municipal/OB = Municipal operating budgets
   Municipal/CIP = Capital Improvement Plan budgets
   HMA = Hazard Mitigation Assistance
   A * by "HMA" indicates that it has a potential for a benefit-cost ratio above 1.0
   EOC = Emergency Operations Center grant (not currently active)
   STEAP = Small Town Economic Assistance Program (State grant program)
4. 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
# DOCUMENTATION OF PLAN DEVELOPMENT

## *APPENDIX B*
## *PREFACE*

An extensive data collection, evaluation, and outreach program was undertaken to compile information about existing hazards and mitigation in the Town of Prospect, 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 PROSPECT
## May 29, 2013

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1. Purpose and Need for Hazard Mitigation Plan
   a. Disaster Mitigation Act of 2000
   b. Status of Prospect's hazard mitigation plan

2. Update on Hazard Mitigation Grant Programs (PDM, HMGP)
   a. Congressional role
   b. Connecticut has funds to distribute under HMGP
   c. Types of projects that get funded

3. What's New with Local Plan Updates and Approvals
   a. Develop goals that connect to the strategies
   b. HAZUS analysis
   c. Better public involvement and outreach to neighboring towns
   d. Make plan maintenance more specific
   e. More emphasis on benefit-cost analysis
   f. Incorporate effects of recent disasters into plan
   g. Incorporation of hazard mitigation plan into other town plans

4. Project Scope
   a. Data collection, outreach
   b. Update vulnerability analysis
   c. Revisit strategies and update plan
   d. DEEP and FEMA review and approval

5. Project Schedule

6. Review of Hazards and Events from 2007-2013 (Table attached)

7. Review of Table of Strategies from Last Plan

8. Data Collection Needs

9. Outreach and Public Involvement
   a. Public meeting vs. surveymonkey survey
   b. Letters to surrounding communities

10. Next Steps

11. Matching Grant

12. Association of State Floodplain Managers (ASFPM) Conference

## *Meeting Minutes*

**NATURAL HAZARD MITIGATION PLAN**
**Data Collection Meeting for Prospect**
**May 29, 2013**

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### *Welcome & Introductions*

The following individuals attended the data collection meeting:

- Gene McCarthy, Public Works
- William Donovan, Land Use Inspector
- Robert J. Chatfield, Mayor
- David Murphy, Milone & MacBroom, Inc. (MMI)

### *Description and Need for Hazard Mitigation Plans / Disaster Mitigation Act of 2000*

Mr. Murphy briefly described the basis for the natural hazard planning process and possible outcomes, including the role of the updated plan in grant application support for the municipalities within the region. Mr. Murphy noted that with three declared disasters in the past few years there are opportunities for grants under HMGP through the State. Consistent with the previous plan, the updated plan will address flooding, hurricanes and tropical storms, winter storms and nor'easters, summer storms and tornadoes, earthquakes, dam failure, wildfires, and landslides. These hazards were discussed along with critical facilities and development trends.

### *Critical Facilities*

- The new Public Works facility at 221 Cheshire Road does not have a backup generator. The town is interested in an HMGP for standby power.
- The Community School will be purchased from Regional School District #16 and converted to a community center/shelter. This is a long term plan and no final plans have been made.
- No other changes to critical facilities.

### *Development Trends*

- A new bank has been constructed at the Waterbury Line
- Scott Road – Toll Brothers Regency development is ongoing and will consist of 366 units. It will have town water; sewer and no wetland encroachments have been needed.
- A new banquet facility has been constructed at the Waterbury line.
- A new elementary school (Prospect Elementary) is in the final design stages. It will be located at Route 69 (75 New Haven Road). EPA is expected to provide funding to extend the water mains.

- Six new streets have been built and 25% of the homes have been built. These are all dead end streets. Three have tanks with dry hydrants and the other three have no fire protection.
- The town will be updating the Plan of Conservation and Development this year.

***Flooding***

- Gramar Avenue is the most persistent flooding problem in town. Oxford General Industries gets flooded. Prospect will install more drainage in the industrial park and will need to tie it back to Route 68.
- A drainage study conducted after the 1983 floods lead to drainage projects that have prevented much flooding.
- Irene caused approximately three days of power outages. Flooding occurred on Putting Green Lane. Two twin pipes clogged causing a culvert to wash out. The culvert will be replaced with a box culvert in the next ten years. Right now it is just there without a culvert. The town submitted less than $50,000 in public assistance reimbursements for Irene.
- The town fared well during Sandy and submitted $33,000 in public assistance reimbursements. CL&P was in Prospect all night and they only had one day of power outages. It was mainly just a wind event and pine trees came down.

***Winter Storms***

- Bob is the Public Works Director. The town has 58 miles of road and a staff of eight.
- A sand and salt mixture is still used to treat roadways.
- The town applied for $106,000 in public assistance reimbursements for Storm Nemo and expects 75% reimbursement.
- No public building roofs collapsed due to the Jan 2011 storms. A few private homes did have collapses.
- Public buildings and school roofs were shoveled.
- The October snow caused seven days of power outages. Reportedly, power had to be restored to the town of Cheshire first. The shelter was open and occupied for five days. The fire house was open for residents to use the showers. The town supermarket had to throw out food. CodeRED was used throughout the event. The town is not fond of Alert Now and feels that CodeRED is affordable to the town and they have more control.

***Dams***

- The Regional Water Authority rebuilt their dam a few years ago.
- East Mountain Reservoir spillway was lowered five feet.

# Hazard Mitigation Plan Update
# Prospect, Connecticut

Presented by:
David Murphy, P.E., CFM
Associate
Milone & MacBroom, Inc.

May 29, 2013

MILONE & MACBROOM®

# Purpose and Need for 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 Prospect's Plan
  - Developed 2007
  - Adopted and Approved 2008
  - Expires 2013

# What is a Natural Hazard?

- An extreme natural event that poses a risk to people, infrastructure, and resources

# What is Hazard Mitigation?

- Actions that reduce or eliminate long-term risk to people, property, and resources from natural hazards and their effects

# 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)
  - RFC (Repetitive Flood Claims)
  - SRL (Severe Repetitive Loss)
- Congress is re-arranging some programs
- Connecticut has >$20M to distribute under HMGP

# Update on Hazard Mitigation Grant Programs

| State | Description | Grant |
|---|---|---|
| Connecticut | Home elevations | $641,025 |
| Connecticut | Culvert replacement | $500,000 |
| Connecticut | Home acquisition | $411,000 |
| Connecticut | East Haven home elevation | $75,206 |
| Connecticut | Home elevation | $64,575 |
| Connecticut | Home elevation | $56,700 |
| Maine | Floodplain acquisition and structure removal | $2,157,678 |
| Massachusetts | Downtown flood mitigation/culvert replacement | $3,000,000 |
| Massachusetts | Pond flood hazard project | $1,745,700 |
| Massachusetts | Flood hazard mitigation project | $1,079,925 |
| Massachusetts | Culvert project | $525,000 |
| Massachusetts | Housing elevation and retrofit | $473,640 |
| Massachusetts | Housing elevation and retrofit | $449,935 |
| Massachusetts | Road mitigation project | $186,348 |
| Massachusetts | Flood mitigation project | $145,503 |
| New Hampshire | Water planning for firefighting | $134,810 |
| New Hampshire | Culvert project | $112,500 |
| New Hampshire | Box culvert project | $102,000 |
| New Hampshire | Culvert project | $72,750 |
| New Hampshire | Dry hydrants | $15,251 |
| New York | Beach road elevation | $1,792,521 |
| New York | Subdivision utilities: overhead to underground | $300,767 |
| New York | WWTP Floodwall construction | $223,200 |
| New York | Culvert project | $122,664 |
| Vermont | Fluvial erosion risk assessment | $337,498 |
| Vermont | Road mitigation project | $140,441 |
| Vermont | Inundation & erosion controls to a public building | $99,188 |

Connecticut is currently accepting HMGP applications to fund standby power supply!

MILONE & MACBROOM®

# What's New with Local Plan Updates and Approvals

- Develop goals that connect to the strategies
- HAZUS analysis
- Improve public involvement and outreach to neighboring towns
- Make plan maintenance more specific
- More emphasis on benefit-cost analysis
- Incorporate effects of recent disasters
- Show how the plan will be incorporated into other town plans

# Project Scope of Services

- Task 1 – Project Initiation and Data Collection
- Task 2 – Risk and Vulnerability Assessment
- Task 3 – Strategy Update and Plan Development
- Task 4 – DEEP/DEMHS and FEMA Review and Plan Adoption

# Project Schedule

- Task 1 – Project Initiation and Data Collection: May and June 2013
- Task 2 – Risk and Vulnerability Assessment: May and June 2013
- Task 3 – Strategy Update and Plan Development: June and July 2013
- Task 4 – DEEP/DEMHS and FEMA Review and Plan Adoption: *The goal is to be ahead of the State Plan*

# Review of Hazards and Events, 2007-2013

- Hazards in the Prospect Plan:
  - Flooding
  - Hurricanes and tropical storms
  - Summer storms and tornadoes
  - Winter storms and nor'easters
  - Earthquakes
  - Wildfires
  - Dam failure

**Roaring Brook at Roaring Brook Road (upstream)**

# Review of Hazard Mitigation Strategies

Box Culvert / Bridge and Walls – Tenmile River at Route 68



MILONE & MACBROOM®

# Review of Hazard Mitigation Strategies

- Elevate or remove flood-prone buildings
- Wet and dry floodproofing
- Move critical facilities from flood zones
- Strengthen or reinforce the 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

# Data Collection and Discussion

- What are Prospect's critical facilities?
- Shelters and evacuation routes
- Discussion of recent storms
- Development and redevelopment trends
- Utilities above/below ground?
- How are drainage complaints received and tracked?
- Areas of flooding

# Data Collection and Discussion

- Areas prone to wind damage
- Tree maintenance
- Snow and ice removal routes
- Areas prone to icing in winter
- Dams and effects of dam failure
- Areas with and without fire protection
- Areas prone to wildfires, fire department off-road capability, coordination with utilities/nearby municipalities

# Outreach and Public Involvement

- Letters to surrounding municipalities
- Public meeting vs. using surveymonkey.com

**Update to the State of Connecticut Hazard Mitigation Plan**

**1. Please indicate whether you are respondng as a resident of Connecticut or as a representative of a state agency, municipality, or organization. You are encouraged to respond to the survey more than once if you wish to respond as a resident and a representative of an organization.**

- [ ] Resident
- [ ] State Agency, Municipality, or Organization

**2. If you are responding as a resident, please enter your five-digit zip code.**

**3. If you are responding as a representative of a state agency, municipalty, or organization, please select one of the following.**

- [ ] State Agency
- [ ] Federal Agency
- [ ] Regional Planning Agency/Council of Government
- [ ] Municipal Department
- [ ] Municipal Government, Board, or Commission
- [ ] Educational Institution
- [ ] Business
- [ ] Utility
- [ ] Watershed or Conservation Organization
- [ ] Other

Please enter the name of the agency, municipality, or organization

**4. Were you aware that Connecticut maintains a Hazard Mitigation Plan?**

- ○ Yes
- ○ No

**5. Many communities in Connecticut have hazard mitigation plans that are separate and distinct from various emergency operations plans. Are you aware if your**

# Next Steps

- Date for survey or public information meeting
- Date for receipt of any materials resulting from this meeting
- Work with City of Waterbury to track staff time

# One Last Thing!

ASFPM 2013 CONFERENCE
REMEMBERING THE PAST – INSURING THE FUTURE
JUNE 9-14, 2013 – HARTFORD, CT

Connecticut Convention Center

Click here for more information

## ASFPM PRESENTS

REMEMBERING THE PAST – INSURING THE FUTURE

The Association of State Floodplain Managers will convene the world's largest and most comprehensive floodplain management conference, our 37th annual gathering, June 9 -14, 2013, in Hartford, Connecticut.

### The Premier Flood Conference

Join 1,200 of the nation's floodplain managers June 9 - 14, 2013, at the Connecticut Convention Center in Hartford, CT, as we pilot improvements in flood risk management and national policy. Government Officials, planners, engineers, consultants, watershed managers, flood protection product vendors, educators, and others will gather for the most comprehensive floodplain management conference in the world. Participants interact, exchange ideas, make contacts, form partnerships, and prepare for a more sustainable future for flood damage reduction.

Our theme for 2013 is derived from New England's rich history and its vibrant future. The play on words with "insuring" is a tribute to Hartford's status as "the birthplace of insurance." Connecticut is New England's second smallest and southernmost state. Its compact borders contain a variety of landscapes, from the shoreline beaches of Long Island Sound in the south, to urban skylines and quaint historic villages, and hardwood forests in the northwestern and northeastern hills. The Connecticut River Valley cuts through the center of the state. Despite New England's reputation for

### Conference Menu

- Why Attend?
- Registration
- Location
- The Conference Hotels
- Hartford, CT
- CT Convention Center
- Transportation
- Conference Program
- Full Conference Program
- Plenary Sessions
- Program Changes & Updates
- Concurrent Sessions
- Workshops
- Field Tours

*Engineering, Planning*
*Landscape Architecture*
*and Environmental Science*

MILONE & MACBROOM®

May 29, 2013

Mr. James Stewart, P.E.
Director of Public Works
Borough of Naugatuck
246 Rubber Avenue
Naugatuck, CT 06770

**RE: Town of Prospect Hazard Mitigation Plan Update**
**MMI #1014-49**

Dear Jim:

Milone & MacBroom, Inc. (MMI) is working with the Town of Prospect to update the hazard mitigation plan that was approved by FEMA in 2007. In this plan, the town indicated that it would make an effort to coordinate with surrounding communities when the plan was updated. The Town of Prospect and MMI are interested in coordinating with the Borough of Naugatuck relative to hazards that could cross municipal boundaries such as flooding, as well as strategies for hazard mitigation that could be addressed by the two communities.

We recall that you are the representative from Naugatuck that worked with MMI and COGCNV several years ago to develop the borough's hazard mitigation plan and, therefore, will have the most valuable input for the update of the Prospect hazard mitigation plan. Please take a moment to share your thoughts for the following:

1. Do the communities of Prospect and Naugatuck face any shared hazards that could be addressed by both communities? Examples could be flooding along Fulling Mill Brook or windstorms 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. Do the communities of Prospect and Naugatuck currently cooperate on any of the following:
   - Local emergency communications or response
   - Road maintenance, drainage system maintenance, public works, etc.
   - Communications with water, sewer, electric, and other utility providers

You may contact either of 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
davem@miloneandmacbroom.com

Scott Bighinatti
Senior Environmental Scientist
scottb@miloneandmacbroom.com

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*Engineering, Planning*
*Landscape Architecture*
*and Environmental Science*

MILONE & MACBROOM®

May 29, 2013

Mr. Clark Hurlburt, Deputy EMD/CERT Coordinator
Town of Bethany
Town Hall
40 Peck Road
Bethany, CT 06524

**RE: Town of Prospect Hazard Mitigation Plan Update**
**MMI #1014-49**

Dear Mr. Hurlburt:

Milone & MacBroom, Inc. (MMI) is working with the Town of Prospect to update the hazard mitigation plan that was approved by FEMA in 2007. In this plan, the town indicated that it would make an effort to coordinate with surrounding communities when the plan was updated. The Town of Prospect and MMI are interested in coordinating with the Town of Bethany relative to hazards that could cross municipal boundaries such as flooding, as well as strategies for hazard mitigation that could be addressed by the two communities.

We understand that you are the representative from Bethany that is working on the South Central Regional Council of Governments multijurisdiction hazard mitigation plan and, therefore, will have the most valuable input for the update of the Prospect hazard mitigation plan. Please take a moment to share your thoughts for the following:

1. Do the towns of Prospect and Bethany face any shared hazards that could be addressed by both communities? Examples could be flooding along Beacon Hill Brook or windstorms 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. Do the towns of Prospect and Bethany currently cooperate on any of the following:
   - Local emergency communications or response
   - Road maintenance, drainage system maintenance, public works, etc.
   - Communications with water, sewer, electric, and other utility providers

You may contact either of 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
davem@miloneandmacbroom.com

Scott Bighinatti
Senior Environmental Scientist
scottb@miloneandmacbroom.com

1014-49-1-m2913-1-ltr.docx

# Press Release for Prospect Library

## Public Survey about Mitigation of Natural Hazards

Tropical Storm Irene, October snowstorm Alfred, and Superstorm Sandy are recent events that caused severe damage in the region and resulted in Federal disaster declarations. Flooding, heavy snow, wind, and downed power lines cause damage to property, disrupt our daily routines, close our schools and businesses, and jeopardize the health and safety of the citizens of Prospect.

What can be done to minimize our vulnerabilities to natural hazards? The Town of Prospect is updating its hazard mitigation plan to identify activities that can be undertaken before natural hazards occur in order to minimize property damage, risk of life, and the costs that are shared by all. The plan will discuss the occurrence and consequences of floods, winter storms, tornadoes, hurricanes and tropical storms, wildfires, earthquakes, and dam failure. The plan will outline the steps that Prospect can take to mitigate for future natural hazards.

In order to gain input to the hazard mitigation plan, the town has developed an internet-based survey. Residents and business owners are invited to take the survey and offer ideas for minimizing the damage that occurs and the costs that are borne by our town. Please go to https://www.surveymonkey.com/s/prospecthazardmitigationplan. For more information, please contact Mayor Chatfield.

-End-

# nnual Essay Contest Sponsored by Knights of Columbus *by George Hughes*

The Knights of Columbus, Fr. James F. O'Dea Chapter 3459 of Prospect sponsors an nual essay contest for Prospect fourth and fifth graders.

This year's theme was aying It Forward." The stu- nts were asked to write their says based on this topic.

The award recipients this ar were, Madison Lisowski, h grade; Megan O'Donnell, aron McKay and Alina Gega, h grade.

We are pleased to include the inning essays here.

ay It Forward
*y Megan O'Donnell*

Pay it forward means that ou do a good deed for someone nd you don't expect anything in eturn. All you want is them to do good deed for someone else in eed.

In my family we pay it for- vard by volunteering at commu- ity events. Last night we signed p to help with the Algonquin egetable garden. We will be elping clean up the school rounds and plant vegetables. The vegetables will be donated to he St. Vincent and DePale [sic] Soup Kitchen to help feed the omeless. Everyone that is help- ing is asking for nothing in return for their time.

I hope that someone that eats the vegetables will be happy that they had food to eat and do something nice for someone else that needs help.

Pay it forward is something that we should try to remember when someone does something nice for us. Even if it is an adult or friend or stranger.

*The Knights of Columbus recently held their annual essay contest for fourth and fifth graders in Prospect. Shown above with Joseph L. Gomez are, l. to r., Madison Lisowski, Megan O'Donnell, Aaron McKay and Alina Gega.*

Paying It Forward
*by Madison Lisowski*

"Pay it forward" means doing something kind for someone, not in hope for something in return, but in hope that they will do something kind for someone else. Pay it forward is also a random act of kindness. The thoughtfulness in the kind act helps people know that you care. Every once in a while, you should do something sweet and worthwhile for someone just to let them know that you are there for them. Paying it forward can be done in many different ways. You could help out in a soup kitchen, raise money for the poor or just give someone in front of you on line a dollar.

One time, I was at a restaurant and a man gave our family $10 for ice cream, just because he wanted to make us happy. His act of kindness inspired me to do something nice. After he left, his wife had left the case to her glasses and my sister and I had brought them to her. He too had gotten rewarded for doing a nice act without expecting anything in return.

Paying it forward brings the community closer and helps it become a better place. If everyone in a small neighborhood, such as Prospect, does something kind for their neighbor, soon enough, every person will come together and it will become a better and friendlier place. This is why doing a small act makes a difference in life. Sometimes it is risky to do kind things for people you do not know, but in the end, you have made someone happy and that is more important.

Some people do nice things just to get something out of it for themselves. Although it is nice that they helped someone, it is not the right reason to do a good thing. Paying it forward shows the world that you are not cruel and self-centered. Doing the nice thing is the right thing to do and it inspires others to do nice things as well.

Paying it forward does not only bring a community closer, but at some point, the act will be repaid to you. Do not expect this act to be coming for it shall come when the time is right. Paying it forward is how God wants us to act and it will leave you shining like the sun.

# Thirsting for Adventure? The LemonAid Days Campaign Could be Your Ticket

For many children, the perfect carefree summer day means sunshine, a shady porch and a cool glass of lemonade. For others, it means no place to play, not being sure where the next meal will come from, or not even knowing where they will sleep that night.

The Salvation Army invites youth groups, families and individuals to help raise money and awareness to benefit homeless children living in the family emergency shelter in Waterbury by participating in the LemonAid Days Campaign.

It's easy and it's fun! Simply operate a lemonade stand on Friday, July 19, and donate the proceeds to the shelter.

We'll give you a publicity kit containing all the information and promotional material you'll need to get started.

Be creative … set up a competition … challenge your friends and neighbors to sponsor your stand. The sunny sky is the limit in the LemonAid Days Campaign. And to celebrate your success, a grand finale will be held for all participants on Saturday, July 20, at Chase Park on Highland Avenue from 11 a.m. to 1 p.m. Prizes, games and food are only a part of the fun.

Don't miss your chance to help homeless children right in your town. It just might turn out to be your greatest summer adventure!

Call The Salvation Army today at 203-754-7056 to register, request your publicity kit or find out more information. Cheers!

# NAMI Waterbury Announces T-Shirt Contest Winner

The 3rd Annual T-Shirt Drawing Contest was held for the NAMI Walk and, again, Naugatuck High School came away a winner.

This year Ryan Russett, with his design of the Republican-American Clock Tower with brains pushing the American Flag to the top to show how they are overcoming the stigma of mental illness, came away with the grand prize.

The committee felt that Ryan's design took in the spirit of the Greater Waterbury area and all it represents by using the Clock Tower in his design.

Russett is a sophomore in Ms. Hamandrawatee Pertab's class. Ms. Pertab told us that he is a very talented artist who has shown an incredible amount of enthusiasm. The entire class put forth wonderful designs that were beautiful and made the choice very difficult.

The first runner-up was Brittaney Carpa with her illustration of a couple walking through the brain for the NAMI 2013 Walk. The second runner-up was Marcus Ruff.

NAMI Waterbury will again be running its next T-Shirt Contest and want to kick off in September this year. Any school that would like to participate can contact Kim Pernerewski at 203-578-5447. We would like to have 200 entries. This year we would like to get the entries in by February 2014 so we can have an art show in March. We will then have NAMI members help to pick the winners.

# Public Survey about Mitigation of Natural Hazards

Tropical Storm Irene, October snowstorm Alfred, and Superstorm Sandy are recent events that caused severe damage in the region and resulted in Federal disaster declarations. Flooding, heavy snow, wind, and downed power lines cause damage to property, disrupt our daily routines, close our schools and businesses, and jeopardize the health and safety of the citizens of Prospect.

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For more information, please contact Mayor Chatfield at 203-758-4461.

Come Join The Fun!

**Summer Theatre Camp**

*Our 22nd Year! 7 Weeks!*

Classes start July 1 and run through August 16, 9-3pm.

*One of the best theatre camps in Connecticut... for kids and young adults!*

TWO GROUPS: Ages 7-9 and 10-18

Call the Box Office to sign up!

**Early Bird Subscriptions are now available**

Sign up today for our upcoming 23rd Season!

*Subscribers also get discounts on other events.*

*Our next Mainstage Season will have some fun surprises!*

DECD

Seven Angels THEATRE
*Your Professional Theatre*

For the box office & camp information call...

203.757.4676

sevenangelstheatre.org

Seven Angels Theatre is Greater Waterbury's only Equity professional regional theatre and is located in the historic Hamilton Park Pavilion on Plank Road in Waterbury, CT. Minutes off I-84. Free parking and wheelchair access.

# Press Release for Prospect Web Site

## Public Survey about Mitigation of Natural Hazards

Tropical Storm Irene, October snowstorm Alfred, and Superstorm Sandy are recent events that caused severe damage in the region and resulted in Federal disaster declarations. Flooding, heavy snow, wind, and downed power lines cause damage to property, disrupt our daily routines, close our schools and businesses, and jeopardize the health and safety of the citizens of Prospect.

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-End-

## WEB EXTRAS
TODAY AT REP-AM.COM

**>> IN THE RED ZONE** View a photo galleries and video highlights from the Oxford-Notre Dame of Fairfield and Cheshire-West Haven games. Also, watch a video from the Pomperaug-New Milford game.

**>> UCONN FOOTBALL** Watch a video of Coach P. talking about the team's energy heading into today's game at Buffalo.

**>> SENIOR BOWLING** Watch a video report on the Sky Top Lanes senior league.

High **70**
Low **45**

Plenty of sun today; Dress for chilly weather tonight. Page **8A**


| | | |
|---|---|---|
| Accent **1D** | Crossword **5D** | People **4D** |
| Annie's Mailbox **4D** | Editorials **6A** | Public notices **7C** |
| Births **2B** | Horoscope **4D** | Public record **2A** |
| Business **8D** | Lottery **2A** | Stocks **7D** |
| Classified **3C** | Movie theaters **2D** | Sudoku **5D** |
| Comics **6D** | Obituaries **4-5B** | Television **5D** |


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Waterbury, Connecticut
All rights reserved

**Read it at rep-am.com**

Coppa. The league, which meets every Friday afternoon, has one rule: Nobody under 60 is allowed. See story on Page 3B.

**VISIT REP-AM.COM FOR A VIDEO ON THE LEAGUE**

# Ready for nature's nastiness

## Towns need plans to be eligible for funds

BY QUANNAH LEONARD
REPUBLICAN-AMERICAN

In Watertown, whenever the Steele Brook rises, it first floods The Gowans-Knight Co. Inc. on Knight Street.

That business, which builds and refurbishes fire trucks, floods before Bradshaw Chrysler Jeep on Main Street and well before Watertown Plaza off Route 63, said Charles Berger Jr., Watertown's town engineer. The Gowans-Knight Co. is at the lowest point along Steele Brook, he said.

It's a tiny brook and then it's a nightmare, said Day Palmer, vice president of The Gowans-Knight Co. Every

*See* **FLOOD**, *Page* **7A**

DARLENE DOUTY REPUBLICAN-AMERICAN

**Day Palmer, vice president of Gowans-Knight Co. in Watertown, holds a photo taken when the business was flooded after tropical storm Lee in 2011. Cities and towns in Greater Waterbury are updating their plans to mitigate natural hazards.**

# Keno ge step clo to appr

## Legislators s OK of video

BY MARK PAZNIO
©THE CONNECTICUT M

The Connecticut took a step Thursda bringing keno to bar rants and other out year, while legisl Hartford began a stu feasibility of int video slots to pari-n cilities in Bridgep Haven and Windsor

Keno seems a su The General Assem ed its authorization

*See* **KENO**,

**LOTTERY**

Keno is ex to expand tery's netw vendors by as 600 new

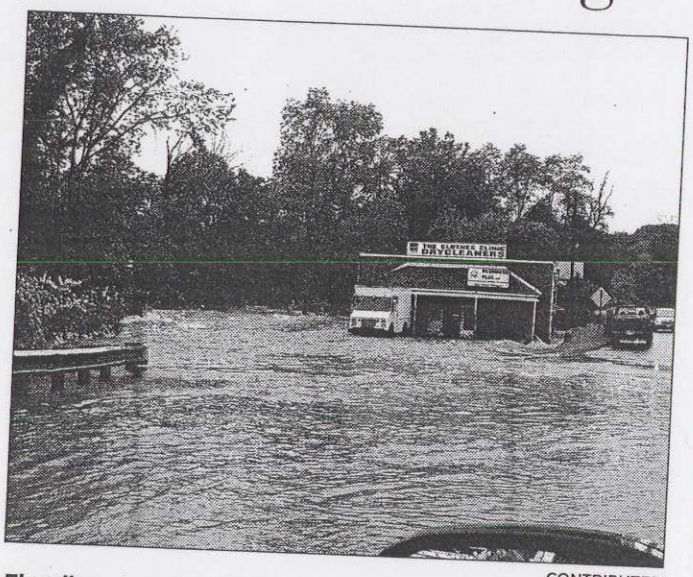
# FLOOD: Plans in various stages

*Continued from Page One*

time it rains, the business has to be on alert, so it can be ready to move trucks and other equipment, she said outside her business Thursday morning.

"We understand that the town is trying to correct the problem, but the amount of money it's going to cost to correct the problem is probably ... it's never going to happen," Palmer said. "So therefore, every time we have a flood, we do more things when we're doing our repairs to make it not affect us as much."

Reducing the persistent flooding along Steele Brook is just one example of the projects in Greater Waterbury that could qualify for federal hazard mitigation funds through the Federal Emergency Management Agency. To be eligible for those funds, though, communities must have an approved natural hazard mitigation plan, state and local officials said.



CONTRIBUTED

**Flooding along Steele Brook in Watertown spills over and floods this business on Riverside Street in 2011. Cities and towns in Greater Waterbury are updating their plans to mitigate natural hazards. Communities must do this to be eligible for FEMA funds for certain projects.**

**WATERTOWN AND 12** other towns in the Central Naugatuck Valley Region have plan updates underway, with the municipalities at different stages of the process, said David Murphy, managing project engineer in water resources with Milone & MacBroom, Cheshire, the consulting firm hired to write the plans. The updated plans will discuss the occurrence and consequences of floods, winter storms, tornadoes, hurricanes and tropical storms, wildfires, earthquakes, landslides and dam failure.

Watertown, Woodbury and Oxford have completed a first draft, which is in the reviewing process, said Murphy, project manager.

Waterbury, Cheshire, Prospect and Wolcott finished drafts in the spring, and already have done surveys and hosted a public meeting. Some of those communities are now reviewing the drafts, he said.

The remaining six towns, Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury and Thomaston, have

small portion is set aside for addressing future known issues, he said.

Scott Devico, spokesman for the state Division of Emergency Management and Homeland Security, said the state division provides assistance and recommendations on hazard mitigation plans if asked by towns. It's a joint venture with the state Department of Energy and Environmental Protection, he said.

In Waterbury, the city has applied for FEMA hazard mitigation funding to pay for drainage improvements at the Chase Building on Grand Street. Waterbury can't receive that funding until the city's plan is updated, Murphy said.

The project cost estimate is $221,000, said Lou Spina, the city's provisional director of public works. The project entails installing a storm drain that would connect to an existing storm drain system on Leavenworth Street, said Mark Pronovost, Waterbury's city engineer.

During an intense storm, water builds up in a low spot in that parking area. Workers from streets and public works typically will put down about 40 to 50 sandbags to protect the basement, Spina said. He

proofing, Berger said.

Watertown has applied to FEMA for hazard mitigation grant funds to flood proof all businesses along Steele Brook that are subject to significant flooding, he said. That application is under review, he said.

Total project costs for that option is about $1.9 million, Berger said. If approved, FEMA would pay 75 percent, or about $1.5 million. Property owners would be responsible for 25 percent.

Berger said the plan update is a reinforcement of what the town knows it needs to address as far as hazard mitigation, as well as looking for new ideas.

"The whole goal is to be prepared as we can, take as many steps as we can ahead of time and be prepared to react afterward if something gets significantly damaged," Berger said.

At The Gowans-Knight Co., Day has pictures in her office of the flooding that occurred on site when Storm Lee hit in 2011. The company got two-and-a-half feet of water, she said.

The company has spent $150,000 in the last two years to protect itself against flooding, Palmer said. That doesn't include the $7,000

# KENO: L

*Continued from Page One*

the Malloy administration is negotiating profit-sharing terms with tribal casinos and, now, the lottery's board has authorized developing the infrastructure necessary to produce the game by June 1, 2014.

The odds are less certain for the introduction of video slot machines at three pari-mutuel facilities. The study was initiated by lawmakers in those communities who say slots might be necessary to hang onto gambling revenues in the face of growing competition in New York and Massachusetts.

The confluence of the day's events underlined the importance and the volatility of the gambling industry in the Northeast, where a rapid expansion of casinos and other betting facilities is undercutting Connecticut's two tribal casinos, Foxwoods and Mohegan Sun.

"The fact of the matter is the state of Connecticut is in the gaming industry, and we've been seeing revenues continue to drop," said Sen. Andres Ayala, D-Bridgeport, as lawmakers began their public look at video slots.

From a high of $718 million in 2006, the state saw its annual gambling income drop to $612 million last year. The revenue comes primarily from two sources: the shrinking slots revenue from the tribal casinos and the growing profits of the lottery.

Keno represents a twofold expansion for the lottery: It is a new game, and it also is

DON'T

Watertown, Woodbury and Oxford have completed a first draft, which is in the reviewing process, said Murphy, project manager.

Waterbury, Cheshire, Prospect and Wolcott finished drafts in the spring, and already have done surveys and hosted a public meeting. Some of those communities are now reviewing the drafts, he said.

The remaining six towns, Beacon Falls, Bethlehem, Middlebury, Naugatuck, Southbury and Thomaston, have started the planning process and have or will host informational meetings and online surveys sometime soon, he said.

Towns in the Litchfield Hills Council of Elected Officials region have begun to update their plans, and those in the Northwestern Connecticut Council of Governments have just started their first mitigation plans, Murphy said.

Samuel Gold, acting executive director of the Council of Governments Central Naugatuck Valley, which is coordinating the updates, said the hazard mitigation plans are only good for five years.

**WHEN A NATURAL DISASTER OCCURS,** and when a disaster is declared in Connecticut, a small portion of FEMA funds are available to address known hazards that could be a future problem, Gold said. Most money is spent for recovery, while a phy said.

The project cost estimate is $221,000, said Lou Spina, the city's provisional director of public works. The project entails installing a storm drain that would connect to an existing storm drain system on Leavenworth Street, said Mark Pronovost, Waterbury's city engineer.

During an intense storm, water builds up in a low spot in that parking area. Workers from streets and public works typically will put down about 40 to 50 sandbags to protect the basement, Spina said. He said the city is trying to avoid any expensive damage and to keep the building online to conduct city business.

Watertown has its first draft posted on the town website, www.watertownct.org. for public comment.

Berger said the town doesn't have a preferred alternative yet for the Steele Brook flood mitigation project.

**WATERTOWN HAS CONDUCTED A NUMBER OF STUDIES** and has been looking at a number of alternatives over the years, he said. Those alternatives range from buying out people who are in the flood plain and relocating their businesses to a flood-free site, to more of a structural project, where the town would build flood walls and pump stations to try to protect properties where they are now.

And in between those alternatives are several more alternatives, including flood prepared as we can, take as many steps as we can ahead of time and be prepared to react afterward if something gets significantly damaged," Berger said.

At The Gowans-Knight Co., Day has pictures in her office of the flooding that occurred on site when Storm Lee hit in 2011. The company got two-and-a-half feet of water, she said.

The company has spent $150,000 in the last two years to protect itself against flooding, Palmer said. That doesn't include the $7,000 it paid to repair pavement damaged by flooding, she said.

The business now stores everything six inches to a foot-and-a-half off the floor in the shop. It also has installed an interior mezzanine for securing welding equipment and bought two additional sets of lifts for lifting up fire trucks.

"We are doing our own hazard mitigation because we know it's just going to keep happening and we can't afford to move somewhere else," Palmer said. "Because the cost of moving is astronomical, even though we've looked into it numerous times."

Residents and business owners can email ideas about the plans to the Council of Governments Central Naugatuck Valley at comments@cogcnv.org.

*Contact Quannah Leonard at qleonard@rep-am.com, on Facebook at RA The Valley or on Twitter @RA_Quannah.*

Reno represents a twofold expansion for the lottery: It is a new game, and it also is

# SPY: Violators allowed to retire

*Continued from Page One*

prosecution, Ellard's letter said. In some cases, U.S. prosecutors declined to take action but in nearly every case the employees were allowed to retire without punishment.

In one case, a worker was suspended without pay then retired; in another case, a worker's promotion was canceled; in two cases, military employees suffered a reduction in rank, extra duty and brief reduction in salary for two months.

Public concerns about how telephone and Internet surveillance data is handled by the NSA have intensified in the wake of leaks about the correct internal problems that led to the NSA's accidental collection of 56,000 emails and other communications by Americans, and they insisted that willful abuse of surveillance data by officials is almost non-existent.

Grassley, who had asked Ellard last month to provide more information about the 12 his foreign girlfriend's telephone number in 2004. The official also tried to retrieve data about his own phone but was prevented because internal mechanisms prevented queries on domestic phone numbers without authorization. The matter was referred to the Justice Department. The official retired in 2012 before internal disciplinary action could be taken.

In another case, the foreign girlfriend of a U.S official reported her suspicions that the official was listening to her telephone calls.

An internal investigation found that the official had made internal surveillance queries on the phones of nine

## TODAY'S POLL

VOTE ONLINE AT **REP-AM.COM**

**If you had access to the technology, would you spy on a spouse, boyfriend or girlfriend?**

FIND RESULTS OF YESTERDAY'S QUESTION ON PAGE 2A.

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## *Meeting Minutes*

**NATURAL HAZARD MITIGATION PLANS FOR CHESHIRE, PROSPECT, WATERBURY, AND WOLCOTT**
**Council of Governments Central Naugatuck Valley**
**Project Kick-Off Meeting**
***June 26, 2006***

---

### *I. Welcome & Introductions*

The following individuals attended the project kick-off meeting, and will comprise the steering committee:

- David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- Ken Livingston, AICP, Fitzgerald & Halliday, Inc. (FHI)
- Virginia Mason, Council of Governments Central Naugatuck Valley
- Jeffrey Cormier, Council of Governments Central Naugatuck Valley
- Chet Sergey, Wolcott Local Emergency Planning Commission
- Bob Chatfield, Mayor, Town of Prospect
- George Noewatne, Cheshire Public Works Department
- Jack Casner, Cheshire Fire Department
- Adam Rinko, Waterbury Fire Department

### *II. Description and Need for Hazard Mitigation Plans / Disaster Mitigation Act of 2000*

David described the Disaster Mitigation Act of 2000 and the desire of FEMA to have hazard mitigation planning occur at the local level. A discussion about the pre-disaster hazard mitigation grant program and eligible types of projects took place at this time, and continued intermittently throughout the meeting. The issue is especially relevant in Waterbury, where FEMA will likely be assisting with response and clean-up after the June 2 events. Although funding for disaster response is allocated differently than funding for hazard mitigation, some of the long-term solutions in Waterbury (and other communities) will require pre-disaster hazard mitigation funding.

### *III. Project Scope*

David described the project scope, organized as follows:

- Task 1 – Project Initiation and Data Collection
- Task 2 – Vulnerability Assessment
- Task 3 – Public Meetings
- Task 4 – Response Planning and Recommendations
- Task 5 – FEMA Review and Plan Adoptions

Unlike most planning projects, this project began before the kick-off meeting because the unusual rainfall events in May and June provided opportunities to observe flooding or near-flooding conditions.

The team had questions about the public meetings and public hearings. One public meeting will be held in each municipality to hear from the public and exchange information. David and Ken will likely lead these meetings. These may be coincident with regularly-scheduled meetings of different commissions, although it is not required. The team discussed the likelihood that members of the public would talk about some issues that are not covered in the plans, such as water in basements, potholes and sinkholes caused by water and sewer main breaks, etc. MMI and FHI will listen to all comments and subsequently determine which will be included in the planning process with the steering committee.

The public hearings to adopt the natural hazard plans will occur at the end of the project. The Board of Selectmen, Board of Alderman, or other executive commission will need to adopt each plan after FEMA's comments are addressed.

## *IV. Hazards*

The COG's grant application included a number of hazards that have been organized as follows:

- ❑ Flooding
- ❑ Hurricanes
- ❑ Winter storms
- ❑ Summer storms and tornadoes
- ❑ Earthquakes
- ❑ Dam failure
- ❑ Wildfires

Over the last month, the following additional hazards have been considered for inclusion in the plans:

- ❑ Mass movement/Landslides (Waterbury)
- ❑ Collapse/Subsidence above Mines (Cheshire)

Virginia raised two points for discussion. First, the mine subsidence issue may not be appropriate for the Cheshire natural hazard plan, depending on other factors. Nevertheless, we are likely to hear about it at the public meeting. Second, significant water main breaks were originally noted in the grant application based on incidents in Waterbury. However, water main breaks and their resulting damage are not really natural hazards, and this will not be included. Although damage resulting from a compromised storm sewer pipe (earth movement, sinkholes, potholes, washed out roads) may be similar, the cause of the damage is natural (heavy rainfall).

## *V. Data Collection Needs, Availability, and Key Contacts*

David explained that the following departments and/or their commissions typically provide an individual to attend the data collection meetings in each municipality:

- ❑ Public Works
- ❑ Engineering
- ❑ Planning & Zoning
- ❑ Emergency Management or Fire Department
- ❑ Optional: Mayor or Selectman's Office

Each local official in the steering committee should begin to identify the other individuals who should attend the data collection meeting. These meetings will need to occur during the summer, despite the difficulty of working around vacations.

Each municipality will need to provide lists of hazard events such as winter storms, flooding, summer storms, and brush fires, along with descriptions of their results and effects on populations. MMI and FHI can rely on other sources of information (such as the Connecticut Natural Hazard Mitigation Plan) to describe notable hurricanes and earthquakes, although each municipality is free to offer information about these as well.

In the case of Waterbury, Adam indicated that the damage caused by the June 2 storm has been well-documented and organized, and this information will be provided to MMI and FHI. Lists of potential projects have been compiled by the City's engineering consultant.

Bob provided a preliminary list of problem areas in Prospect and marked some of these on a map. It is anticipated that these areas will be field-checked, along with any others that are listed during the meeting in Prospect. Meetings in Wolcott and Cheshire will also yield lists of problem areas that will be field-checked.

A related conversation ensued regarding the erosion damage caused by ATV use in Prospect. Although ATVs are not a natural hazard, the erosion is caused by excessive rainfall. There may be a way to address some of the problem areas in the plan.

## *VI. Proposed Schedule*

The following proposed schedule was modified from the schedule presented in the scope of services. It has been updated to the current status of the project.

| ***Month and Year*** | ***Tasks*** |
|---|---|
| April – May 2006 | Preliminary data collection and field reconnaissance. |
| June 2006 | ***Project kick-off meeting*** with COGCNV and a representative from each municipality; data collection; field reconnaissance. |
| July 2006 | Meet with municipalities; data collection; field reconnaissance. |
| August 2006 | Meet with municipalities; data collection; field reconnaissance; data review; vulnerability assessments. |
| September 2006 | Data review; vulnerability assessments. |
| October 2006 | Data review; vulnerability assessments; additional data collection and field reconnaissance (if necessary). |
| November 2006 | Additional data collection and field reconnaissance (if necessary); Present findings to the public and collection of comments. |
| December 2006 | Incorporate public comments; develop recommendations. |
| January 2007 | Draft plans to COGCNV. |
| February 2007 | Meet with COGCNV. |
| March 2007 | Edits to plans; final draft plans to municipalities. |
| April 2007 | Meet with municipalities; final edits. |
| May 2007 | Submit final draft plans to FEMA. |
| June 2007 | FEMA review. |
| July 2007 | FEMA review. |
| August 2007 | Incorporate FEMA edits. |
| September 2007 | Adopt plans in municipalities. |
| October 2007 | Submit final plans to FEMA. |
| *November 2007 – March 2008* | *Reserve time for delays associated with DEP and FEMA review, etc.* |

The next step is for David to contact the steering committee members and schedule the data collection meetings in each municipality.

## *Meeting Minutes*

**NATURAL HAZARD MITIGATION PLAN FOR PROSPECT**
**Council of Governments Central Naugatuck Valley**
**Initial Data Collection Meeting**
***July 25, 2006***

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### *I. Welcome & Introductions*

The following individuals attended the data collection meeting:

- David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- Samuel Eisenbeiser, Fitzgerald & Halliday, Inc. (FHI)
- Scott Bighinatti, Milone & MacBroom, Inc. (MMI)
- Virginia Mason, Council of Governments Central Naugatuck Valley
- Jeffrey Cormier, Council of Governments Central Naugatuck Valley
- Bob Chatfield, Mayor, Town of Prospect
- Bill Donovan, Land Use Inspector, Town of Prospect

### *II. Discussion of Hazard Mitigation Procedures in Effect & Problem Areas*

Bob had previously given David a list of flooding problem areas within the town. The Town of Prospect has been extremely proactive in its hazard mitigation efforts since 1983.

#### *A. Emergency Response Capabilities & Evacuation Routes*

Evacuation Shelters are the Fire House and Senior Center (both have generators).

The mobile home park on Cook Road is vulnerable to tornadoes and category 4 & 5 hurricanes because the homes are not anchored. The mobile home park residents also had trouble getting to the shelters because the state roads in Prospect are a low priority for the CT DOT during bad winter storms. As a result, Summit Road was widened to allow for emergency access (see below).

Prospect has 11 plow routes, which are reprioritized for fire and emergency access on a case by case basis during storms. CT DOT plow trucks tend to get off Routes 68 and 69 and prioritize Routes 8 and 84 instead, so Summit and Plank Roads have been redone (oversized) to accommodate fire trucks and other emergency vehicles during winter storms. The Town stores sand and salt mix at Public Works on Route 68 which it rations to the CT DOT so they don't have to return to Watertown to re-supply (and it keeps them in the Town). The state replenishes any amount of sand/salt mix they take.

#### *B. Zoning and Subdivision Regulations*

Cul-de-sacs must be a minimum of 60' wide at the end, and can be as narrow as 24' wide if they can never be elongated. A cul-de-sac must be able to allow a school bus to turn around without it backing up. A maximum of 20 houses are allowed on dead-end streets, and a 50' town right of way must be included at the end. New roads that are not dead ends must be a minimum of 30' wide.

Subdivisions must use box culverts for drainage – no twin culverts are allowed.

The town has been successful in convincing landowners and developers to make improvements.

Utilities must be underground in new developments, depending on depth to bedrock. When the bedrock is too shallow, poles can be used. This is reviewed on a case by case basis.

C. *Roadways*

In 1983, the Prospect experienced heavy flooding due to a rain event of 12" over 3 days. This flood event prompted a massive reconstruction effort of the Town's drainage system, and it is policy for the Town Engineer to oversize all drainage structures in an effort to mitigate flood damage. If the design calls for a 12" pipe, they use a 15" pipe; if the design calls for a 15" pipe, they use an 18" pipe; if the design calls for an 18" pipe, they use a 24" pipe, and so on. As a result, the town drainage system is oversized, and combined with the altitude of the town flooding isn't a major problem for Prospect. A 500,000 bond is obtained every other year for such efforts.

The Town has a Stormwater Management Plan (Phase II?) in effect.

The Town does annual cutbacks for private landowners who request tree removal, and does necessary tree removal on a case by case basis. CL&P only comes around every three years to do trimming near power lines. The Town removes trees and branches along roadways, and has a tree company on call to remove downed trees during storms. A few years ago an ice storm occurred and two subdivisions in town were without power for 3 days! Too many tree limbs broke and the response time of CL&P was slow. Prospect's policy is to take out trees whenever they may be a threat to roadways or aboveground utilities and put 30' cutbacks along new roads to mitigate possible outages.

In October 2005, Prospect had no problems with the 2 weeks of heavy rainfall. No roads had to be closed due to flooding or drainage concerns.

No headwalls in Prospect – they are 99% percent gone.

*D. Noted Problem Areas*

a. ATV's – Erosion problems on Corinne Drive and Terry Road are related to ATV use. On Corinne Drive, the drainage pipes were overwhelmed by excessive runoff due to ATV paths channelizing overland flow. Riprap work will be done on a few brooks in the Corinne Drive area, and a detention basin at the park (Mixville?) will be increased in size.
b. Raudis Pond at Clark Hill Road – Despite its proximity to the road, Raudis Pond had not flooded the road in over 50 years. The June 2nd storm of 8" of rain in 3 hours caused the road to flood. This storm was a greater than 100-year storm event (from "Precipitation in Connecticut", Miller et al., 2004):

    i. 100-year, 1-hour storm: 2.4 inches
    ii. 100-year, 6-hour storm: 6.0 inches
    iii. 100-year, 12-hour storm: 7.2 inches
    iv. 100-year, 24-hour storm: 8.4 inches

    The 36" pipe downstream at Route 68 and Spring Road backed up to the point where water was flooded above the fire hydrant located on Route 68 at the end of Clark Hill Road. It was suggested to increase the culvert size at Route 68 to be able to withstand a greater than 100-year rain event.
c. Terry Road – This year, Prospect replaced the old 15" pipe under the road with a larger 30" pipe to carry flow from Turkey Hill to the Waterbury Reservoir after the road washed out. The new pipe is lower in elevation than the old pipe, and the surrounding area has been reinforced with riprap to prevent erosion. Should the pipe back up in the future due to heavy flows, there is now at least 0.5 acres of storage area behind Terry Road to mitigate flood flows.
d. Boulder Brook – There are 39 housing units here, but Bill doesn't think the new development will cause any future drainage problems. The detention basin was breached during the extreme storms this spring but is being fixed.
e. Salem Road – 800 feet west of Pondview Drive, the 36" pipe will sometimes backup due to beavers living in the culvert. When it backs up, it floods four septic fields near CWC lands. The town regularly pulls down the beaver dams (without killing the beavers) to prevent leachate from reaching water company lands.
f. Drain under Route 68 – A tributary to Ten Mile Brook flows under Route 68 between the Public Works and Plank Road. The water flows over the road (or can freeze on the road in winter) 2 to 3 times per year because the pipe here is undersized. The bridge on Route 68 at Plank Road spanning Ten Mile River was replaced a few years ago (1987).
g. The Town Landfill – The landfill in the northeastern part of Prospect is surrounded by three brooks. These brooks drain to Cheshire. Downstream of the landfill, the streams combine and flow in, around, and over ledge which

during flood conditions creates rapid velocities and backups at the culvert under Plank Road. Such backups have flooded nearby septic fields. The culvert under Plank Road should be increased in size to accommodate higher flows. The backups have never been severe enough to affect the upstream landfill, so leachate from the landfill area is not a concern.

h. New Subdivision north of Candee Road – During construction, runoff to Roaring Brook may be increased. No problems are expected to occur after development is completed, as the subdivision will have a detention basin. Some houses nearby are situated on wetland soils.

i. Roaring Brook at Roaring Brook Road – The culvert under Roaring Brook Road near Norm's Pony Farm is too small and often overflows the road. Prospect is currently in negotiations to obtain some land in the area which will enable them to fix the problem, as Roaring Brook is a protected and sensitive watershed area (RWA).

Brush fires do occur, but would not be classified as "wildfires". Such fires never reach into the treetops. Prospect has a brush fire truck equipped with 4WD.

Prospect contacts the local water companies (CWC, RWA) for assistance in regards to maintenance / firefighting activities on their lands. Virginia recommended we contact the water companies to mention this project and get any input they may have.

A new development on Summit Road, west of Pineview Road, was stopped by the Army Corps of Engineers due to it being a "sensitive" area.

A new development on Summit Road has significantly increased detention capacity, so flooding is no longer an issue at that location.

Complaint logs (paper only) are kept in Bob's office and reviewed annually. About 1 to 2 complaints per month are related to drainage.

Dams in the town are generally in good repair. A dam on Route 69 (Waterbury Reservoir?) is slated for major repairs, and one near Waterbury (in Prospect or in Waterbury?) was recently lowered by 6' to reduce pressure on the dam (and has consequently lowered its flood mitigation capacity). Major repairs are also slated for a dam on Route 68 (West Brook Reservoir or Cheshire Reservoir?) on an inactive reservoir. The town also oversized a box culvert on Summit Road in case the upstream dam (unregistered dam?) should fail.

Ice is a greater problem in Prospect than in surrounding towns due to its greater elevation. Severe icing is another reason Prospect has a policy to cut back trees from the road. An example is Terry Road near the Waterbury Reservoir, where pine trees shaded the road creating a cold zone with increased icing along Waterbury property. Waterbury cut back the trees and the situation improved.

## *IV. Acquisitions*

- Zoning Regulations: Adopted September 26, 1962, last amended July 14, 2005
- Subdivision Regulations: Adopted July 1, 2004, last amended June 17, 2005.
- Inland Wetland and Watercourses Regulations: Adopted July 1, 1974, last amended March 13, 2000.
- Emergency Operations Plan: Adopted December 23, 2005.
- Plan of Conservation and Development: Will be sent by Bob or Bill (they were out of copies).
- Five Year Plan of Proposed Capital Projects: Dated February 7, 2006.
- Town of Prospect Budget Sheet: 2004-2005 to 2006-2007.

COGCNV field notes
Field inspection on June 28, 2006.
Notes typed June 28, 2006.
Scott Bighinatti

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Connecticut experienced a heavy storm the morning of June 28, 2006. This event had rainfall intensities reaching one inch per hour during morning rush hour over the western part of the state. The weather station KCTMIDDL8 (www.wunderground.com) in Eastern Middlebury, Connecticut recorded 1.05 inches for this rain event between the hours of 6:30 and 10:00 am. Recent rainfall at this gauge totaled 0.71, 0.92, 0.61, 0.11, and 0.03 inches on June 23, 24, 25, 26, and 27, respectively, so soil conditions were considered saturated. Sites in Prospect were checked for potential flooding during the later part of the storm on June 28, based on recommendations provided by the mayor's office in Prospect.

Photographs:

1. Site 7: Mountain Brook at Plank Road, Upstream
2. Site 7: Mountain Brook at Plank Road, Downstream
3. Site 7: Mountain Brook at Plank Road, Downstream Staff Gauge
4. Site 3: Private Pond at Clark Hill Road (north side of road, high stage)
5. Site 3: Private Pond at Clark Hill Road (rip rap overflow)
6. Site 4: Unnamed Stream at Terry Road, Upstream (new culvert)
7. Site 4: Unnamed Stream at Terry Road, Downstream (new culvert)
8. Site 5: Unnamed Stream at Spring Road near Rt. 68, Downstream
9. Site 5: Unnamed Stream at Spring Road near Rt. 68, Upstream
10. Site 5: Fulling Mill Brook at Spring Road, Downstream
11. Site 5: Fulling Mill Brook at Spring Road, Upstream
12. Site 1: Marks Brook Area of Straitsville Road (no flooding).
13. Site 6: Roaring Brook at Roaring Brook Road, Upstream
14. Site 6: Roaring Brook at Roaring Brook Road, Downstream
15. Site 6: Roaring Brook Road area regularly flooded by Roaring Brook
16. Site 10: Ten Mile River at intersection of Rt. 68 and Plank Road, Upstream flow
17. Site 10: Ten Mile River at intersection of Rt. 68 and Plank Road, Upstream
18. Site 10: Ten Mile River at intersection of Rt. 68 and Plank Road, Downstream

These notes follow the sequence of photography above, including some sites that were not photographed.

Site 7: Mountain Brook at Plank Road – This stream is running rapidly. There is a staff gauge downstream noting that the water was about two feet deep.

Site 8: Summit Road – The areas of Whebey Drive and Holley Lane were inspected. No watercourses were noted on or near these dead end streets. Mountain Brook flows under Juggernaut Road, which intersects with Summit Road. Juggernaut Road may be worth a look during a later field reconnaissance.

Site 2: Corinne Drive – No flooding was observed at this site. There may be an intermittent watercourse present, but it is well hidden by vegetation.

Site 3: Private Pond / Unnamed Stream at Clark Hill Road – A private pond exists onsite, damming an unnamed stream. This pond may be known locally as Raudis Pond. The top of the riprap spillway is either at or slightly above the level of the road. Streamflow through the spillway is slow at the moment. Judging from the landscaping at the edge of the pond near the road, the potential exists for water to flood the road. This unnamed stream flows south to Site 5 (Spring Road).

Site 4: Unnamed Stream at Terry Road – This unnamed stream drains Turkey Hill and flows under Terry Road into East Mountain Reservoir. This stream apparently did severe damage to the road during the previous months, as a new culvert has recently been laid to direct flow under the road (see photo). No wingwalls or guardrails have been installed on the bridge, but the sides are well-reinforced with riprap.

Site 5: Unnamed Stream at Spring Road – This stream is the same as the one in Site 3. It drains under Route 68 at the intersection of Clark Hill Road and into an impoundment before draining under Spring Road and into a smaller impoundment. This impoundment drains west until the unnamed stream empties into Fulling Mill Brook. There is almost no potential for flooding from the small impoundment here as it is an overflow dam, and the larger impoundment has enough surface area to mitigate floods. The culvert where the stream passes under Route 68 at Clark Hill Road was not inspected (it would be categorized as Site 9), but should be inspected in a subsequent reconnaissance.

Fulling Mill Brook at Spring Road – This stream is quite high, as evidenced in the downstream photo (see photo). Streamflow on the east side of the road (upstream) is quite fast.

Site 1: Marks Brook at Straitsville Road – This stream was completely hidden by vegetation. A photo was taken of the area prone to flooding. According to a Town of Prospect Police Officer who stopped while I was inspecting the area, the entire road was washed out recently from the heavy rains, presumably in late April or mid-May.

Site 6: End of Roaring Brook Road – An equestrian facility marks the end of Roaring Brook Road. There is no drainage on Roaring Brook Road at this location, and the steep grade of the road results in flows along the sides of the roadway of one to two inches deep.

Roaring Brook at Roaring Brook Road – The culvert here is much too small to handle flood flows. According to the neighbor on the west side of the road just south of the brook, the culvert regularly overflows and the excess streamflow discharges along the road until it flows off the road across the street from his house. The road likely flooded recently, as there was evidence of soil deposition on the road just south of the gentleman's driveway.

Site 10: Ten Mile River at Route 68 near Plank Road – Ten Mile River flows down a steep grade at this location with the potential for a lot of erosion. A bridge was installed in 1987 at the site and appears suitable for flood flows. Concrete wingwalls were also installed to reduce scour around the 80-degree turn the river takes to flow under Route 68. The area around the Public Works on Route 68 should be observed during a subsequent reconnaissance.

Yankee Clipper

WATERBURY REPUBLICAN-AMERICAN

11/21/06

# Prospect eyes plan for disasters

## Consultant drafts mitigation guide, seeks public input

BY JODIE MOZDZER
REPUBLICAN-AMERICAN

PROSPECT — Whether it's ice on Route 69 or an overflow of Raudis Pond at Clark Hill Road, the town will soon have a plan of action.

That's because an engineering and environmental science consulting firm is currently drafting a "pre-disaster mitigation" plan for Prospect and three other towns to have a guideline for how to handle an array of natural disasters.

Representatives from Milone & MacBroom of Cheshire presented the project at Town Hall on Monday night. The goal: to receive more resident input on natural disaster concerns here to draft a complete plan.

"A lot of times the individual people know something the town fathers just don't think of," said Virginia Mason, the assistant director of the Council of Governments Central Naugatuck Valley, which is overseeing the project in Prospect plus Waterbury, Cheshire and Wolcott. Each town will have its own plan and its own meeting to get localized input.

Once the town has an emergency plan in place by the spring, it will be eligible for more state and federal emergency grants, Mason said. This is the second round of plans the council is overseeing. Oxford and Woodbury adopted their own pre-disaster plans this year.

The program is funded by the Federal Emergency Management Agency.

David Murphy of Milone & MacBroom presented a list of natural disaster concerns in Prospect, including winter storms causing road troubles on Routes 68 and 69, flooding of brooks and reservoirs in town and wind affecting the mobile home park on Cook Road.

The plan will identify the

See **PLAN**, *Page* **2B**

# PLAN: Federal funds will be available

*Continued from 1B*

natural hazards and address potential ways to prepare for them and alleviate their effects.

After the plan is complete and a public hearing is held, it will be submitted to the FEMA for approval.

From there, any extra mitigation measures outlined in the plan, like a beefed up communications system for emergency responders, will become eligible for grant money.

Only two people attended Prospect's meeting, but Mason said input will be accepted via e-mail until December.

Anyone with specific concerns about the effect that floods, hurricanes, earthquakes, wild fire and winter storms have on Prospect are urged to contact Murphy at davem@miloneandmacbroom.com.

BRIEFLY 11/15/06

## Meeting discusses natural emergency

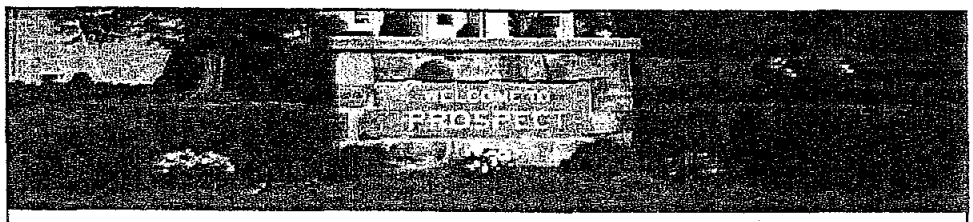
PROSPECT — What types of natural emergencies can a small town like Prospect anticipate?

A meeting will be held at 7 p.m. Monday at the Town Hall Assembly Room to discuss the importance of planning to minimize the effects of natural disasters.

The town will be seeking input from the public about possible local natural hazards such as hurricanes, northeasters, floods, severe thunderstorms, wildfires and earthquakes. The public is invited to attend and participate in the process.

In coming months, consultants will develop a plan identifying actions that can be taken before a disaster to reduce the loss of life and property damages associated with the event. The plan will be submitted to FEMA in accordance with the Disaster Mitigation Act of 2000.

For further information, contact Virginia Mason or Selma Alves at (203) 757-0535.



# Natural Hazard Pre-Disaster Mitigation Plan Prospect, Connecticut


Presented by:

David Murphy, P.E. – Associate
Milone & MacBroom, Inc.

Samuel Eisenbeiser, Senior Planner
Fitzgerald & Halliday, Inc.


November 20, 2006

## History of Hazard Mitigation Plans

- **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

MILONE & MACBROOM, INC.

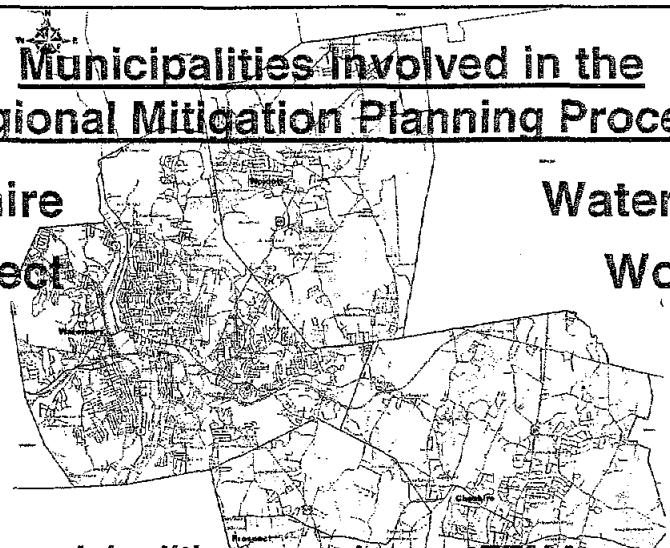
# Municipalities Involved in the Regional Mitigation Planning Process

Cheshire

Waterbury

Prospect

Wolcott



***Local municipalities must have a FEMA approved Hazard Mitigation Plan in place to receive federal grant funds for hazard mitigation projects.***

MILONE & MACBROOM, INC.

## Selection of FEMA Pre-Disaster Mitigation Grants: 2003-2006

*List does not include seismic, wind retrofit, home acquisition, and planning projects*

| *State* | *Description* | *Grant* |
|---|---|---|
| Colorado | Detention pond | $3,000,000 |
| Oregon | Water conduit replacement | $3,000,000 |
| Washington | Road elevation | $3,000,000 |
| Oregon | Floodplain restoration | $2,984,236 |
| Colorado | Watershed mitigation | $2,497,216 |
| Georgia | Drainage improvements | $1,764,356 |
| Massachusetts | Pond flood hazard project | $1,745,700 |
| Oregon | Ice storm retrofit | $1,570,836 |
| North Dakota | Power transmission replacement | $1,511,250 |
| Texas | Home elevations | $1,507,005 |
| Florida | Storm sewer pump station | $1,500,000 |
| Massachusetts | Flood hazard mitigation project | $1,079,925 |
| Kansas | Effluent pump station | $765,000 |
| South Dakota | Flood channel restoration | $580,657 |
| Massachusetts | Culvert project | $525,000 |
| Texas | Storm shelter | $475,712 |
| Massachusetts | Housing elevation and retrofit | $473,640 |
| Utah | Fire station retrofit | $374,254 |
| Washington | Downtown flood prevention project | $255,000 |
| New York | WWTP Floodwall construction | $223,200 |
| Massachusetts | Road mitigation project | $186,348 |
| Massachusetts | Flood mitigation project | $145,503 |
| Vermont | Road mitigation project | $140,441 |
| New Hampshire | Water planning for firefighting | $134,810 |
| Oregon | Bridge scour relocation project | $116,709 |
| New Hampshire | Box culvert project | $102,000 |
| Missouri | Bank stabilization | $48,750 |
| Tennessee | Utility protection | $40,564 |
| Wisconsin | Waterway stabilization | $12,909 |

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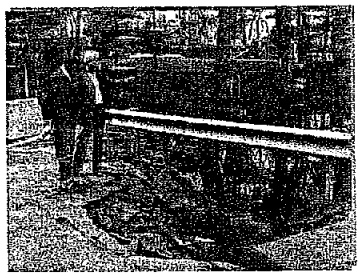
## What is a Natural Hazard ?

- An extreme natural event that poses a risk to people, infrastructure, and resources



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## What is Hazard Mitigation?

- ***Pre-disaster*** actions that reduce or eliminate long-term risk to people, property, and resources from natural hazards and their effects

Warning Signs on Sandbank Road – a type of hazard mitigation

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## Long-Term Goals of Hazard Mitigation

- Reduce loss / damage to life, property, and infrastructure
- Reduce the cost to residents and businesses
- 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 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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## Components of Hazard Mitigation Planning Process

- Identify natural hazards that could occur in Prospect
- Evaluate the vulnerability of structures and populations and identify critical facilities and areas of concern
- Assess adequacy of mitigation measures currently in place
- Evaluate potential mitigation measures that could be undertaken to reduce the risk and vulnerability
- Develop recommendations for future mitigation actions

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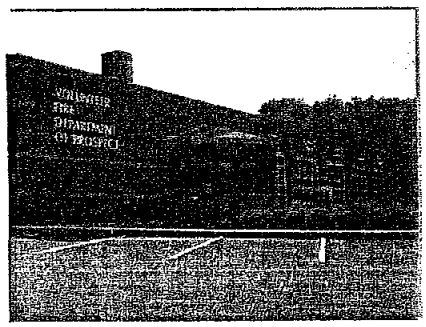
## Prospect's Critical Facilities

- Emergency Services – Police, Fire, Ambulance
- Municipal Facilities – Town Hall, Municipal Buildings, Department of Public Works
- Shelters – Senior Center and Fire House



Volunteer Fire Department in Prospect

- Health Care and Assisted Living
- Water Utilities – Well, Reservoirs, Pump Stations

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## Prospect's Critical Facilities

- Wastewater Utilities – Pumping Stations
- Transportation

Resident State Trooper's Office in Prospect

Town of Prospect Public Works Trucks

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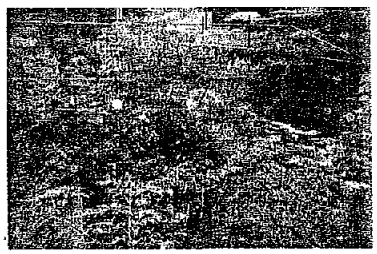
## Potential Mitigation Measures

- Develop and implement warning systems
- Adopt local legislation that limits or regulates development in vulnerable areas
- Public education programs – dissemination of public safety information
- Construction of structural measures
- Allocate technical and financial resources for mitigation programs
- Preserve critical land areas and natural systems
- Research and / or technical assistance for local officials



Box Culvert / Bridge and Walls – Tenmile River at Route 68

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## Natural Hazards Facing Prospect

- Inland flooding
- Winter storms, nor'easters, heavy snow, blizzards, ice storms
- Hurricanes
- Summer storms, tornadoes, thunderstorms, hail
- Dam failure
- Wildfires
- Earthquakes

Unnamed Stream at Spring Road near Route 68 (Downstream)

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## Hurricanes

- Winds
- Heavy rain / flooding

1955 Flooding

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## Summer Storms and Tornadoes

Lightning over Boston

Tornado in KS

- Heavy wind / tornadoes / downbursts
- Lightning
- Heavy rain
- Hail

Flooding in MN

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## Winter Storms

- Blizzards and nor'easters
- Heavy snow and drifts
- Freezing rain / ice

Blizzard of 1978 - CT

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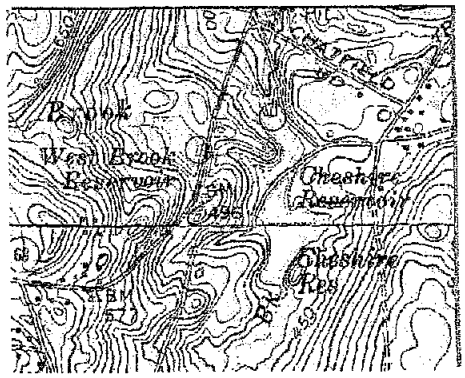
## Dam Failure

- Caused by severe rains or earthquakes
- Possibility of loss of life and millions of dollars in property damage




Two Dams in Prospect

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## Wildfires

- Prospect has low to moderate risk of wildfires
  - Fire
  - Heat
  - Smoke

Photo courtesy of FEMA

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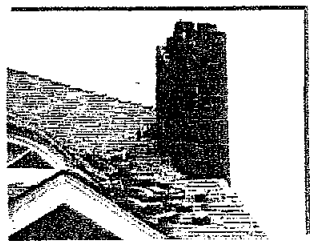
## Earthquakes

- Prospect is in an area of minor seismic activity
- Can cause dam failure
  - Shaking
  - Liquefaction
  - Secondary (Slides / Slumps)



Photos courtesy of FEMA

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## Area-Specific Problems

- Flooding caused by poor drainage and encroachment
- Wind
- Snow and ice

***The Town of Prospect has been very proactive in natural hazard mitigation since flooding in 1983***

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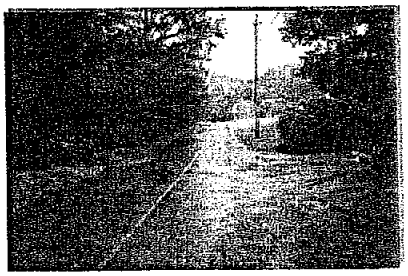
## Flooding and Poor Drainage

- Roaring Brook at Roaring Brook Road
- Tributary of Fulling Mill Brook at Spring Road and Route 68
- Fulling Mill Brook at Salem Road
- Tributary of Waterbury Reservoir at Terry Road

Roaring Brook at Roaring Brook Road (upstream)



Roaring Brook Road near Roaring Brook

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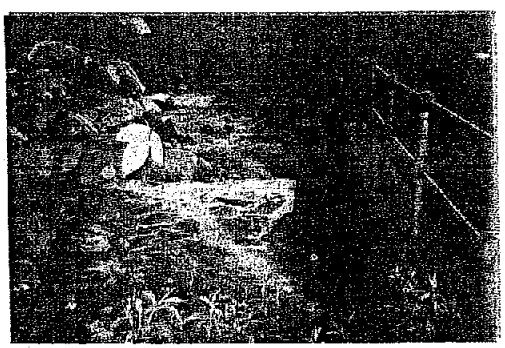
## Flooding and Poor Drainage

- Mountain Brook near Plank Road and Landfill
- Tributary of Tenmile River at Route 68



Mountain Brook near Plank Road (upstream)

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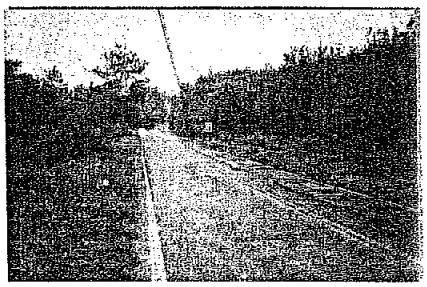
## Flooding and Poor Drainage

- Raudis Pond at Clark Hill Road
- Marks Brook at Straitsville Road



Marks Brook Area of Straitsville Road

Raudis Pond at Clark Hill Road

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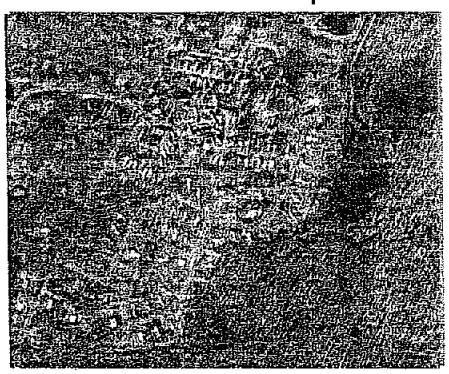
## Wind

- Mobile Home Park on Cook Road
  - Homes are not secured
  - Access to shelters can be impaired during storms



Aerial Photograph of Mobile Home Park

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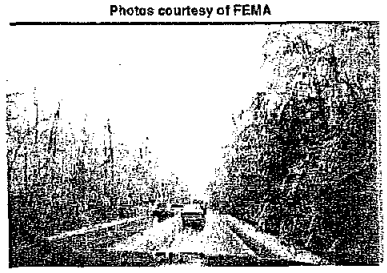
## Snow and Ice

- Elevation / temperature
- State slow to plow Routes 68 & 69
- Densely wooded areas such as Terry Road cause cold zones
- Unnamed tributary to Tenmile River near DPW ices on Route 68

Photos courtesy of FEMA



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## Next Steps

- Incorporate input from residents
- Rank hazard vulnerability
- Develop a response strategy
- Prepare the draft plan with recommendations for review by the Town and the public
- Adopt and implement the plan

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# Questions and Additions

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## *Meeting Minutes*

## NATURAL HAZARD MITIGATION PLAN FOR PROSPECT
**Council of Governments Central Naugatuck Valley**

## PUBLIC INFORMATION MEETING – NOVEMBER 20, 2006

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### *I. Welcome & Introductions*

The following individuals attended the information meeting:

- David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- Sam Eisenbeiser, Fitzgerald & Halliday, Inc.
- Virginia Mason, Council of Governments Central Naugatuck Valley
- Jodie Mozdzer, Reporter for Waterbury Republican-American
- Nelson Abarzua, Prospect Resident Trooper
- Richard Mortenson, Prospect LEPC and resident of Boulder Brook

Virginia introduced the project team and the project, explaining the COG's role in the project, the goals of the Disaster Mitigation Act, and the relationship to the FEMA pre-disaster and post-disaster funding processes.

### *II. Power Point: "Natural Hazard Pre-Disaster Mitigation Plan, Prospect, Connecticut"*

David and Sam presented the power point slideshow *(copy to be appended to notes during Plan compilation).*

### *III. Discussion*

After the presentation, Mr. Mortenson and Mr. Abarzua were able to spend some time discussing their thoughts about natural hazard mitigation.

Mr. Abarzua believes that the presentation mostly touched on the two big winter problem areas: Route 69 from the center of town to the Bethany line, and Route 68 near DPW toward the Cheshire line:

- Route 69 from the center of town to the Bethany line – This area suffers from icing and is a major road from New Haven to Waterbury without any nearby alternatives. During a recent winter, it had to be completely shut down to clear snow, ice, and accidents.

- Route 68 near DPW toward the Cheshire line – This area is known locally as "Accident Alley." The road has a sharp turn, a steep grade, and water comes off the hillside and causes black ice.

Mr. Abarzua agreed with previous characterizations of the CT DOT's lack of response in Prospect.

He agreed that flooding problems were mainly related to streams and ponds being close to roadway elevations, and thought that the presentation hit all the most important areas of flooding. He emphasized the Straitsville Road area, as well.

Communication dead spots include Route 42 and Straitsville Road.

Mr. Abarzua inquired if a FEMA pre-disaster grant could be used to fund a system similar to reverse 911, but that sends text messages to mobile phones. This could be used, for example, to notify residents of a power outage duration.

Mr. Mortenson is a recent resident of Prospect and lives in the new Boulder Brook development off Route 68 near Spring Road. This development is lower than Route 68 and residents sometimes have trouble getting in and out during snow and ice conditions. Power outages have also been a problem in that development, and one resident of the complex is on oxygen. He wondered if there was a way that the Plan could address these types of small site-specific problems.

Mr. Mortenson also is concerned with the affect of power loss on sewer pump stations, including the one that serves Boulder Brook. Although the systems typically have septic tanks that can hold wastewater for a couple days while pumping stations are repaired, the potential for a backup is real. David indicated that the best way to address that type of problem isn't to focus on the repair of the pumping stations, but to focus on maintaining access and protecting electrical systems so the stations can be repaired quickly. Also, the problem should be presented as one that affects every neighborhood served by a pumping station, rather than just Boulder Brook.

# APPENDIX C
# HAZUS DOCUMENTATION

# Hazus-MH: Flood Event Report

**Region Name:** Prospect 2

**Flood Scenario:** Fulling Mill

**Print Date:** Friday, March 14, 2014

***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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Flood Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Flood Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building-Related Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14 square miles and contains 101 census blocks. The region contains over 3 thousand households and has a total population of 8,707 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 3,420 buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92.16% of the buildings (and 78.39% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religion | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.00%** |

**Table 2**
**Building Exposure by Occupancy Type for the Scenario**

| Occupancy | Exposure ($1000) | Percent of Total |
|---|---|---|
| Residential | 36,882 | 54.7% |
| Commercial | 4,736 | 7.0% |
| Industrial | 25,623 | 38.0% |
| Agricultural | 158 | 0.2% |
| Religion | 0 | 0.0% |
| Government | 0 | 0.0% |
| Education | 0 | 0.0% |
| **Total** | **67,399** | **100.00%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 3 schools, 1 fire station, 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:** | Prospect 2 |
| **Scenario Name:** | Fulling Mill |
| **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 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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 | 1 | 0 | 0 | 0 |
| Hospitals | 0 | 0 | 0 | 0 |
| Police Stations | 1 | 0 | 0 | 0 |
| Schools | 3 | 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 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 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 3 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the flood is 0.06 million dollars, which represents 0.09 % 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 0.06 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 42.37% 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 | 0.02 | 0.00 | 0.01 | 0.00 | 0.03 |
| | Content | 0.01 | 0.00 | 0.02 | 0.00 | 0.03 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **0.03** | **0.01** | **0.03** | **0.00** | **0.06** |
| 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** | **0.03** | **0.01** | **0.03** | **0.00** | **0.06** |

## Appendix A: County Listing for the Region

Connecticut

- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Total Study Region** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Flood Event Report

**Region Name:** Prospect 2

**Flood Scenario:** Mountain Brook

**Print Date:** Friday, March 14, 2014

***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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Flood Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
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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.

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# Building Inventory

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|---|---|---|
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| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religion | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.00%** |

**Table 2**
**Building Exposure by Occupancy Type for the Scenario**

| Occupancy | Exposure ($1000) | Percent of Total |
|---|---|---|
| Residential | 75,511 | 85.1% |
| Commercial | 8,886 | 10.0% |
| Industrial | 1,806 | 2.0% |
| Agricultural | 469 | 0.5% |
| Religion | 355 | 0.4% |
| Government | 0 | 0.0% |
| Education | 1,726 | 1.9% |
| **Total** | **88,753** | **100.00%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 3 schools, 1 fire station, 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:** | Prospect 2 |
| **Scenario Name:** | Mountain Brook |
| **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 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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 | 1 | 0 | 0 | 0 |
| Hospitals | 0 | 0 | 0 | 0 |
| Police Stations | 1 | 0 | 0 | 0 |
| Schools | 3 | 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 7 tons of debris will be generated. Of the total amount, Finishes comprises 100% of the total, Structure comprises 0% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 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 15 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 25 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the flood is 0.23 million dollars, which represents 0.26 % 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 0.23 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 81.94% 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 | 0.05 | 0.01 | 0.00 | 0.00 | 0.06 |
| | Content | 0.13 | 0.03 | 0.00 | 0.01 | 0.17 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **0.19** | **0.03** | **0.00** | **0.01** | **0.23** |
| 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** | **0.19** | **0.03** | **0.00** | **0.01** | **0.23** |

## Appendix A: County Listing for the Region

Connecticut

- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Total Study Region** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Flood Event Report

**Region Name:** Prospect 2

**Flood Scenario:** Tenmile River

**Print Date:** Friday, March 14, 2014

***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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Flood Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Flood Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building-Related Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14 square miles and contains 101 census blocks. The region contains over 3 thousand households and has a total population of 8,707 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 3,420 buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92.16% of the buildings (and 78.39% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religion | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.00%** |

**Table 2**
**Building Exposure by Occupancy Type for the Scenario**

| Occupancy | Exposure ($1000) | Percent of Total |
|---|---|---|
| Residential | 12,960 | 87.7% |
| Commercial | 994 | 6.7% |
| Industrial | 825 | 5.6% |
| Agricultural | 0 | 0.0% |
| Religion | 0 | 0.0% |
| Government | 0 | 0.0% |
| Education | 0 | 0.0% |
| **Total** | **14,779** | **100.00%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds.
There are 3 schools, 1 fire station, 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:** | Prospect 2 |
| **Scenario Name:** | Tenmile River |
| **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 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 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 | 1 | 0 | 0 | 0 |
| Hospitals | 0 | 0 | 0 | 0 |
| Police Stations | 1 | 0 | 0 | 0 |
| Schools | 3 | 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 8 tons of debris will be generated. Of the total amount, Finishes comprises 58% of the total, Structure comprises 26% of the total. If the debris tonnage is converted into an estimated number of truckloads, it will require 0 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 3 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 1 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the flood is 0.15 million dollars, which represents 1.00 % 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 0.15 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 100.00% 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 | 0.10 | 0.00 | 0.00 | 0.00 | 0.10 |
| | Content | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **0.15** | **0.00** | **0.00** | **0.00** | **0.15** |
| 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** | **0.15** | **0.00** | **0.00** | **0.00** | **0.15** |

## Appendix A: County Listing for the Region

Connecticut

- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Total Study Region** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 10-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 | 17 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Commercial | 158 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Education | 4 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Government | 4 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 74 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Religion | 11 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Residential | 3,152 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Total** | **3,420** | | **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 | 32 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Masonry | 235 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| MH | 127 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Steel | 126 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Wood | 2,900 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 0 | 3 |

## 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 8,707) 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
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 20-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 | 17 | 99.84 | 0 | 0.16 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Commercial | 158 | 99.79 | 0 | 0.21 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Education | 4 | 99.78 | 0 | 0.22 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Government | 4 | 99.77 | 0 | 0.23 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 74 | 99.77 | 0 | 0.23 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Religion | 11 | 99.81 | 0 | 0.19 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Residential | 3,152 | 99.99 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Total** | **3,419** | | **1** | | **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 | 32 | 99.70 | 0 | 0.30 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Masonry | 234 | 99.78 | 1 | 0.22 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| MH | 127 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Steel | 126 | 99.76 | 0 | 0.24 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Wood | 2,900 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 0 | 3 |

## 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 8,707) 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 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 | 1.61 | 0.00 | 0.00 | 0.00 | 1.61 |
| | Content | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **1.61** | **0.00** | **0.00** | **0.00** | **1.61** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Relocation | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 |
| | Rental | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Wage | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **0.01** | **0.00** | **0.00** | **0.00** | **0.01** |
| Total | | | | | | |
| | **Total** | **1.62** | **0.00** | **0.00** | **0.00** | **1.62** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 50-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 : 50 - year Event**

| | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Occupancy** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Agriculture | 17 | 99.28 | 0 | 0.68 | 0 | 0.04 | 0 | 0.00 | 0 | 0.00 |
| Commercial | 157 | 99.23 | 1 | 0.74 | 0 | 0.04 | 0 | 0.00 | 0 | 0.00 |
| Education | 4 | 99.26 | 0 | 0.74 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Government | 4 | 99.22 | 0 | 0.78 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 73 | 99.19 | 1 | 0.80 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Religion | 11 | 99.37 | 0 | 0.62 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Residential | 3,136 | 99.48 | 16 | 0.52 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| **Total** | **3,402** | | **18** | | **0** | | **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 | 32 | 98.89 | 0 | 1.10 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Masonry | 233 | 99.00 | 2 | 0.96 | 0 | 0.04 | 0 | 0.00 | 0 | 0.00 |
| MH | 127 | 100.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Steel | 125 | 99.17 | 1 | 0.81 | 0 | 0.02 | 0 | 0.00 | 0 | 0.00 |
| Wood | 2,886 | 99.51 | 14 | 0.48 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 0 | 3 |

## 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 57 tons of debris will be generated. Of the total amount, 0 tons (0%) is Other Tree Debris. Of the remaining 57 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 2 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 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 0.8 million dollars, which represents 0.11 % 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 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 | 762.27 | 20.33 | 6.47 | 3.11 | 792.19 |
| | Content | 28.94 | 0.00 | 0.00 | 0.00 | 28.94 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **791.22** | **20.33** | **6.47** | **3.11** | **821.14** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Relocation | 0.36 | 0.25 | 0.02 | 0.02 | 0.66 |
| | Rental | 0.42 | 0.00 | 0.00 | 0.00 | 0.42 |
| | Wage | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **0.79** | **0.25** | **0.02** | **0.02** | **1.08** |
| Total | | | | | | |
| | **Total** | **792.01** | **20.58** | **6.50** | **3.13** | **822.22** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 100-year Return Period

**Print Date:** Thursday, May 02, 2013

***Disclaimer:***
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# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
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| Economic Loss | 9 |
| Building Losses | |
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| Appendix B: Regional Population and Building Value Data | 11 |

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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:
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# Building Inventory

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Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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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| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 7 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 | 16 | 95.96 | 1 | 3.36 | 0 | 0.48 | 0 | 0.19 | 0 | 0.00 |
| Commercial | 153 | 96.93 | 4 | 2.74 | 0 | 0.31 | 0 | 0.02 | 0 | 0.00 |
| Education | 4 | 97.42 | 0 | 2.52 | 0 | 0.06 | 0 | 0.00 | 0 | 0.00 |
| Government | 4 | 97.28 | 0 | 2.66 | 0 | 0.06 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 72 | 96.94 | 2 | 2.80 | 0 | 0.21 | 0 | 0.06 | 0 | 0.00 |
| Religion | 11 | 97.22 | 0 | 2.69 | 0 | 0.08 | 0 | 0.01 | 0 | 0.00 |
| Residential | 3,015 | 95.66 | 131 | 4.15 | 6 | 0.19 | 0 | 0.00 | 0 | 0.00 |
| **Total** | **3,275** | | **138** | | **7** | | **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 | 31 | 96.21 | 1 | 3.63 | 0 | 0.17 | 0 | 0.00 | 0 | 0.00 |
| Masonry | 225 | 95.60 | 9 | 3.88 | 1 | 0.45 | 0 | 0.07 | 0 | 0.00 |
| MH | 127 | 99.92 | 0 | 0.06 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Steel | 122 | 97.11 | 3 | 2.60 | 0 | 0.26 | 0 | 0.03 | 0 | 0.00 |
| Wood | 2,775 | 95.69 | 120 | 4.14 | 5 | 0.17 | 0 | 0.00 | 0 | 0.00 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 0 | 3 |

## 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 5,401 tons of debris will be generated. Of the total amount, 3,510 tons (65%) is Other Tree Debris. Of the remaining 1,891 tons, Brick/Wood comprises 15% 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 12 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 1,601 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 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 3.0 million dollars, which represents 0.40 % 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 3 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 | 2,514.58 | 99.08 | 43.40 | 19.20 | 2,676.26 |
| | Content | 163.70 | 12.36 | 10.92 | 2.24 | 189.22 |
| | Inventory | 0.00 | 0.21 | 1.86 | 0.20 | 2.28 |
| | **Subtotal** | **2,678.28** | **111.65** | **56.18** | **21.65** | **2,867.76** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 10.46 | 0.35 | 2.03 | 12.84 |
| | Relocation | 80.25 | 8.24 | 1.72 | 1.49 | 91.70 |
| | Rental | 30.62 | 4.83 | 0.36 | 0.12 | 35.94 |
| | Wage | 0.00 | 3.71 | 0.59 | 4.78 | 9.08 |
| | **Subtotal** | **110.88** | **27.24** | **3.01** | **8.43** | **149.56** |
| Total | | | | | | |
| | **Total** | **2,789.16** | **138.89** | **59.19** | **30.07** | **3,017.32** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 200-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 47 buildings will be at least moderately damaged. This is over 1% of the total number of buildings in the region. There are an estimated 1 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 | 15 | 86.56 | 2 | 10.14 | 0 | 2.18 | 0 | 1.04 | 0 | 0.08 |
| Commercial | 142 | 90.11 | 13 | 8.25 | 2 | 1.43 | 0 | 0.21 | 0 | 0.00 |
| Education | 4 | 91.50 | 0 | 7.74 | 0 | 0.73 | 0 | 0.03 | 0 | 0.00 |
| Government | 4 | 91.28 | 0 | 7.87 | 0 | 0.82 | 0 | 0.02 | 0 | 0.00 |
| Industrial | 67 | 90.27 | 6 | 7.99 | 1 | 1.36 | 0 | 0.36 | 0 | 0.02 |
| Religion | 10 | 90.34 | 1 | 8.86 | 0 | 0.76 | 0 | 0.04 | 0 | 0.00 |
| Residential | 2,712 | 86.05 | 398 | 12.62 | 40 | 1.28 | 1 | 0.03 | 1 | 0.02 |
| **Total** | **2,954** | | **420** | | **44** | | **2** | | **1** | |

**Table 3: Expected Building Damage by Building Type : 200 - year Event**

| **Building Type** | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Concrete | 28 | 88.45 | 3 | 9.89 | 1 | 1.64 | 0 | 0.02 | 0 | 0.00 |
| Masonry | 204 | 86.95 | 25 | 10.45 | 5 | 2.20 | 1 | 0.37 | 0 | 0.03 |
| MH | 126 | 99.10 | 1 | 0.68 | 0 | 0.20 | 0 | 0.00 | 0 | 0.02 |
| Steel | 114 | 90.86 | 9 | 7.40 | 2 | 1.46 | 0 | 0.28 | 0 | 0.00 |
| Wood | 2,493 | 85.96 | 371 | 12.80 | 35 | 1.19 | 1 | 0.03 | 0 | 0.02 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 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 7,810 tons of debris will be generated. Of the total amount, 4,786 tons (61%) is Other Tree Debris. Of the remaining 3,024 tons, Brick/Wood comprises 28% 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 34 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 2,183 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 1 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 8.0 million dollars, which represents 1.06 % 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 8 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 87% 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 | 5,785.41 | 303.23 | 182.73 | 73.09 | 6,344.47 |
| | Content | 926.19 | 55.31 | 88.92 | 18.35 | 1,088.77 |
| | Inventory | 0.00 | 1.26 | 14.15 | 1.58 | 16.99 |
| | **Subtotal** | **6,711.60** | **359.80** | **285.81** | **93.01** | **7,450.22** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 51.42 | 2.98 | 4.78 | 59.17 |
| | Relocation | 196.56 | 52.18 | 13.84 | 11.75 | 274.33 |
| | Rental | 69.40 | 31.98 | 2.71 | 0.70 | 104.79 |
| | Wage | 0.00 | 53.21 | 5.00 | 55.50 | 113.71 |
| | **Subtotal** | **265.96** | **188.78** | **24.53** | **72.73** | **552.00** |
| Total | | | | | | |
| | **Total** | **6,977.56** | **548.58** | **310.33** | **165.75** | **8,002.23** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 500-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 250 buildings will be at least moderately damaged. This is over 7% of the total number of buildings in the region. There are an estimated 12 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 | 11 | 64.29 | 4 | 23.26 | 1 | 8.03 | 1 | 3.85 | 0 | 0.56 |
| Commercial | 111 | 70.14 | 33 | 20.65 | 13 | 7.92 | 2 | 1.29 | 0 | 0.01 |
| Education | 3 | 71.84 | 1 | 20.50 | 0 | 7.07 | 0 | 0.59 | 0 | 0.00 |
| Government | 3 | 71.90 | 1 | 20.07 | 0 | 7.38 | 0 | 0.65 | 0 | 0.00 |
| Industrial | 52 | 70.33 | 14 | 19.46 | 6 | 8.16 | 1 | 1.88 | 0 | 0.17 |
| Religion | 8 | 70.28 | 3 | 22.73 | 1 | 6.47 | 0 | 0.52 | 0 | 0.00 |
| Residential | 2,056 | 65.24 | 871 | 27.62 | 195 | 6.19 | 18 | 0.58 | 12 | 0.37 |
| **Total** | **2,244** | | **926** | | **216** | | **22** | | **12** | |

**Table 3: Expected Building Damage by Building Type : 500 - year Event**

| **Building Type** | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Concrete | 21 | 66.35 | 7 | 21.88 | 4 | 11.24 | 0 | 0.53 | 0 | 0.00 |
| Masonry | 154 | 65.58 | 53 | 22.52 | 23 | 9.90 | 4 | 1.72 | 1 | 0.29 |
| MH | 120 | 94.48 | 4 | 3.32 | 2 | 1.84 | 0 | 0.09 | 0 | 0.27 |
| Steel | 90 | 71.13 | 23 | 18.40 | 11 | 8.68 | 2 | 1.77 | 0 | 0.03 |
| Wood | 1,884 | 64.97 | 821 | 28.33 | 167 | 5.76 | 17 | 0.59 | 10 | 0.35 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 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 24,356 tons of debris will be generated. Of the total amount, 14,867 tons (61%) is Other Tree Debris. Of the remaining 9,489 tons, Brick/Wood comprises 28% 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 107 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 6,810 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 20 households to be displaced due to the hurricane. Of these, 3 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 29.3 million dollars, which represents 3.87 % 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 29 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 85% 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 | 17,627.16 | 1,143.87 | 804.40 | 293.97 | 19,869.41 |
| | Content | 5,475.01 | 337.57 | 511.61 | 104.58 | 6,428.77 |
| | Inventory | 0.00 | 7.84 | 76.56 | 7.37 | 91.77 |
| | **Subtotal** | **23,102.17** | **1,489.28** | **1,392.58** | **405.92** | **26,389.95** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 122.05 | 9.60 | 15.22 | 146.87 |
| | Relocation | 1,435.09 | 220.90 | 72.05 | 54.86 | 1,782.90 |
| | Rental | 438.65 | 123.83 | 10.77 | 3.29 | 576.54 |
| | Wage | 0.00 | 137.52 | 16.23 | 218.59 | 372.33 |
| | **Subtotal** | **1,873.74** | **604.30** | **108.64** | **291.96** | **2,878.64** |
| Total | | | | | | |
| | **Total** | **24,975.91** | **2,093.58** | **1,501.22** | **697.88** | **29,268.59** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** Probabilistic 1000-year Return Period

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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 574 buildings will be at least moderately damaged. This is over 17% of the total number of buildings in the region. There are an estimated 48 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 | 8 | 44.78 | 5 | 30.94 | 3 | 15.29 | 1 | 7.53 | 0 | 1.46 |
| Commercial | 79 | 50.15 | 43 | 27.19 | 29 | 18.15 | 7 | 4.46 | 0 | 0.04 |
| Education | 2 | 51.05 | 1 | 27.09 | 1 | 18.18 | 0 | 3.68 | 0 | 0.00 |
| Government | 2 | 51.56 | 1 | 26.22 | 1 | 18.41 | 0 | 3.80 | 0 | 0.00 |
| Industrial | 37 | 50.22 | 19 | 25.01 | 14 | 18.63 | 4 | 5.70 | 0 | 0.44 |
| Religion | 6 | 50.71 | 3 | 30.69 | 2 | 15.73 | 0 | 2.88 | 0 | 0.00 |
| Residential | 1,507 | 47.80 | 1,134 | 35.97 | 394 | 12.51 | 70 | 2.22 | 47 | 1.50 |
| **Total** | **1,640** | | **1,206** | | **443** | | **83** | | **48** | |

**Table 3: Expected Building Damage by Building Type : 1000 - year Event**

| **Building Type** | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Concrete | 15 | 45.61 | 8 | 25.63 | 8 | 25.53 | 1 | 3.23 | 0 | 0.00 |
| Masonry | 109 | 46.46 | 65 | 27.67 | 48 | 20.22 | 11 | 4.77 | 2 | 0.89 |
| MH | 112 | 87.82 | 7 | 5.76 | 6 | 4.77 | 1 | 0.45 | 2 | 1.20 |
| Steel | 64 | 50.85 | 29 | 23.29 | 25 | 19.95 | 7 | 5.82 | 0 | 0.10 |
| Wood | 1,375 | 47.40 | 1,080 | 37.25 | 340 | 11.71 | 64 | 2.20 | 42 | 1.44 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 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 43,551 tons of debris will be generated. Of the total amount, 26,035 tons (60%) is Other Tree Debris. Of the remaining 17,516 tons, Brick/Wood comprises 32% 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 225 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 11,903 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 76 households to be displaced due to the hurricane. Of these, 14 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 68.8 million dollars, which represents 9.10 % 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 69 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 86% 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 | 38,640.87 | 2,693.09 | 1,865.71 | 662.88 | 43,862.55 |
| | Content | 14,997.41 | 1,063.47 | 1,308.69 | 286.40 | 17,655.97 |
| | Inventory | 0.00 | 22.35 | 188.74 | 16.18 | 227.28 |
| | **Subtotal** | **53,638.27** | **3,778.91** | **3,363.14** | **965.47** | **61,745.79** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 147.34 | 20.95 | 14.83 | 183.12 |
| | Relocation | 4,047.87 | 550.40 | 176.06 | 130.85 | 4,905.18 |
| | Rental | 1,229.73 | 310.90 | 25.30 | 8.10 | 1,574.04 |
| | Wage | 0.00 | 169.09 | 34.98 | 198.74 | 402.81 |
| | **Subtotal** | **5,277.60** | **1,177.73** | **257.29** | **352.52** | **7,065.15** |
| Total | | | | | | |
| | **Total** | **58,915.88** | **4,956.64** | **3,620.43** | **1,317.99** | **68,810.94** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** UN-NAMED-1938-4

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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:** | 108 mph |

## Building Damage

### General Building Stock Damage

Hazus estimates that about 130 buildings will be at least moderately damaged. This is over 4% of the total number of buildings in the region. There are an estimated 4 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 | 13 | 75.35 | 3 | 17.25 | 1 | 4.79 | 0 | 2.31 | 0 | 0.29 |
| Commercial | 127 | 80.60 | 23 | 14.87 | 6 | 3.93 | 1 | 0.59 | 0 | 0.00 |
| Education | 3 | 82.61 | 1 | 14.33 | 0 | 2.93 | 0 | 0.13 | 0 | 0.00 |
| Government | 3 | 82.23 | 1 | 14.39 | 0 | 3.22 | 0 | 0.16 | 0 | 0.00 |
| Industrial | 60 | 80.82 | 10 | 14.17 | 3 | 4.01 | 1 | 0.93 | 0 | 0.08 |
| Religion | 9 | 80.70 | 2 | 16.27 | 0 | 2.88 | 0 | 0.15 | 0 | 0.00 |
| Residential | 2,374 | 75.32 | 661 | 20.97 | 107 | 3.40 | 6 | 0.19 | 4 | 0.12 |
| **Total** | **2,590** | | **701** | | **118** | | **8** | | **4** | |

**Table 3: Expected Building Damage by Building Type**

| **Building Type** | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Concrete | 25 | 77.82 | 5 | 16.71 | 2 | 5.35 | 0 | 0.12 | 0 | 0.00 |
| Masonry | 179 | 76.30 | 41 | 17.24 | 13 | 5.43 | 2 | 0.90 | 0 | 0.13 |
| MH | 123 | 97.24 | 2 | 1.88 | 1 | 0.77 | 0 | 0.02 | 0 | 0.09 |
| Steel | 103 | 81.64 | 17 | 13.31 | 5 | 4.23 | 1 | 0.81 | 0 | 0.01 |
| Wood | 2,179 | 75.12 | 620 | 21.40 | 92 | 3.18 | 6 | 0.20 | 3 | 0.11 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 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 14,901 tons of debris will be generated. Of the total amount, 9,104 tons (61%) is Other Tree Debris. Of the remaining 5,797 tons, Brick/Wood comprises 28% 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 65 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 4,161 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 8 households to be displaced due to the hurricane. Of these, 2 people (out of a total population of 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 16.6 million dollars, which represents 2.20 % 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. 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 86% 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 | 10,729.23 | 644.36 | 444.08 | 166.74 | 11,984.41 |
| | Content | 2,719.40 | 143.02 | 256.85 | 50.12 | 3,169.38 |
| | Inventory | 0.00 | 3.57 | 39.62 | 4.07 | 47.27 |
| | **Subtotal** | **13,448.63** | **790.95** | **740.56** | **220.93** | **15,201.06** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 100.12 | 6.20 | 12.81 | 119.13 |
| | Relocation | 582.65 | 124.16 | 36.98 | 30.79 | 774.59 |
| | Rental | 182.05 | 72.67 | 6.06 | 1.90 | 262.68 |
| | Wage | 0.00 | 106.98 | 10.48 | 147.58 | 265.03 |
| | **Subtotal** | **764.70** | **403.92** | **59.72** | **193.09** | **1,421.43** |
| Total | | | | | | |
| | **Total** | **14,213.33** | **1,194.87** | **800.28** | **414.01** | **16,622.49** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

## Fire Station Facility Functionality: 10 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 20 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 50 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 100 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 200 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 500 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Fire Station Facility Functionality: 1000 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

*Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.*

## Police Station Facility Functionality: 10 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 20 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 50 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 100 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 200 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 500 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

## Police Station Facility Functionality: 1000 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 1 | 100.00 |
| **Total** | **1** | **100.00** |
| **Study Region Total** | **1** | **100.00** |

*Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.*

## School Functionality: 10 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 100.00 |
| **Total** | **3** | **100.00** |
| **Study Region** | **3** | **100.00** |

## School Functionality: 20 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 100.00 |
| **Total** | **3** | **100.00** |
| **Study Region** | **3** | **100.00** |

## School Functionality: 50 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 100.00 |
| **Total** | **3** | **100.00** |
| **Study Region** | **3** | **100.00** |

## School Functionality: 100 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 100.00 |
| **Total** | **3** | **100.00** |
| **Study Region** | **3** | **100.00** |

## School Functionality: 200 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 0.00 |
| **Total** | **3** | **0.00** |
| **Study Region** | **3** | **0.00** |

## School Functionality: 500 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 0.00 |
| **Total** | **3** | **0.00** |
| **Study Region** | **3** | **0.00** |

## School Functionality: 1000 - year Event

*May 02, 2013*

| | Count | Functionality (%) |
|---|---|---|
| **Connecticut** | | |
| New Haven | 3 | 0.00 |
| **Total** | **3** | **0.00** |
| **Study Region** | **3** | **0.00** |

*Totals only reflect data for those census tracts/blocks included in the user's study region and will reflect the entire county/state only if all of the census blocks for that county/state were selected at the time of study region creation.*

# Hazus-MH: Hurricane Event Report

**Region Name:** Prospect

**Hurricane Scenario:** GLORIA

**Print Date:** Thursday, May 02, 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.*

# Table of Contents


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building Inventory | 4 |
| General Building Stock | |
| Essential Facility Inventory | |
| Hurricane Scenario Parameters | 5 |
| Building Damage | 6 |
| General Building Stock | |
| Essential Facilities Damage | |
| Induced Hurricane Damage | 8 |
| Debris Generation | |
| Social Impact | 8 |
| Shelter Requirements | |
| Economic Loss | 9 |
| Building Losses | |
| Appendix A: County Listing for the Region | 10 |
| Appendix B: Regional Population and Building Value Data | 11 |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region and has a total population of 8,707 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 million dollars (2006 dollars). Approximately 92% of the buildings (and 78% of the building value) are associated with residential housing.

# Building Inventory

## General Building Stock

Hazus estimates that there are 3,420 buildings in the region which have an aggregate total replacement value of 756 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 | 592,998 | 78.4% |
| Commercial | 92,066 | 12.2% |
| Industrial | 50,921 | 6.7% |
| Agricultural | 5,438 | 0.7% |
| Religious | 6,117 | 0.8% |
| Government | 4,424 | 0.6% |
| Education | 4,515 | 0.6% |
| **Total** | **756,479** | **100.0%** |

## Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 3 schools, 1 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:** | 81 mph |

## 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**

| | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Occupancy** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Agriculture | 17 | 98.91 | 0 | 1.00 | 0 | 0.07 | 0 | 0.02 | 0 | 0.00 |
| Commercial | 156 | 98.96 | 2 | 0.97 | 0 | 0.07 | 0 | 0.00 | 0 | 0.00 |
| Education | 4 | 98.96 | 0 | 1.03 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Government | 4 | 99.00 | 0 | 0.99 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Industrial | 73 | 98.93 | 1 | 1.04 | 0 | 0.03 | 0 | 0.00 | 0 | 0.00 |
| Religion | 11 | 99.15 | 0 | 0.83 | 0 | 0.02 | 0 | 0.00 | 0 | 0.00 |
| Residential | 3,123 | 99.07 | 29 | 0.91 | 1 | 0.02 | 0 | 0.00 | 0 | 0.00 |
| **Total** | **3,388** | | **31** | | **1** | | **0** | | **0** | |

**Table 3: Expected Building Damage by Building Type**

| Building Type | None | | Minor | | Moderate | | Severe | | Destruction | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** | **Count** | **(%)** |
| Concrete | 32 | 98.51 | 0 | 1.48 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 |
| Masonry | 232 | 98.58 | 3 | 1.34 | 0 | 0.07 | 0 | 0.01 | 0 | 0.00 |
| MH | 127 | 99.99 | 0 | 0.01 | 0 | 0.00 | 0 | 0.00 | 0 | 0.00 |
| Steel | 125 | 98.91 | 1 | 1.04 | 0 | 0.05 | 0 | 0.00 | 0 | 0.00 |
| Wood | 2,874 | 99.10 | 26 | 0.88 | 0 | 0.02 | 0 | 0.00 | 0 | 0.00 |

## Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none 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 | 1 | 0 | 0 | 1 |
| Police Stations | 1 | 0 | 0 | 1 |
| Schools | 3 | 0 | 0 | 3 |

## 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 1,075 tons of debris will be generated. Of the total amount, 659 tons (61%) is Other Tree Debris. Of the remaining 416 tons, Brick/Wood comprises 23% 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 4 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 320 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 8,707) will seek temporary shelter in public shelters.

## Economic Loss

The total economic loss estimated for the hurricane is 1.2 million dollars, which represents 0.16 % 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 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 | 1,105.12 | 31.74 | 11.85 | 5.64 | 1,154.35 |
| | Content | 58.88 | 0.00 | 0.00 | 0.00 | 58.88 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **1,164.00** | **31.74** | **11.85** | **5.64** | **1,213.23** |
| Business Interruption Loss | | | | | | |
| | Income | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Relocation | 4.12 | 0.45 | 0.07 | 0.05 | 4.69 |
| | Rental | 2.32 | 0.00 | 0.00 | 0.00 | 2.32 |
| | Wage | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | **Subtotal** | **6.44** | **0.45** | **0.07** | **0.05** | **7.01** |
| Total | | | | | | |
| | **Total** | **1,170.43** | **32.19** | **11.92** | **5.69** | **1,220.23** |

## Appendix A: County Listing for the Region

Connecticut
- New Haven

## Appendix B: Regional Population and Building Value Data

| | | Building Value (thousands of dollars) | | |
|---|---|---|---|---|
| | Population | Residential | Non-Residential | Total |
| **Connecticut** | | | | |
| New Haven | 8,707 | 592,998 | 163,481 | 756,479 |
| **Total** | **8,707** | **592,998** | **163,481** | **756,479** |
| **Study Region Total** | **8,707** | **592,998** | **163,481** | **756,479** |

# Hazus-MH: Earthquake Event Report

**Region Name:** Prospect

**Earthquake Scenario:** East Haddam 6.4

**Print Date:** May 02, 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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building and Lifeline Inventory | 4 |
| Building Inventory | |
| Critical Facility Inventory | |
| Transportation and Utility Lifeline Inventory | |
| Earthquake Scenario Parameters | 6 |
| Direct Earthquake Damage | 7 |
| Buildings Damage | |
| Critical Facilities Damage | |
| Transportation and Utility Lifeline Damage | |
| Induced Earthquake Damage | 11 |
| Fire Following Earthquake | |
| Debris Generation | |
| Social Impact | 12 |
| Shelter Requirements | |
| Casualties | |
| Economic Loss | 13 |
| Building Losses | |
| Transportation and Utility Lifeline Losses | |
| Long-term Indirect Economic Impacts | |
| Appendix A: County Listing for the Region | |
| Appendix B: Regional Population and Building Value Data | |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,707 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 (millions of dollars). Approximately 92.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 215 and 0 (millions of dollars) , respectively.

# Building and Lifeline Inventory

## Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 756 (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 85% 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 0 hospitals in the region with a total bed capacity of 0 beds. There are 3 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 2 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 215.00 (millions of dollars). This inventory includes over 34 kilometers of highways, 1 bridges, 227 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

| System | Component | # Locations/ # Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Highway** | Bridges | 1 | 2.50 |
| | Segments | 7 | 211.80 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **214.30** |
| **Railways** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Light Rail** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Bus** | Facilities | 1 | 1.30 |
| | | Subtotal | **1.30** |
| **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 | **215.60** |

**Table 2: Utility System Lifeline Inventory**

| System | Component | # Locations / Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Potable Water** | Distribution Lines | NA | 2.30 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **2.30** |
| **Waste Water** | Distribution Lines | NA | 1.40 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **1.40** |
| **Natural Gas** | Distribution Lines | NA | 0.90 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **0.90** |
| **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 | **4.50** |

## 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 6.4 |
| **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

Hazus estimates that about 291 buildings will be at least moderately damaged. This is over 9.00 % of the buildings in the region. There are an estimated 8 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** | 10 | 0.38 | 4 | 0.62 | 3 | 1.11 | 1 | 1.68 | 0 | 1.80 |
| **Commercial** | 86 | 3.45 | 33 | 5.30 | 28 | 11.91 | 9 | 18.66 | 2 | 21.82 |
| **Education** | 2 | 0.08 | 1 | 0.13 | 1 | 0.33 | 0 | 0.50 | 0 | 0.68 |
| **Government** | 2 | 0.08 | 1 | 0.13 | 1 | 0.33 | 0 | 0.52 | 0 | 0.63 |
| **Industrial** | 38 | 1.51 | 15 | 2.41 | 15 | 6.41 | 5 | 10.50 | 1 | 13.02 |
| **Other Residential** | 166 | 6.64 | 54 | 8.61 | 40 | 17.09 | 15 | 32.70 | 3 | 42.29 |
| **Religion** | 7 | 0.29 | 2 | 0.32 | 1 | 0.56 | 0 | 0.74 | 0 | 0.73 |
| **Single Family** | 2,194 | 87.56 | 514 | 82.46 | 147 | 62.27 | 16 | 34.69 | 2 | 19.03 |
| **Total** | **2,506** | | **623** | | **237** | | **46** | | **8** | |

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| **Wood** | 2,229 | 88.94 | 519 | 83.38 | 140 | 59.03 | 12 | 26.04 | 1 | 9.08 |
| **Steel** | 56 | 2.22 | 26 | 4.13 | 31 | 13.11 | 11 | 23.44 | 3 | 31.40 |
| **Concrete** | 12 | 0.47 | 4 | 0.72 | 5 | 2.21 | 1 | 2.91 | 0 | 3.67 |
| **Precast** | 5 | 0.20 | 1 | 0.21 | 2 | 0.67 | 1 | 1.34 | 0 | 0.39 |
| **RM** | 24 | 0.95 | 4 | 0.71 | 5 | 1.95 | 1 | 3.01 | 0 | 0.39 |
| **URM** | 122 | 4.87 | 41 | 6.62 | 28 | 11.77 | 8 | 17.12 | 1 | 18.39 |
| **MH** | 59 | 2.35 | 26 | 4.25 | 27 | 11.26 | 12 | 26.14 | 3 | 36.68 |
| **Total** | **2,506** | | **623** | | **237** | | **46** | | **8** | |

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

## Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% 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** | 0 | 0 | 0 | 0 |
| **Schools** | 3 | 0 | 0 | 3 |
| **EOCs** | 0 | 0 | 0 | 0 |
| **PoliceStations** | 1 | 0 | 0 | 1 |
| **FireStations** | 1 | 0 | 0 | 1 |

## 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 | 7 | 0 | 0 | 7 | 7 |
| | Bridges | 1 | 0 | 0 | 1 | 1 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| **Railways** | Segments | 0 | 0 | 0 | 0 | 0 |
| | 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 | 1 | 0 | 0 | 1 | 1 |
| **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 | 0 | 0 | 0 | 0 | 0 |
| 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 | 114 | 11 | 3 |
| Waste Water | 68 | 6 | 1 |
| Natural Gas | 45 | 2 | 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 | 3,020 | 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 44.00% 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 280 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, 2 people (out of a total population of 8,707) 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** | **1** | **0** | **0** |
| **2 PM** | Commercial | 3 | 1 | 0 | 0 |
| | Commuting | 0 | 0 | 0 | 0 |
| | Educational | 1 | 0 | 0 | 0 |
| | Hotels | 0 | 0 | 0 | 0 |
| | Industrial | 1 | 0 | 0 | 0 |
| | Other-Residential | 0 | 0 | 0 | 0 |
| | Single Family | 0 | 0 | 0 | 0 |
| | **Total** | **5** | **1** | **0** | **0** |
| **5 PM** | Commercial | 3 | 1 | 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** | **5** | **1** | **0** | **0** |

## Economic Loss

The total economic loss estimated for the earthquake is 27.81 (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 27.55 (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 53 % 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 | 0.05 | 1.04 | 0.10 | 0.11 | 1.30 |
| | Capital-Related | 0.00 | 0.02 | 0.85 | 0.06 | 0.01 | 0.94 |
| | Rental | 0.20 | 0.10 | 0.56 | 0.04 | 0.01 | 0.91 |
| | Relocation | 0.75 | 0.14 | 0.82 | 0.22 | 0.16 | 2.10 |
| | **Subtotal** | **0.96** | **0.31** | **3.27** | **0.41** | **0.30** | **5.24** |
| **Capital Stock Losses** | | | | | | | |
| | Structural | 1.60 | 0.34 | 1.07 | 0.54 | 0.26 | 3.81 |
| | Non_Structural | 7.48 | 1.03 | 2.72 | 1.41 | 0.52 | 13.16 |
| | Content | 2.65 | 0.21 | 1.19 | 0.84 | 0.27 | 5.16 |
| | Inventory | 0.00 | 0.00 | 0.03 | 0.15 | 0.01 | 0.19 |
| | **Subtotal** | **11.72** | **1.58** | **5.00** | **2.95** | **1.06** | **22.31** |
| | **Total** | **12.68** | **1.89** | **8.26** | **3.36** | **1.36** | **27.55** |

## 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 | 211.85 | $0.00 | 0.00 |
| | Bridges | 2.46 | $0.02 | 0.78 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Subtotal | **214.30** | **0.00** | |
| **Railways** | 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** | |
| **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 | 1.25 | $0.15 | 11.96 |
| | Subtotal | **1.30** | **0.10** | |
| **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** | **215.60** | **0.20** | |

**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 | 2.30 | $0.05 | 2.26 |
| | **Subtotal** | **2.27** | **$0.05** | |
| **Waste Water** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 1.40 | $0.03 | 1.89 |
| | **Subtotal** | **1.36** | **$0.03** | |
| **Natural Gas** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 0.90 | $0.01 | 0.97 |
| | **Subtotal** | **0.91** | **$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** | **4.54** | **$0.09** | |

**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

New Haven,CT

## Appendix B: Regional Population and Building Value Data

| State | County Name | Population | Building Value (millions of dollars) | | |
|---|---|---|---|---|---|
| | | | Residential | Non-Residential | Total |
| **Connecticut** | | | | | |
| | New Haven | 8,707 | 592 | 163 | 756 |
| **Total State** | | **8,707** | **592** | **163** | **756** |
| **Total Region** | | **8,707** | **592** | **163** | **756** |

# Hazus-MH: Earthquake Event Report

**Region Name:** Prospect

**Earthquake Scenario:** Haddam 5.7

**Print Date:** May 02, 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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building and Lifeline Inventory | 4 |
| Building Inventory | |
| Critical Facility Inventory | |
| Transportation and Utility Lifeline Inventory | |
| Earthquake Scenario Parameters | 6 |
| Direct Earthquake Damage | 7 |
| Buildings Damage | |
| Critical Facilities Damage | |
| Transportation and Utility Lifeline Damage | |
| Induced Earthquake Damage | 11 |
| Fire Following Earthquake | |
| Debris Generation | |
| Social Impact | 12 |
| Shelter Requirements | |
| Casualties | |
| Economic Loss | 13 |
| Building Losses | |
| Transportation and Utility Lifeline Losses | |
| Long-term Indirect Economic Impacts | |
| Appendix A: County Listing for the Region | |
| Appendix B: Regional Population and Building Value Data | |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,707 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 (millions of dollars). Approximately 92.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 215 and 0 (millions of dollars) , respectively.

# Building and Lifeline Inventory

## Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 756 (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 85% 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 0 hospitals in the region with a total bed capacity of 0 beds. There are 3 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 2 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 215.00 (millions of dollars). This inventory includes over 34 kilometers of highways, 1 bridges, 227 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

| System | Component | # Locations/ # Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Highway** | Bridges | 1 | 2.50 |
| | Segments | 7 | 211.80 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **214.30** |
| **Railways** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Light Rail** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Bus** | Facilities | 1 | 1.30 |
| | | Subtotal | **1.30** |
| **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 | **215.60** |

**Table 2: Utility System Lifeline Inventory**

| System | Component | # Locations / Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Potable Water** | Distribution Lines | NA | 2.30 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **2.30** |
| **Waste Water** | Distribution Lines | NA | 1.40 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **1.40** |
| **Natural Gas** | Distribution Lines | NA | 0.90 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **0.90** |
| **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 | **4.50** |

## 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 5.7 |
| **Type of Earthquake** | Arbitrary |
| **Fault Name** | NA |
| **Historical Epicenter ID #** | NA |
| **Probabilistic Return Period** | NA |
| **Longitude of Epicenter** | -72.55 |
| **Latitude of Epicenter** | 41.47 |
| **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 136 buildings will be at least moderately damaged. This is over 4.00 % 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** | 13 | 0.46 | 2 | 0.60 | 1 | 0.95 | 0 | 1.51 | 0 | 1.83 |
| **Commercial** | 120 | 4.18 | 23 | 5.49 | 13 | 10.54 | 2 | 16.42 | 0 | 24.41 |
| **Education** | 3 | 0.10 | 1 | 0.14 | 0 | 0.28 | 0 | 0.40 | 0 | 0.75 |
| **Government** | 3 | 0.11 | 1 | 0.14 | 0 | 0.28 | 0 | 0.41 | 0 | 0.65 |
| **Industrial** | 56 | 1.93 | 11 | 2.56 | 7 | 5.48 | 1 | 8.12 | 0 | 12.76 |
| **Other Residential** | 211 | 7.34 | 41 | 10.01 | 24 | 19.52 | 3 | 23.14 | 0 | 17.68 |
| **Religion** | 9 | 0.31 | 1 | 0.34 | 1 | 0.57 | 0 | 0.88 | 0 | 1.30 |
| **Single Family** | 2,458 | 85.58 | 331 | 80.71 | 76 | 62.38 | 7 | 49.13 | 0 | 40.62 |
| **Total** | **2,873** | | **411** | | **121** | | **14** | | **1** | |

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| **Wood** | 2,496 | 86.89 | 331 | 80.57 | 69 | 56.71 | 5 | 33.95 | 0 | 11.20 |
| **Steel** | 92 | 3.19 | 19 | 4.52 | 13 | 10.70 | 2 | 15.84 | 0 | 26.06 |
| **Concrete** | 18 | 0.61 | 3 | 0.77 | 2 | 1.78 | 0 | 1.59 | 0 | 2.19 |
| **Precast** | 7 | 0.23 | 1 | 0.23 | 1 | 0.70 | 0 | 1.61 | 0 | 0.40 |
| **RM** | 28 | 0.99 | 3 | 0.70 | 2 | 1.90 | 0 | 3.29 | 0 | 0.43 |
| **URM** | 147 | 5.11 | 31 | 7.66 | 18 | 14.59 | 4 | 28.52 | 1 | 52.33 |
| **MH** | 85 | 2.97 | 23 | 5.55 | 17 | 13.64 | 2 | 15.20 | 0 | 7.38 |
| **Total** | **2,873** | | **411** | | **121** | | **14** | | **1** | |

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

## Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% 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 | 0 | 0 | 0 | 0 |
| Schools | 3 | 0 | 0 | 3 |
| EOCs | 0 | 0 | 0 | 0 |
| PoliceStations | 1 | 0 | 0 | 1 |
| FireStations | 1 | 0 | 0 | 1 |

## 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 | 7 | 0 | 0 | 7 | 7 |
| | Bridges | 1 | 0 | 0 | 1 | 1 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| **Railways** | Segments | 0 | 0 | 0 | 0 | 0 |
| | 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 | 1 | 0 | 0 | 1 | 1 |
| **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 | 0 | 0 | 0 | 0 | 0 |
| 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 | 114 | 4 | 1 |
| Waste Water | 68 | 2 | 1 |
| Natural Gas | 45 | 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 | 3,020 | 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 58.00% 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 80 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 1 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 8,707) 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** | **2** | **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** | **2** | **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** | **2** | **0** | **0** | **0** |

## Economic Loss

The total economic loss estimated for the earthquake is 12.30 (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 12.16 (millions of dollars); 16 % 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 59 % 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 | 0.01 | 0.37 | 0.03 | 0.04 | 0.45 |
| | Capital-Related | 0.00 | 0.01 | 0.29 | 0.02 | 0.00 | 0.32 |
| | Rental | 0.10 | 0.04 | 0.21 | 0.01 | 0.00 | 0.37 |
| | Relocation | 0.37 | 0.05 | 0.29 | 0.08 | 0.06 | 0.85 |
| | **Subtotal** | **0.47** | **0.11** | **1.16** | **0.14** | **0.11** | **1.99** |
| **Capital Stock Losses** | | | | | | | |
| | Structural | 0.84 | 0.12 | 0.35 | 0.17 | 0.09 | 1.58 |
| | Non_Structural | 3.88 | 0.39 | 1.07 | 0.57 | 0.21 | 6.12 |
| | Content | 1.30 | 0.09 | 0.53 | 0.36 | 0.12 | 2.40 |
| | Inventory | 0.00 | 0.00 | 0.01 | 0.06 | 0.00 | 0.08 |
| | **Subtotal** | **6.02** | **0.60** | **1.96** | **1.16** | **0.43** | **10.18** |
| | **Total** | **6.49** | **0.71** | **3.12** | **1.30** | **0.53** | **12.16** |

## 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 | 211.85 | $0.00 | 0.00 |
| | Bridges | 2.46 | $0.00 | 0.10 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Subtotal | **214.30** | **0.00** | |
| **Railways** | 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** | |
| **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 | 1.25 | $0.10 | 8.28 |
| | Subtotal | **1.30** | **0.10** | |
| **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** | **215.60** | **0.10** | |

**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 | 2.30 | $0.02 | 0.79 |
| | **Subtotal** | **2.27** | **$0.02** | |
| **Waste Water** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 1.40 | $0.01 | 0.67 |
| | **Subtotal** | **1.36** | **$0.01** | |
| **Natural Gas** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 0.90 | $0.00 | 0.34 |
| | **Subtotal** | **0.91** | **$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** | **4.54** | **$0.03** | |

**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

New Haven,CT

## Appendix B: Regional Population and Building Value Data

| State | County Name | Population | Building Value (millions of dollars) | | |
|---|---|---|---|---|---|
| | | | Residential | Non-Residential | Total |
| **Connecticut** | | | | | |
| | New Haven | 8,707 | 592 | 163 | 756 |
| **Total State** | | **8,707** | **592** | **163** | **756** |
| **Total Region** | | **8,707** | **592** | **163** | **756** |

# Hazus-MH: Earthquake Event Report

**Region Name:** Prospect

**Earthquake Scenario:** Portland 5.7

**Print Date:** May 02, 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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building and Lifeline Inventory | 4 |
| Building Inventory | |
| Critical Facility Inventory | |
| Transportation and Utility Lifeline Inventory | |
| Earthquake Scenario Parameters | 6 |
| Direct Earthquake Damage | 7 |
| Buildings Damage | |
| Critical Facilities Damage | |
| Transportation and Utility Lifeline Damage | |
| Induced Earthquake Damage | 11 |
| Fire Following Earthquake | |
| Debris Generation | |
| Social Impact | 12 |
| Shelter Requirements | |
| Casualties | |
| Economic Loss | 13 |
| Building Losses | |
| Transportation and Utility Lifeline Losses | |
| Long-term Indirect Economic Impacts | |
| Appendix A: County Listing for the Region | |
| Appendix B: Regional Population and Building Value Data | |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,707 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 (millions of dollars). Approximately 92.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 215 and 0 (millions of dollars) , respectively.

# Building and Lifeline Inventory

## Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 756 (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 85% 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 0 hospitals in the region with a total bed capacity of 0 beds. There are 3 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 2 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 215.00 (millions of dollars). This inventory includes over 34 kilometers of highways, 1 bridges, 227 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

| System | Component | # Locations/ # Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Highway** | Bridges | 1 | 2.50 |
| | Segments | 7 | 211.80 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **214.30** |
| **Railways** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Light Rail** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Bus** | Facilities | 1 | 1.30 |
| | | Subtotal | **1.30** |
| **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 | **215.60** |

**Table 2: Utility System Lifeline Inventory**

| System | Component | # Locations / Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Potable Water** | Distribution Lines | NA | 2.30 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **2.30** |
| **Waste Water** | Distribution Lines | NA | 1.40 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **1.40** |
| **Natural Gas** | Distribution Lines | NA | 0.90 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **0.90** |
| **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 | **4.50** |

## 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 5.7 |
| **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

Hazus estimates that about 165 buildings will be at least moderately damaged. This is over 5.00 % 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** | 12 | 0.44 | 3 | 0.61 | 1 | 0.98 | 0 | 1.58 | 0 | 1.82 |
| **Commercial** | 113 | 4.06 | 25 | 5.51 | 16 | 10.81 | 3 | 17.04 | 0 | 23.41 |
| **Education** | 3 | 0.10 | 1 | 0.14 | 0 | 0.30 | 0 | 0.43 | 0 | 0.74 |
| **Government** | 3 | 0.10 | 1 | 0.14 | 0 | 0.29 | 0 | 0.43 | 0 | 0.64 |
| **Industrial** | 52 | 1.87 | 12 | 2.57 | 8 | 5.68 | 2 | 8.66 | 0 | 12.62 |
| **Other Residential** | 201 | 7.19 | 45 | 9.76 | 28 | 19.39 | 5 | 25.36 | 0 | 19.52 |
| **Religion** | 8 | 0.30 | 2 | 0.34 | 1 | 0.55 | 0 | 0.85 | 0 | 1.12 |
| **Single Family** | 2,401 | 85.94 | 373 | 80.94 | 90 | 61.98 | 8 | 45.66 | 1 | 40.13 |
| **Total** | **2,794** | | **460** | | **145** | | **19** | | **2** | |

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| **Wood** | 2,438 | 87.27 | 373 | 81.08 | 83 | 56.99 | 6 | 32.01 | 0 | 16.90 |
| **Steel** | 85 | 3.03 | 21 | 4.54 | 16 | 11.32 | 3 | 17.68 | 0 | 27.30 |
| **Concrete** | 16 | 0.59 | 4 | 0.77 | 3 | 1.88 | 0 | 1.89 | 0 | 2.47 |
| **Precast** | 6 | 0.22 | 1 | 0.23 | 1 | 0.68 | 0 | 1.56 | 0 | 0.39 |
| **RM** | 28 | 0.99 | 3 | 0.70 | 3 | 1.88 | 1 | 3.27 | 0 | 0.38 |
| **URM** | 142 | 5.07 | 34 | 7.33 | 20 | 13.63 | 5 | 25.79 | 1 | 41.83 |
| **MH** | 79 | 2.83 | 25 | 5.35 | 20 | 13.62 | 3 | 17.79 | 0 | 10.72 |
| **Total** | **2,794** | | **460** | | **145** | | **19** | | **2** | |

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

## Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% 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 | 0 | 0 | 0 | 0 |
| Schools | 3 | 0 | 0 | 3 |
| EOCs | 0 | 0 | 0 | 0 |
| PoliceStations | 1 | 0 | 0 | 1 |
| FireStations | 1 | 0 | 0 | 1 |

## 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 | 7 | 0 | 0 | 7 | 7 |
| | Bridges | 1 | 0 | 0 | 1 | 1 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| **Railways** | Segments | 0 | 0 | 0 | 0 | 0 |
| | 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 | 1 | 0 | 0 | 1 | 1 |
| **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 | 0 | 0 | 0 | 0 | 0 |
| 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 | 114 | 5 | 1 |
| Waste Water | 68 | 2 | 1 |
| Natural Gas | 45 | 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 | 3,020 | 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 55.00% 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 120 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 1 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 8,707) 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 | 2 | 0 | 0 | 0 |
| | **Total** | **2** | **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** | **2** | **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** | **2** | **0** | **0** | **0** |

## Economic Loss

The total economic loss estimated for the earthquake is 15.05 (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 14.89 (millions of dollars); 17 % 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 59 % 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 | 0.46 | 0.04 | 0.05 | 0.57 |
| | Capital-Related | 0.00 | 0.01 | 0.37 | 0.02 | 0.00 | 0.40 |
| | Rental | 0.12 | 0.05 | 0.26 | 0.02 | 0.01 | 0.45 |
| | Relocation | 0.44 | 0.06 | 0.37 | 0.10 | 0.07 | 1.05 |
| | **Subtotal** | **0.56** | **0.14** | **1.46** | **0.18** | **0.13** | **2.48** |
| **Capital Stock Losses** | | | | | | | |
| | Structural | 0.99 | 0.15 | 0.45 | 0.22 | 0.11 | 1.92 |
| | Non_Structural | 4.66 | 0.49 | 1.33 | 0.69 | 0.26 | 7.43 |
| | Content | 1.62 | 0.11 | 0.65 | 0.43 | 0.15 | 2.96 |
| | Inventory | 0.00 | 0.00 | 0.01 | 0.08 | 0.01 | 0.10 |
| | **Subtotal** | **7.27** | **0.76** | **2.44** | **1.41** | **0.53** | **12.41** |
| | **Total** | **7.83** | **0.89** | **3.91** | **1.59** | **0.66** | **14.89** |

## 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 | 211.85 | $0.00 | 0.00 |
| | Bridges | 2.46 | $0.00 | 0.16 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Subtotal | **214.30** | **0.00** | |
| **Railways** | 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** | |
| **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 | 1.25 | $0.12 | 9.61 |
| | Subtotal | **1.30** | **0.10** | |
| **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** | **215.60** | **0.10** | |

**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 | 2.30 | $0.02 | 0.95 |
| | **Subtotal** | **2.27** | **$0.02** | |
| **Waste Water** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 1.40 | $0.01 | 0.80 |
| | **Subtotal** | **1.36** | **$0.01** | |
| **Natural Gas** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 0.90 | $0.00 | 0.41 |
| | **Subtotal** | **0.91** | **$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** | **4.54** | **$0.04** | |

**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

New Haven,CT

## Appendix B: Regional Population and Building Value Data

| State | County Name | Population | Building Value (millions of dollars) | | |
|---|---|---|---|---|---|
| | | | Residential | Non-Residential | Total |
| **Connecticut** | | | | | |
| | New Haven | 8,707 | 592 | 163 | 756 |
| **Total State** | | **8,707** | **592** | **163** | **756** |
| **Total Region** | | **8,707** | **592** | **163** | **756** |

# Hazus-MH: Earthquake Event Report

**Region Name:** Prospect

**Earthquake Scenario:** Stamford 5.7

**Print Date:** May 02, 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


| Section | Page # |
|---|---|
| General Description of the Region | 3 |
| Building and Lifeline Inventory | 4 |
| Building Inventory | |
| Critical Facility Inventory | |
| Transportation and Utility Lifeline Inventory | |
| Earthquake Scenario Parameters | 6 |
| Direct Earthquake Damage | 7 |
| Buildings Damage | |
| Critical Facilities Damage | |
| Transportation and Utility Lifeline Damage | |
| Induced Earthquake Damage | 11 |
| Fire Following Earthquake | |
| Debris Generation | |
| Social Impact | 12 |
| Shelter Requirements | |
| Casualties | |
| Economic Loss | 13 |
| Building Losses | |
| Transportation and Utility Lifeline Losses | |
| Long-term Indirect Economic Impacts | |
| Appendix A: County Listing for the Region | |
| Appendix B: Regional Population and Building Value Data | |

## 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 14.52 square miles and contains 2 census tracts. There are over 3 thousand households in the region which has a total population of 8,707 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 756 (millions of dollars). Approximately 92.00 % of the buildings (and 78.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 215 and 0 (millions of dollars) , respectively.

# Building and Lifeline Inventory

## Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 756 (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 85% 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 0 hospitals in the region with a total bed capacity of 0 beds. There are 3 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 4 dams identified within the region. Of these, 2 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 215.00 (millions of dollars). This inventory includes over 34 kilometers of highways, 1 bridges, 227 kilometers of pipes.

**Table 1: Transportation System Lifeline Inventory**

| System | Component | # Locations/ # Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Highway** | Bridges | 1 | 2.50 |
| | Segments | 7 | 211.80 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **214.30** |
| **Railways** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Light Rail** | Bridges | 0 | 0.00 |
| | Facilities | 0 | 0.00 |
| | Segments | 0 | 0.00 |
| | Tunnels | 0 | 0.00 |
| | | Subtotal | **0.00** |
| **Bus** | Facilities | 1 | 1.30 |
| | | Subtotal | **1.30** |
| **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 | **215.60** |

**Table 2: Utility System Lifeline Inventory**

| System | Component | # Locations / Segments | Replacement value (millions of dollars) |
|---|---|---|---|
| **Potable Water** | Distribution Lines | NA | 2.30 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **2.30** |
| **Waste Water** | Distribution Lines | NA | 1.40 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **1.40** |
| **Natural Gas** | Distribution Lines | NA | 0.90 |
| | Facilities | 0 | 0.00 |
| | Pipelines | 0 | 0.00 |
| | | Subtotal | **0.90** |
| **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 | **4.50** |

## 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 5.7 |
| **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

Hazus estimates that about 26 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** | 16 | 0.49 | 1 | 0.59 | 0 | 0.87 | 0 | 1.28 | 0 | 1.27 |
| **Commercial** | 148 | 4.53 | 7 | 5.73 | 2 | 10.03 | 0 | 15.28 | 0 | 20.02 |
| **Education** | 4 | 0.12 | 0 | 0.13 | 0 | 0.22 | 0 | 0.30 | 0 | 0.47 |
| **Government** | 4 | 0.11 | 0 | 0.14 | 0 | 0.25 | 0 | 0.35 | 0 | 0.47 |
| **Industrial** | 70 | 2.13 | 3 | 2.58 | 1 | 4.63 | 0 | 6.35 | 0 | 7.97 |
| **Other Residential** | 258 | 7.89 | 15 | 12.21 | 5 | 22.58 | 0 | 19.77 | 0 | 15.69 |
| **Religion** | 10 | 0.32 | 0 | 0.41 | 0 | 0.70 | 0 | 1.16 | 0 | 1.81 |
| **Single Family** | 2,762 | 84.41 | 95 | 78.22 | 15 | 60.72 | 1 | 55.51 | 0 | 52.29 |
| **Total** | **3,272** | | **122** | | **24** | | **2** | | **0** | |

**Table 4: Expected Building Damage by Building Type (All Design Levels)**

| | None | | Slight | | Moderate | | Extensive | | Complete | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Count | (%) | Count | (%) | Count | (%) | Count | (%) | Count | (%) |
| **Wood** | 2,796 | 85.46 | 92 | 75.55 | 12 | 49.32 | 1 | 30.28 | 0 | 0.00 |
| **Steel** | 119 | 3.63 | 5 | 4.10 | 2 | 7.28 | 0 | 8.18 | 0 | 7.80 |
| **Concrete** | 22 | 0.67 | 1 | 0.68 | 0 | 1.05 | 0 | 0.53 | 0 | 0.31 |
| **Precast** | 8 | 0.24 | 0 | 0.30 | 0 | 0.95 | 0 | 2.14 | 0 | 0.19 |
| **RM** | 32 | 0.99 | 1 | 0.89 | 1 | 2.46 | 0 | 3.78 | 0 | 0.00 |
| **URM** | 180 | 5.51 | 14 | 11.31 | 6 | 23.48 | 1 | 45.97 | 0 | 91.70 |
| **MH** | 114 | 3.50 | 9 | 7.17 | 4 | 15.46 | 0 | 9.10 | 0 | 0.00 |
| **Total** | **3,272** | | **122** | | **24** | | **2** | | **0** | |

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

## Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% 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 | 0 | 0 | 0 | 0 |
| Schools | 3 | 0 | 0 | 3 |
| EOCs | 0 | 0 | 0 | 0 |
| PoliceStations | 1 | 0 | 0 | 1 |
| FireStations | 1 | 0 | 0 | 1 |

## 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 | 7 | 0 | 0 | 7 | 7 |
| | Bridges | 1 | 0 | 0 | 1 | 1 |
| | Tunnels | 0 | 0 | 0 | 0 | 0 |
| **Railways** | Segments | 0 | 0 | 0 | 0 | 0 |
| | 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 | 1 | 0 | 0 | 1 | 1 |
| **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 | 0 | 0 | 0 | 0 | 0 |
| 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 | 114 | 1 | 0 |
| Waste Water | 68 | 0 | 0 |
| Natural Gas | 45 | 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 | 3,020 | 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 71.00% 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 0 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 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 8,707) 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 | 0 | 0 | 0 | 0 |
| | **Total** | **0** | **0** | **0** | **0** |
| **2 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** | **0** | **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** | **0** | **0** | **0** | **0** |

## Economic Loss

The total economic loss estimated for the earthquake is 2.10 (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 2.06 (millions of dollars); 17 % 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 60 % 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 | 0.00 | 0.06 | 0.00 | 0.01 | 0.08 |
| | Capital-Related | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.05 |
| | Rental | 0.02 | 0.01 | 0.04 | 0.00 | 0.00 | 0.07 |
| | Relocation | 0.07 | 0.01 | 0.05 | 0.01 | 0.01 | 0.15 |
| | **Subtotal** | **0.09** | **0.02** | **0.20** | **0.03** | **0.02** | **0.35** |
| **Capital Stock Losses** | | | | | | | |
| | Structural | 0.18 | 0.02 | 0.06 | 0.03 | 0.02 | 0.32 |
| | Non_Structural | 0.69 | 0.06 | 0.17 | 0.10 | 0.03 | 1.06 |
| | Content | 0.16 | 0.01 | 0.08 | 0.06 | 0.02 | 0.33 |
| | Inventory | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 |
| | **Subtotal** | **1.03** | **0.10** | **0.32** | **0.20** | **0.07** | **1.71** |
| | **Total** | **1.12** | **0.12** | **0.52** | **0.23** | **0.09** | **2.06** |

## 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 | 211.85 | $0.00 | 0.00 |
| | Bridges | 2.46 | $0.00 | 0.00 |
| | Tunnels | 0.00 | $0.00 | 0.00 |
| | Subtotal | **214.30** | **0.00** | |
| **Railways** | 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** | |
| **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 | 1.25 | $0.03 | 2.27 |
| | Subtotal | **1.30** | **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** | **215.60** | **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 | 2.30 | $0.00 | 0.17 |
| | **Subtotal** | **2.27** | **$0.00** | |
| **Waste Water** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 1.40 | $0.00 | 0.14 |
| | **Subtotal** | **1.36** | **$0.00** | |
| **Natural Gas** | Pipelines | 0.00 | $0.00 | 0.00 |
| | Facilities | 0.00 | $0.00 | 0.00 |
| | Distribution Lines | 0.90 | $0.00 | 0.08 |
| | **Subtotal** | **0.91** | **$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** | **4.54** | **$0.01** | |

**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

New Haven,CT

## Appendix B: Regional Population and Building Value Data

| State | County Name | Population | Building Value (millions of dollars) | | |
|---|---|---|---|---|---|
| | | | Residential | Non-Residential | Total |
| **Connecticut** | | | | | |
| | New Haven | 8,707 | 592 | 163 | 756 |
| **Total State** | | **8,707** | **592** | **163** | **756** |
| **Total Region** | | **8,707** | **592** | **163** | **756** |

# APPENDIX D
# RECORD OF MUNICIPAL ADOPTION

TOWN COUNCIL • TOWN OF PROSPECT, CT 06712-1699
36 CENTER STREET (203) 758-4461

# CERTIFICATE OF ADOPTION
# TOWN OF PROSPECT TOWN COUNCIL

**A RESOLUTION ADOPTING THE TOWN OF PROSPECT HAZARD MITIGATION PLAN UPDATE, 2015**

WHEREAS, the Town of Prospect 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 Prospect Town Council approved the previous version of the Plan in 2008; and

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

WHEREAS, committee meetings were held in 2013 and 2014 and public input was gathered by several methods regarding the development and review of the Hazard Mitigation Plan Update; and
WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedure for the Town of Prospect; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for specific natural hazards that impact the Town of Prospect, 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 Prospect 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 Prospect;
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.
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Mayor and the Town Council.

**Adopted this __3__ day of __February___, 2015 by the Town Council of Prospect, Connecticut**

Thomas Galvin, Chair

**IN WITNESS WHEREOF,** the undersigned has affixed his/her signature and the corporate seal of the

Town of Prospect this _3__ day of ___February__, 2015.

Maryanne C. Anderson

Maryanne C. Anderson, Town Clerk

# APPENDIX E
# FEMA SNOW LOAD GUIDANCE

# FEMA Snow Load Safety Guidance

FEMA

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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:

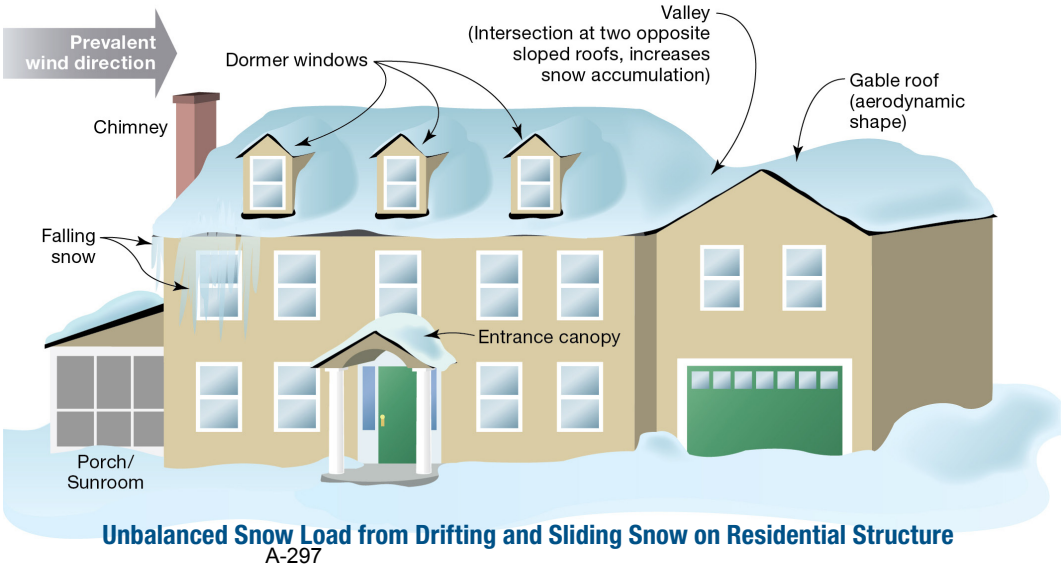
- Sagging ceiling tiles or boards, ceiling boards falling out of the ceiling grid, and/or sagging sprinkler lines and sprinkler heads
- Sprinkler heads deflecting below suspended ceilings
- Popping, cracking, and creaking noises
- Sagging roof members, including metal decking or plywood sheathing
- Bowing 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.

You may also subscribe to the FEMA Building Science e-mail list serve, which is updated with publication releases and FEMA Building Science activities.

Subscribe at https://public.govdelivery.com/accounts/USDHSFEMA/subscriber/new?topic_id=USDHSFEMA_193

Visit the Building Science Branch of the Risk Reduction Division at FEMA's Federal Insurance and Mitigation Administration at http://www.fema.gov/building-science.

Please scan this QR code to visit the FEMA Building Science web page.

# APPENDIX F
# 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<br>❏ Project canceled<br>❏ Project on schedule<br>❏ Anticipated completion date:_____<br>❏ Project delayed<br>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

_____

_____

# Plan Update Evaluation Worksheet

| Plan Section | Considerations | Explanation |
|---|---|---|
| Planning Process | Should new jurisdictions and/or districts be invited to participate in future plan updates? | |
| | Have any internal or external agencies been invaluable to the mitigation strategy? | |
| | Can any procedures (e.g., meeting announcements, plan updates) be done differently or more efficiently? | |
| | Has the Planning Team undertaken any public outreach activities? | |
| | How can public participation be improved? | |
| | Have there been any changes in public support and/or decision- maker priorities related to hazard mitigation? | |
| Capability Assessment | Have jurisdictions adopted new policies, plans, regulations, or reports that could be incorporated into this plan? | |
| | Are there different or additional administrative, human, technical, and financial resources available for mitigation planning? | |
| | Are there different or new education and outreach programs and resources available for mitigation activities? | |
| | Has NFIP participation changed in the participating jurisdictions? | |
| Risk Assessment | Has a natural and/or technical or human-caused disaster occurred? | |
| | Should the list of hazards addressed in the plan be modified? | |
| | Are there new data sources and/or additional maps and studies available? If so, what are they and what have they revealed? Should the information be incorporated into future plan updates? | |
| | Do any new critical facilities or infrastructure need to be added to the asset lists? | |
| | Have any changes in development trends occurred that could create additional risks? | |
| | Are there repetitive losses and/or severe repetitive losses to document? | |

# Worksheet 7.2

Plan Update Evaluation Worksheet

| Plan Section | Considerations | Explanation |
|---|---|---|
| Mitigation Strategy | Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimates accurate? | |
| | Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or eliminated from the plan? | |
| | Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update? | |
| | Are there new funding sources to consider? | |
| | Have elements of the plan been incorporated into other planning mechanisms? | |
| Plan Maintenance Procedures | Was the plan monitored and evaluated as anticipated? | |
| | What are needed improvements to the procedures? | |