TOWN OF CHESHIRE
NATURAL HAZARD PRE-DISASTER MITIGATION PLAN

CENTRAL NAUGATUCK VALLEY REGION

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Council of Governments
Central Naugatuck Valley

Under a grant from the Federal Emergency Management Agency (FEMA) through Connecticut Department of Environmental Protections (DEP)

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLES

FIGURES

TABLE OF CONTENTS (Continued)

APPENDED TABLES

APPENDICES

Cheshire Pre-Disaster Natural Hazard Mitigation Plan

Executive Summary

1. 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.

2. Many commissions and departments play a role in hazard mitigation, including the Planning and Zoning Commission, the Zoning Board of Appeals, the Building Code Board of Appeals, the Energy Commission, the Environment Commission, the Inland Wetland and Watercourses Commission, the Public Building Commission, the Public Safety Commission, the Water Pollution Control Authority/Flood and Erosion Control Board, the Chesprocott Health District, the Quinnipiac River Watershed Partnership, the Building Official, the Fire Department, the Police Department and the Public Works and Engineering Department.

3. The Town considers its police, fire, medical, 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 Cheshire continues. Day-care facilities and convalescent homes 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.

4. The Town of Cheshire has Global Positioning System (GPS) capability to locate the source of incoming cell phone calls as part of its Enhanced 911. Enhanced 911 improves the effectiveness and reliability of wireless 911 calls by having wireless service providers inform the 911 operator of the wireless telephone number of the caller, and the origin of the call within a 50 to 300 meter radius. This technology allows emergency services to provide a faster response to wireless callers. The Town is also considering implementing an

emergency notification system. An emergency notification system combines database and GIS mapping technologies to deliver outbound emergency notifications to geographic areas or specific groups of people such as emergency responder teams.

5. Inland flooding is the primary natural hazard that affects the Town of Cheshire. There are no major structural flood protection measures existing in Cheshire. The Town of Cheshire Sewage Treatment Plant is the only municipal facility in the Town regularly impacted by flooding. Spring floods along the Quinnipiac River often approach the Treatment Plant, which was built in the 100-year floodplain.

6. The Town of Cheshire has in place a number of measures to prevent flood damage. These include regulations, codes, and ordinances preventing encroachment and development near floodways: Flood Plain Management Regulations (Section 46 of Cheshire Zoning Regulations), Soil Erosion and Sedimentation Control Regulations (Section 49 of Cheshire Zoning Regulations), Drainage (Section 4.4 of Cheshire Subdivision and Other Land Use Regulations), Design Standards (Section 5.2 and 5.3 of Cheshire Subdivision and Other Land Use Regulations), Drainage Facilities For Storm Water and All other Drainage Excluding Sanitary Drainage Facilities (Section 7 of Cheshire Subdivision and Other Land Use Regulations), and Inland Wetlands and Watercourses Regulations.

7. In the 1980's a comprehensive storm drainage inventory was completed for the Town, and in 1991 a Master Drainage Study was completed to evaluate existing drainage structures, provide computer models to calculate the runoff impact of land use changes, and to provide guidance on how to reduce the impact of urbanization on the riverine system. The Town uses these documents to identify potential problems and plan for maintenance and upgrades.

8. Nuisance flooding and minor overbank flooding are of particular concern in northeast Cheshire in the area of East Sindall Stream and West Sindall Stream, in southern Cheshire along the Mill River, and in southwest Cheshire near and along Willow Brook in the Brooksvale Road area.

9. Overbank and floodplain flooding are of particular concern along the Quinnipiac River in northeast Cheshire and along the Tenmile River and its tributaries in western and northern Cheshire. The Tenmile River has a broad floodplain that runs through mainly rural, agricultural, and light industrial areas.

10. Increased cooperation between municipal departments is necessary with regard to controlling growth and development in flood zones. This will provide a system of checks and balances to ensure that development leads to flood-resistant structures and reduces risk to people. In particular, the Planning and Zoning Commission should continue to universally and fairly apply the flood damage prevention codes within the bylaws and regulations administered by the Commission; the Building Department should not be placed in a difficult position at the end of the process to enforce flood damage prevention codes when the Planning and Zoning Commission or Inland Wetlands & Watercourses Commission may have allowed for variances in building locations, structure elevations; and the Environmental Committee should be provided with the staff and funding to provide education with regard to flood mitigation of existing properties that are not subject to permitting programs of the Inland Wetlands & Watercourses Commission, Planning and Zoning Commission, or Building Department.

11. The following preventive mitigation measures are recommended to reduce future flooding: Develop a checklist that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to the proposed project; 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; update the Town-wide Master Drainage Study and continue to update it at least every five years (part of this study should include the introduction of a comprehensive catch basin maintenance program); reinstate the Town in FEMA's community rating system; require Flood Hazard Area, Subdivision, and commercial and industrial zoning permit applications to provide flood elevation and location data, particularly for parcels along the

Ten Mile River, Mill River, the Quinnipiac River, and Willow Brook; new buildings constructed in flood prone areas should be protected to the highest recorded flood level, regardless of being within a defined SFHA; new buildings should be designed and graded to shunt drainage away from the building; use the Town two-foot contour maps to develop more exact regulatory flood-hazard maps and data using FEMA flood elevations (this could be conducted as part of the Map Mod program).

12. Natural resource protection mitigation measures are recommended to help prevent damage from inland and nuisance flooding include acquisition of additional municipal open space properties inside SFHAs, selectively pursuing conservation objectives listed in the Plan of Conservation and Development, continued regulation of development in protected and sensitive areas, and purchase of private land in the 100-year floodplain and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use.

13. Specific structural mitigation measures recommended to prevent flood damage include: excavation of East Sindall stream to restore original flow capacity reduced by debris deposition from upstream erosion, and consider raising the elevation of the bridge and increasing the conveyance capacity of the bridge over Honeypot Brook at Blacks Road.

14. In Cheshire's heavily wooded landscape, mitigation measures for winds, hail, tornadoes, and downbursts are: increase tree limb maintenance and inspections; continue outreach regarding dangerous trees on private property; continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas; continue the required compliance with the amended Connecticut Building Code for wind speeds; and make literature available during the permitting process regarding appropriate design standards.

15. For winter storms, the following recommendations are applicable to aspects of winter storms such as winds, snow, and ice: increase tree limb maintenance and inspections, continue to require that utilities be placed underground in new developments and pursue funding to place

them underground in existing developed areas, complete evacuation plan to ensure timely migration of people to shelters from all areas of Cheshire, particularly the northwestern portion of Cheshire; post a final 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 to critical facilities during a winter storm event, and continue to encourage two modes of egress into every neighborhood by the creation of through streets.

16. Certain areas of Cheshire are at risk of developing sinkholes due to collapse of overlying sediments into mining tunnels used in the 19th and early 20th centuries. The Town is not responsible for the sinkholes, and it would be cost-prohibitive for the Town of Cheshire to fund an excavation of old mining sites with the intention to properly fill the areas of the former shafts. However, potential mitigation measures for sinkholes include improving the tracking of settling problems; conducting an in-depth study to identify sinkhole prone areas, including mapping out the abandoned mine workings, determining site-specific threats to safety and property, and implementing appropriate safeguards where possible; requiring potential developers to review historical atlases, maps, aerial photographs, this study, the above sinkhole study, and any other related reports for evidence that subsidence could occur as part of the Site Plan Review process; increasing public awareness regarding problem areas and associated potential hazards; and adjusting local zoning ordinances to account for potentially hazardous conditions, including a new Site Plan Review hazard mitigation checklist.

17. Regarding earthquakes, portions of the Town of Cheshire are underlain by sand and gravel. In addition to sandy areas, some portions of Cheshire are built on old mine areas which have been filled. Structures in these two types of 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 or filled material may be application of the most stringent building codes, or possibly the prohibition of certain types of new construction. Consider preventing new residential development in historical mining areas prone to collapse, consider preventing residential development on or below steep slopes, consider adding earthquakes to

the list of hazards covered by the Emergency Operations Plan, and ensure that municipal departments have adequate backup facilities in case earthquake damage occurs to municipal buildings.

18. 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. The two Class C dams in Cheshire are Mixville Pond Dam and Broad Brook Reservoir Dam. Mixville Pond Dam presents the highest damage potential to Town residents, while the Broad Brook Reservoir Dam presents a damage potential to residents downstream on the Quinnipiac River in other communities. Both Class C dams in the Town should continue to be regularly inspected by their respective owners, with maintenance performed as required to keep the dams in safe and functional order. With regard to the Mixville Pond Dam, the Town should move forward and update the Emergency Operations Plan for the dam, and prepare a new dam failure analysis if appropriate.

19. Wildfires can occur in the undeveloped wooded, shrubby, or grassland areas of Cheshire, found at the margins of low-density suburban type development known as the wildland interface. The South Central Connecticut Regional Water Authority and the Town should continue to extend the public water supply systems into areas that require water for fire protection and identify and upgrade those portions of the public water supply systems that are substandard from the standpoint of adequate pressure and volume for fire-fighting purposes. The Public Works Department, working with the Fire Department, should explore innovative solutions to fire protection where conventional water systems are not available.

1.0 INTRODUCTION

1.1 Background and Purpose

The term *hazard* refers to an extreme natural event that poses a risk to people, infrastructure, or resources. In the context of natural disasters, pre-disaster hazard mitigation is commonly defined as any sustained action that permanently reduces or eliminates long-term risk to people, property, and resources from natural hazards and their effects.

The primary purpose of a pre-disaster hazard mitigation plan (HMP) is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community or group of communities to prevent loss of life and reduce property damages associated with the identified hazards. This HMP is prepared specifically to identify hazards in the Town of Cheshire, Connecticut ("Cheshire" or "Town"). The HMP is relevant not only in emergency management situations, but also should be used within the Town of Cheshire's land use, environmental, and capital improvement frameworks.

The Disaster Mitigation Act of 2000 (DMA), commonly known as the 2000 Stafford Act amendments, was approved by Congress and signed into law in October 2000, creating Public Law 106-390. The purposes of the DMA are to establish a national program for pre-disaster mitigation and streamline administration of disaster relief.

The Disaster DMA requires local communities to have a Federal Emergency Management Agency (FEMA)-approved mitigation plan in order to be eligible to receive post-disaster Hazard Mitigation Grant Program (HMGP) grants and Pre-Disaster Mitigation (PDM) program project grant funds. Once a community has a FEMA-approved hazard mitigation plan, the community is then eligible to apply for PDM project funds for mitigation activities.

The subject pre-disaster hazard mitigation plan was developed to be consistent with the requirements of the HMGP, PDM, and Flood Management Assistance (FMA) programs. These programs are briefly described below.

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 pre-disaster plans and projects is meant to reduce overall risks to populations and facilities. PDM funds should be used primarily to support mitigation activities that address natural hazards. In addition to providing a vehicle for funding, the PDM program provides an opportunity to raise risk awareness within communities.

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.

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. Three types of grants are available under FMA. These are Planning, Project, and Technical Assistance grants.

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:

- ***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 recommendations, 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 Cheshire'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 Cheshire previously participated in the Community Rating System, but does not participate at the present time.

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 Cheshire:

- Inland Flooding
- Hurricanes
- Summer Storms, including Tornadoes
- Winter Storms
- Earthquakes
- Sinkholes
- Dam Failure
- Wildfires

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, Appended Tables 1 and 2 provide summaries of the hazard events and hazard effects that impact the Town of Cheshire, 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.

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 Cheshire'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 Measures, Strategies, and Alternatives,* and if necessary, *a Summary of Recommendations.* 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 Programs, Policies, and Mitigation Measures*** gives an overview of the measures that the Town of Cheshire 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 Measures, Strategies, and Alternatives*** identifies mitigation alternatives, including those that may be the least cost effective or inappropriate for Cheshire.

- ***Summary of Recommended Mitigation Measures, Strategies, and Alternatives*** provides a summary of the recommended courses of action for Cheshire 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 Discussion of STAPLEE Ranking Method

To prioritize recommended mitigation measures, it is necessary to determine how effective each measure will be in reducing or preventing damage. A set of criteria commonly used by public administration officials and planners was applied to each proposed strategy. The method, called STAPLEE, stands for the "Social, Technical, Administrative, Political, Legal, Economic and Environmental" criteria for making planning decisions. The following questions were asked about the proposed mitigation strategies:

- **Social**: Is the proposed strategy socially acceptable to Cheshire? Are there equity issues involved that would mean that one segment of Cheshire could be treated unfairly?
- **Technical**: Will the proposed strategy work? Will it create more problems than it will solve?
- **Administrative**: Can Cheshire implement the strategy? Is there someone to coordinate and lead the effort?
- **Political**: Is the strategy politically acceptable? Is there public support both to implement and maintain the project?
- **Legal**: Is Cheshire authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?

- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy presented in this plan was evaluated and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation matrix with the total scores from each strategy can be found in Appendix A. After each strategy is evaluated using the STAPLEE method, it is possible to prioritize the strategies according to the final score. The highest scores are determined to be of more importance, economically, socially, environmentally and politically and, hence, prioritized over those with lower scores.

1.5 Documentation of the Planning Process

The Town of Cheshire is a member of the Council of Governments of the Central Naugatuck Valley (COGCNV), the regional planning agency for Cheshire and twelve other member municipalities: Beacon Falls, Bethlehem, Middlebury, Naugatuck, Oxford, Prospect, Southbury, Thomaston, Waterbury, Watertown, Wolcott, and Woodbury. The municipalities of Oxford, Waterbury, Watertown, and Woodbury have existing mitigation plans, and hazard mitigation plans are being concurrently developed for the municipalities of Prospect and Wolcott.

Ms. Virginia Mason of the COGCNV coordinated the development of this Hazard Mitigation Plan. The COGCNV applied for the grant from FEMA through the Connecticut Department of Environmental Protection (DEP). The adoption of this plan in the Town of Cheshire will also be coordinated by the COGCNV.

The following individuals from the Town of Cheshire provided information, data, studies, reports, and observations; and were involved in the development of the Plan:

- Mr. Jack Casner, Fire Chief, Cheshire Fire Department
- Mr. George Noewatne, Operations Manager, Department of Public Works / Engineering
- Ms. Suzanne M. Simone, Environmental Planner, Planning & Zoning Department
- Ms. Lisa Murphy, Assistant Town Planner, Planning & Zoning Department
- Mr. Joseph Michelangelo, Director / Town Engineer, Department of Public Works / Engineering
- Mr. Mark Cunningham, Highway Superintendent, Department of Public Works / Engineering

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 and field reconnaissance that were held to develop this Hazard Mitigation Plan:

- ***A field inspection was performed May 16, 2006.*** Observations were made of numerous potential flooding and problem areas within the Town.

- ***A field inspection was performed June 7, 2006.*** Observations were made of flooding on Sandbank Road and Peck Lane.

- ***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.

- ***A project meeting with Town officials was held July 25, 2006.*** Necessary documentation was collected, and problem areas within the Town were discussed.

- ***A second project meeting with Town officials was held September 22, 2006.*** Necessary documentation was collected, and problem areas within the Town were discussed.

- ***Field inspections were performed on September 22, 2006.*** Observations were made of an area of Cheshire damaged from a detention pond failure in Meriden.

- ***A public information meeting was held October 18, 2006 at 7:30 P.M.*** Preliminary findings were presented and public comments solicited.

- ***Field inspections were performed on October 28, 2006.*** Observations of flooding were made in the northeastern part of Cheshire and near the Cheshire Industrial Park.

While residents were invited to the public information meeting via newspaper, 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 Planning Department 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 has begun coordinating emergency services in the region. Fire, Police, EMS, Red Cross, emergency management directors, and other departments participate 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 has been transferred by the COGCNV to the pre-disaster mitigation planning process.

Additional opportunities for the public to review the Plan will be 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 is sent for FEMA review will be posted on the Town website and the COGCNV website to provide opportunities for public review and comment. Such comments will be incorporated into the final draft when applicable. Upon receiving conditional approval from FEMA, the public hearing will be scheduled, at which time any remaining comments can be addressed. Notification of the opportunity to review the Plan on the websites and the public information meeting will be placed on the websites and placed in local newspapers.

If any final plan modifications result from the comment period leading up to and including the public hearing to adopt the plan, these will be submitted to FEMA as page revisions with a cover letter explaining the changes. It is not anticipated that any major modifications will occur at this phase of the project.

Appendix B contains copies of meeting minutes, field notes and observations, the public information meeting presentation, and other records that document the development of this Pre-Disaster Hazard Mitigation Plan, to date.

2.0 COMMUNITY PROFILE

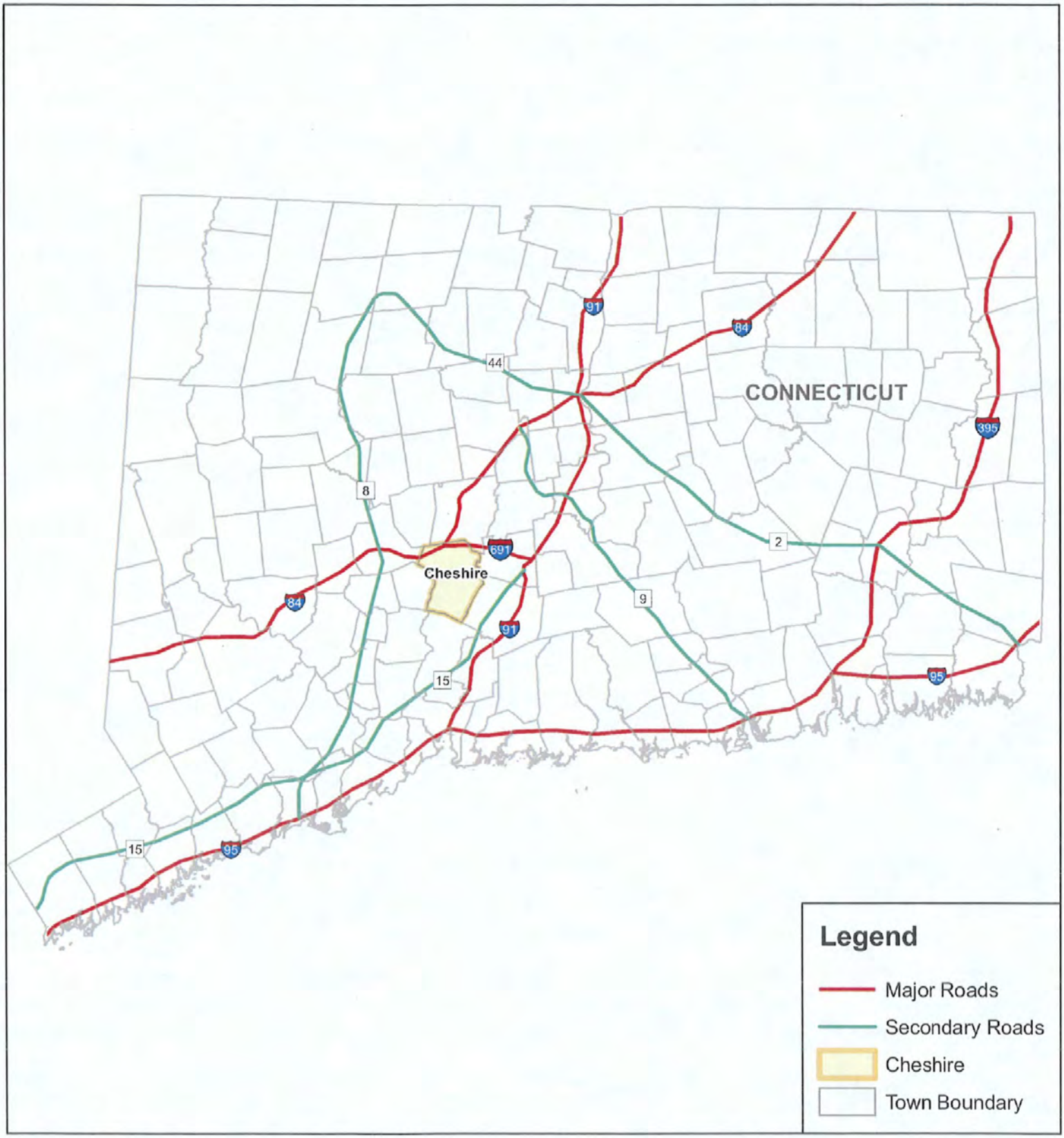
2.1 Physical Setting

The Town of Cheshire is located in New Haven County at the intersection of Interstate 84 and Interstate 691. It is bordered by the City of Waterbury and the Town of Prospect to the west, the Towns of Southington and Wolcott to the north, the Town of Wallingford and City of Meriden to the east, and the Town of Hamden to the south. Refer to Figure 2-1 for a location schematic and Figure 2-2 for a location map. Cheshire is the fourth-most developed community in the Central Naugatuck Valley Region.

Cheshire is located within the southern part of the Triassic Valley, a broad central lowland containing prominent basalt ridges in central Connecticut. The topography of the Town consists mainly of gently rolling hills, with the Peck Mountain ridgeline running along most of the western boundary of the Town. Elevations range from approximately 100 feet above sea level (based on the National Geodetic Vertical Datum of 1929) to approximately 700 feet in the steeper hills located in the northwestern part of the town.

As the home of a broad suburban residential community, numerous industrial facilities, three state prison facilities (Cheshire Correctional Institution, Manson Youth Institution and Webster Correctional Institution), many state and federal buildings, utility organizations, and major financial institutions, the Town of Cheshire is vulnerable to a loss of life and property due to an array of hazards.

Figure 2-1: Cheshire 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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Figure 2-2: Cheshire 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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2.2 *Existing Land Use*

Cheshire encompasses 32.9 square miles and is characterized by a compact commercial district surrounded by low- to medium-density residential districts interspersed with agricultural operations. Table 2-1 provides a summary of land use in Cheshire by area. In addition, refer to Figure 2-3 for a map of generalized land use in the Central Naugatuck Valley Region.

Table 2-1
Land Use by Area

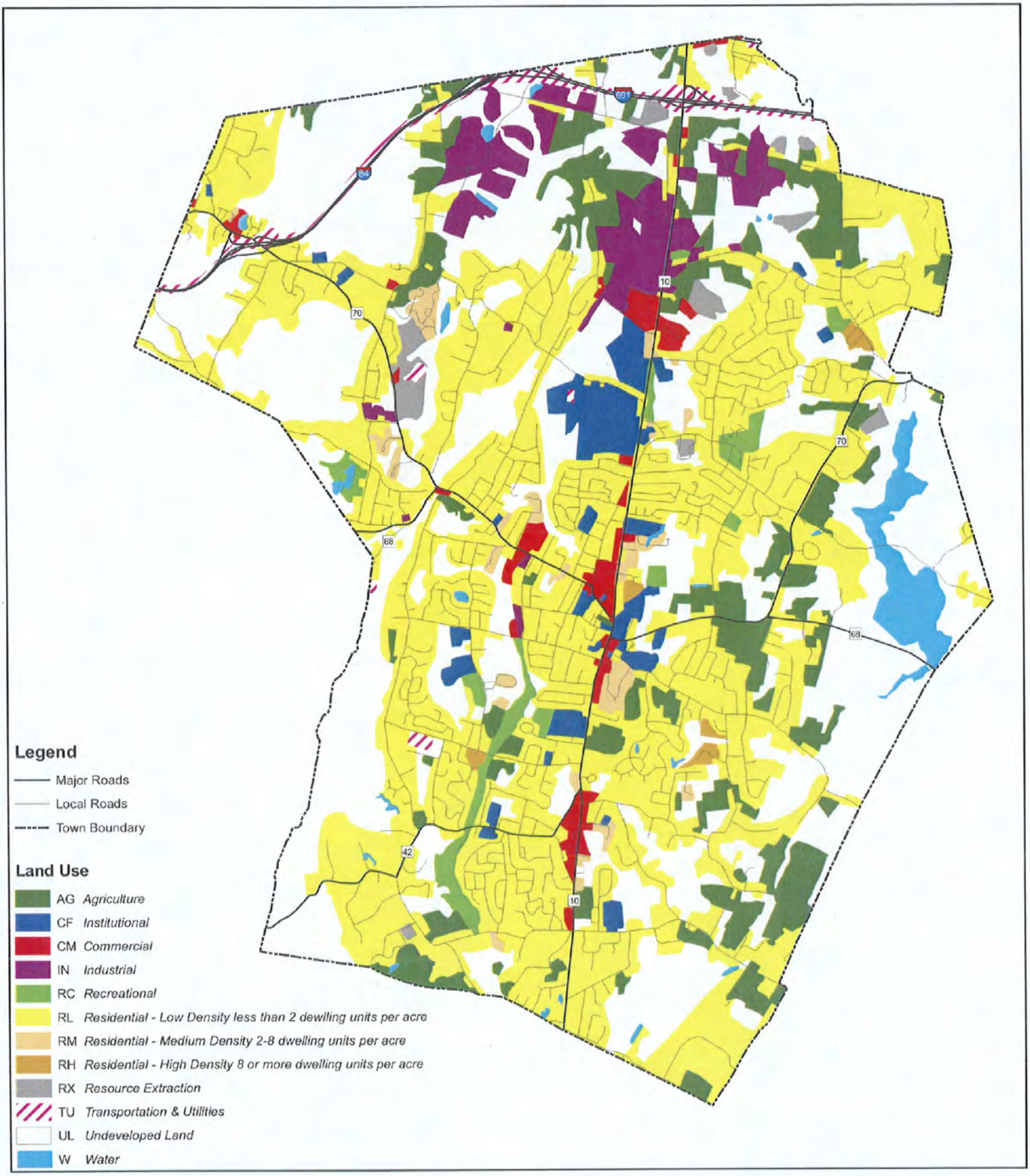
Land Use	Area (acres)	Pct.
Residential - Low Density	8677	41.0%
Vacant	7499	35.4%
Agricultural	1883	8.9%
Industrial	740	3.5%
Institutional	537	2.5%
Water	385	1.8%
Commercial	312	1.5%
Recreational	302	1.4%
Utilities/Transportation	292	1.4%
Residential - Medium Density	270	1.3%
Mining	198	0.9%
Residential - High Density	69	0.3%

Source: Council of Governments Central Naugatuck Valley, 2000

The largest concentration of industrial land uses is located in the northern end of Cheshire near the I-691 and I-84 interchanges. Just south of the industrial area along Route 10 is the largest of Cheshire's three penal institutions, Cheshire Correctional Institution.

Most commercial facilities are located along Route 10, especially at the intersection of Route 10 with Route 68 and Route 70. Residential areas extend from Route 10 outward towards the town's borders. Most of the residential development is low-density in

Figure 2-3: Cheshire Generalized Land Use



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

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character. Agricultural facilities are located throughout the town, and Cheshire is known as the "Bedding Plant Capital of Connecticut." Steep slopes and water features limit development at the east and west borders of the town.

2.3 *Geology*

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

In terms of North American bedrock geology, the Town of Cheshire 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 Cheshire is divided between two geologic provinces. Bedrock belonging to the Mesozoic Basin lies under the majority of the Town, while bedrock belonging to the Eugeosyncline Sequence underlies the northwestern portion of the Town. Mesozoic Basin rocks contain characteristic sedimentary conglomerates, sandstones, and mudrocks that usually bear a red or brownish appearance from an abundance of iron oxide minerals (chiefly hematite and limonite). Eugeosynclinal rocks are typically more 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 Cheshire is part of two terranes. The majority of the Town

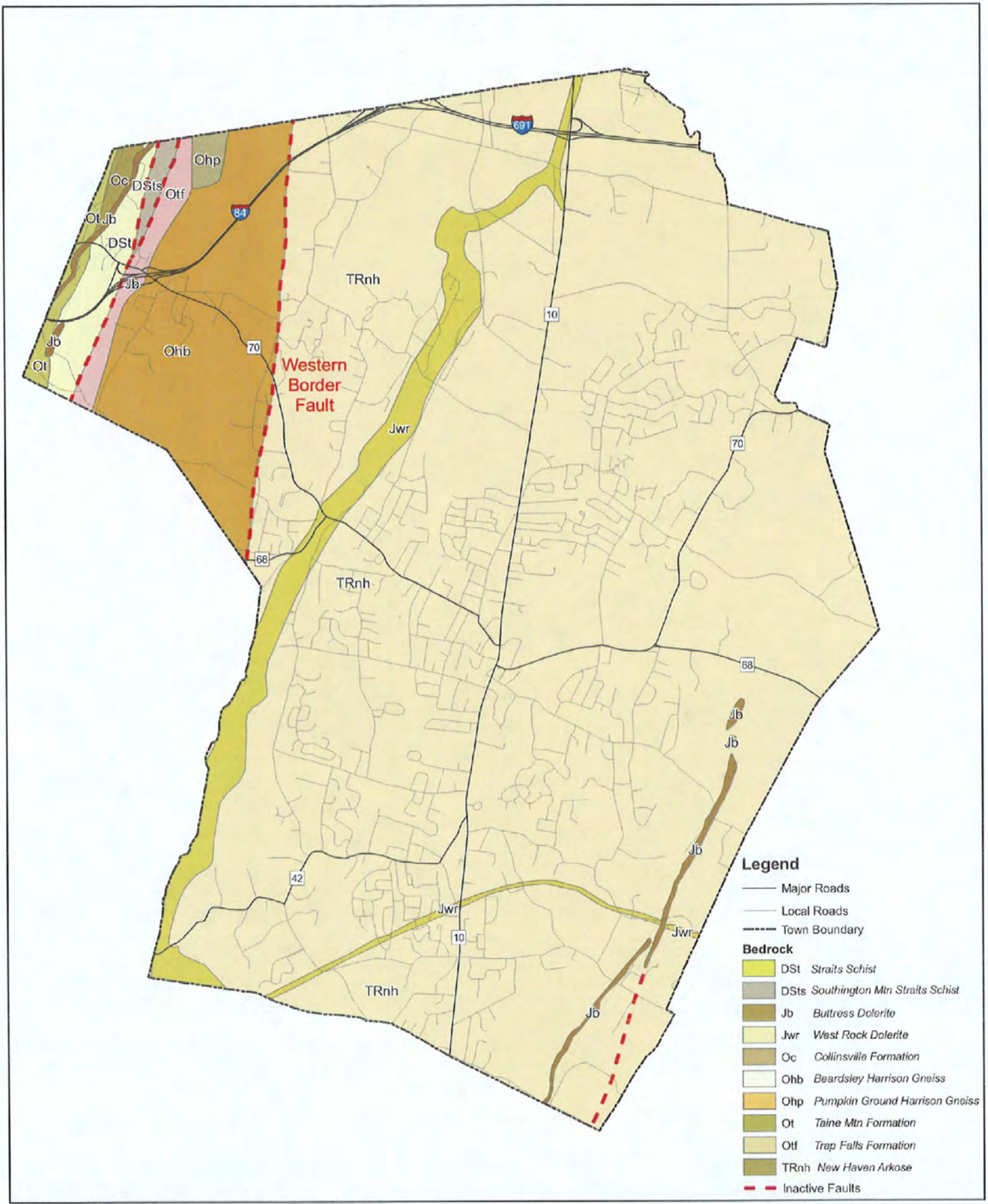
is underlain by the Newark Terrane which formed when Pangea split apart. This area is lies within the Mesozoic Basin geologic province described above. The northwestern portion of Cheshire is underlain by the Iapetos Terrane, comprised of remnants of the Iapetos Ocean that existed before Pangaea was formed. This terrane formed when Pangaea was consolidated and its boundaries are coincident with the Eugeosyncline Sequence geologic province described above.

The Town of Cheshire's bedrock consists of three general lithologies: volcanic and intrusive igneous silicate gneisses and basalts, sedimentary arkose, and metasedimentary and metaigneous schists. The bedrock intrusions trend northeast-southwest through the Town. Refer to Figure 2-4 for a depiction of the bedrock geology in the Town of Cheshire.

Approximately 83% of the Town is underlain by the New Haven Arkose of the Newark Terrane. The New Haven Arkose is a thick sequence of sedimentary rock striking north-northeast and dipping approximately 15° to the east. Igneous intrusions include the Buttress Dolerite and the West Rock Dolerite. The mines discussed in Section 8.0 are associated with the igneous intrusions.

A number of unnamed faults are located in Cheshire in the northwestern and southeastern parts of Town, and the Western Border Fault divides the Newark Terrane and the Iapetos Terrane in Cheshire near the northwestern part of Town. The Western Border Fault is a large fault extending along the western edge of the Mesozoic Basin and stretches from Milford northwards into Massachusetts. None of these faults are active. Bedrock 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 Cheshire. Brick (1997) noted that the barite ore deposits at Jinny Hill occupy faults that are presumably inactive.

Figure 2-4: Cheshire Bedrock Geology



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

Miles
0 0.5 1

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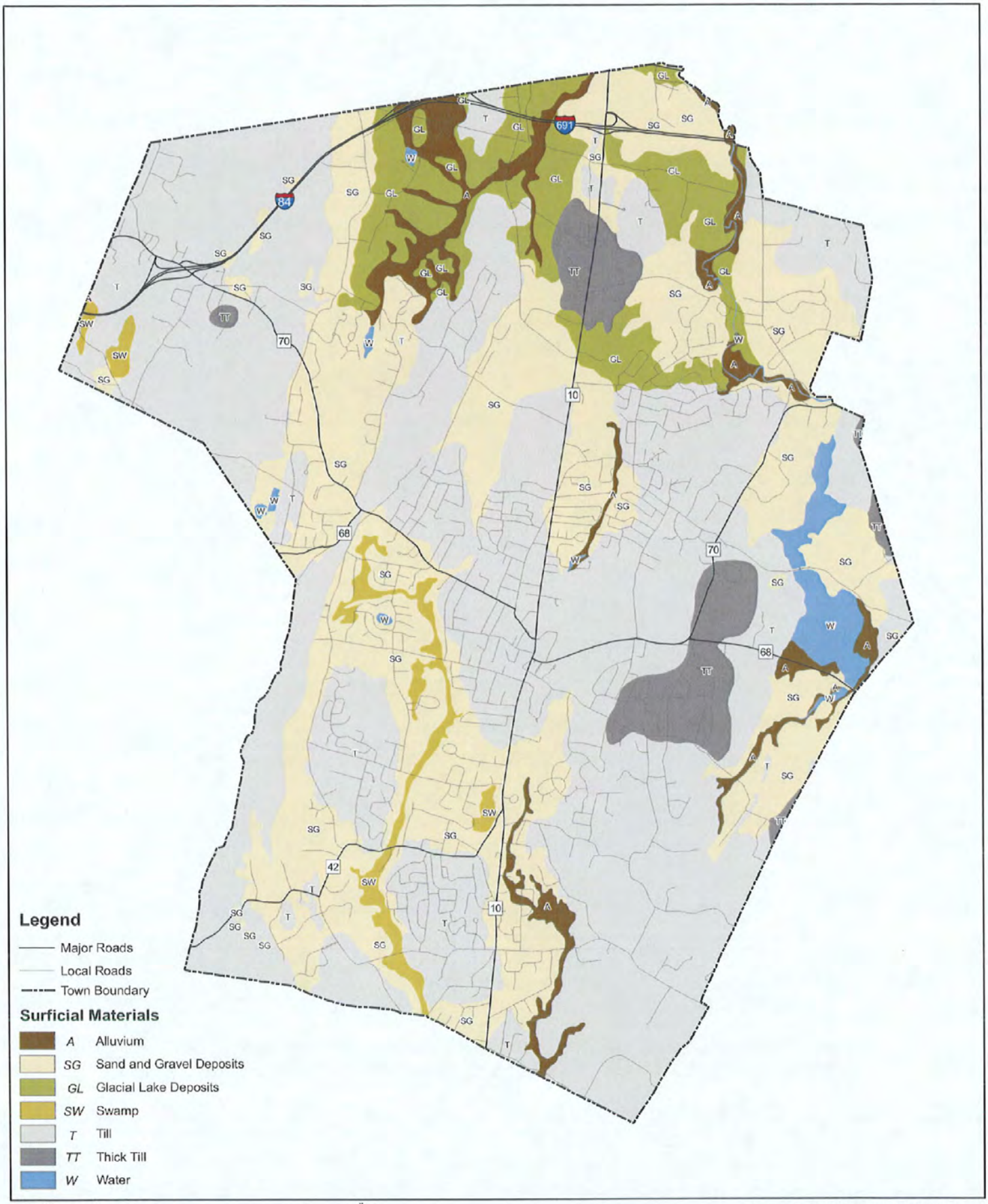
At least twice in the late Pleistocene, continental ice sheets moved across Connecticut. As a result, surficial geology of the Town is characteristic of the depositional environments that occurred during glacial and postglacial periods. Refer to Figure 2-5 for a depiction of surficial geology.

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 most of the northwestern, central, and southeastern portions of Cheshire. The remainder of the Town consists primarily of stratified sand and gravel ("stratified drift") areas 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.

Approximately 50% of the soils in the Town are either the Udorthents urban land complex, Manchester gravelly sandy loam, Branford silt loam, or Yalesville or Cheshire fine sandy loam soil types. The remainder of the Town has soil types of consisting primarily of various silty and sandy loams.

The Udorthents series are disturbed soils underlying urban and built up lands where the original soil type is no longer easily identified. The Manchester series consists of very deep, excessively drained soils formed in sandy and gravelly glacial outwash and stratified drift. They are nearly level to steep soils on outwash plains, terraces, kames, deltas and eskers. Slope ranges from 0 to 45 percent. The Branford series consists of very deep, well drained soils formed in loamy over sandy and gravelly outwash. They are nearly level to strongly sloping soils on outwash plains and terraces. Slope ranges from 0 to 15 percent.

Figure 2-5: Cheshire Surficial Geology



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

Miles
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The Yalesville series consists of moderately deep, well drained soils formed in a loamy till. They are nearly level to moderately steep soils on hills and ridges. Slope ranges from 0 to 50 percent. Depth to bedrock ranges from 20 to 40 inches. The Cheshire series consists of very deep, well drained loamy soils formed in supraglacial till on uplands. They are nearly level to very steep soils on till plains and hills. Slope ranges from 0 to 60 percent.

The amount of stratified drift present in the Town is important for several reasons:

- The stratified drift in Cheshire provides productive aquifers currently used by the South Central Connecticut Regional Water Authority (RWA) to provide drinking water via pumping wells to the Town.

- With regard to inland flooding, areas of stratified materials are generally coincident with inland 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 northeastern Cheshire.

- The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence related to previous mining activities in the Town. These topics will be discussed in later sections.

2.4 Climate

Cheshire 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 approximately 43 inches per year as averaged between

the weather stations in Woodbury, Wolcott, and Hamden (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 19th 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.

2.5 *Drainage Basins and Hydrology*

The Town of Cheshire lies within drainage basins corresponding to the Quinnipiac River, the Ten Mile River, Broad Brook, Willow Brook, Mill River, Beaver Pond Brook, and the Mad River. These are described below. Cheshire's water bodies include several ponds and reservoirs and numerous streams, most of which are unnamed. Many impoundments are present in Cheshire, and many of the floodplains surrounding the channels are undeveloped due to nearby wetlands.

Quinnipiac River

The Quinnipiac River originates at the borders of New Britain and Farmington in Deadwood Swamp, a Connecticut DEP wildlife management and flood control area. The river flows southward through the municipalities of Plainville, Southington, Cheshire, Meriden, Wallingford, North Haven, and New Haven for 38 miles, emptying into New Haven Harbor and eventually reaching Long Island Sound.

Most of northeastern Cheshire (7.21 square miles, 21.79% of Cheshire's land area) lies within the Quinnipiac River drainage basin, and over 60% of the land area of the Town

eventually drain into the Quinnipiac River. The Quinnipiac River forms part of the town boundary between northeastern Cheshire and Southington. At the location where the Quinnipiac River enters Cheshire proper, it drains about 40 square miles, including the area of Cheshire that drains to the Ten Mile River.

The major tributary to the Quinnipiac River in northeastern Cheshire is Honeypot Brook. Honeypot Brook has its headwaters in an unnamed pond in east-central Cheshire and drains southwest under Wiese Road where it enters Honeypot Brook Pond. After flowing out of this impoundment, Honeypot Brook flows west through an unnamed pond, eventually turning north and entering the impoundment of Weeks Pond. It then flows north through a well-developed residential section of Cheshire near Honeypot Glen, after which it is joined by the outflow from the impounded Cheshire Park Pond. Honeypot Brook continues flowing northeast through an undeveloped section of Cheshire and then under Blacks Road to enter the Quinnipiac River in a swampland. In total, Honeypot brook drains 3.41 square miles of the Quinnipiac River basin in Cheshire.

The Quinnipiac River continues to flow south and east across Cheshire, being joined by several unnamed streams that drain the Honeypot Glen area and another that drains the northeastern corner of Cheshire near Meriden, before being joined by the outlet of Broad Brook at the Meriden city line. The DEP and Quinnipiac River Watershed Association stock trout in the Quinnipiac Gorge along the Cheshire/Meriden town line. There are no dams of note directly on the Quinnipiac River in the town of Cheshire.

Ten Mile River

Most of northern Cheshire (10.35 square miles, 31.29% Cheshire's land area) drains to the Ten Mile River. The Ten Mile River has its headwaters in Prospect consisting of two main streams: West Brook and Mixville Brook. West Brook is impounded at the West Brook Reservoir, and then empties into the Cheshire Reservoir in Prospect. Mixville Brook also drains into the Cheshire Reservoir. The Ten Mile River begins in Prospect as

the outflow of the Cheshire Reservoir at the Cheshire Reservoir Dam. When the Ten Mile River enters Cheshire, it has already drained 4.76 square miles.

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 next joined by Mountain Brook, which drains a large marsh in Prospect, before being impounded at Moss Farms Pond / Lake Percivel by the Lake Percivel Dam. Downstream of this dam is the Ten Mile River's confluence with Cuff Brook, a stream that drains most of northwestern Cheshire and has multiple impoundments along its run.

After the tributary of Cuff Brook, the Ten Mile River drains northeastward through a large wetland area, after which it is joined by Judd Brook in the Cheshire Industrial Park, and then finally empties into the Quinnipiac River near Milldale. In total, the Ten Mile River drains 20.261 square miles across the municipalities of Prospect, Waterbury, Cheshire, Wolcott, and Southington.

Broad Brook

The Broad Brook drainage basin comprises most of the lightly-developed eastern part of Cheshire, draining a total of 3.71 square miles in the Town and comprising 11.22% of Cheshire's land area. Broad Brook has its headwaters just north of Boulder Road and flows in a northeasterly direction through Copper Valley, being joined by an unnamed stream before draining into the Broad Brook Reservoir just south of Yalesville Road. This large impoundment is 290 acres in size and is fed by swampland and three other unnamed streams besides Broad Brook. After draining through the Broad Brook Reservoir Dam, it flows north to empty into the Quinnipiac River near the Cheshire / Meriden municipal boundary. In total, Broad Brook drains an area measuring 4.81 square miles in the towns of Cheshire and Meriden.

Willow Brook

The southwestern part of Cheshire lies within the drainage basin of Willow Brook, comprising an area of 6.83 square miles and 20.65% of Cheshire's land area. Willow Brook has its headwaters in the swamps near West Cheshire south of Route 68. Most of the streambed of Willow Brook lies in wetlands near fairly developed residential and commercial areas. The brook winds south through Cheshire collecting outflow from several wetland areas before being joined by the outflow of Roaring Brook near Brooksvale, and the outflow from Sanford Brook and Brooksvale Stream which flows out of Hamden.

Willow Brook then flows south into Hamden where it is joined by Jepp Brook before emptying into the Mill River near Sleeping Giant State Park. In total, Willow Brook drains a land area of 12.97 square miles across the towns of Cheshire, Prospect, Bethany, and Hamden. There are no impoundments of note along Willow Brook or its tributaries in the Town of Cheshire, although there is one at the Mount Sanford Road Pond near the swamps along the Hamden / Cheshire town line.

Mill River

The southeastern part of Cheshire lies within the Mill River drainage basin. This drainage basin consists of 4.70 square miles in the town of Cheshire and makes up 14.21% of Cheshire's land area. The Mill River has its headwaters in Cheshire near Hicock Pond, a small impoundment in central Cheshire near State Route 68 / 70. It flows in a southwesterly / southerly direction through a lightly developed area, being impounded by the Tyler Pond Dam near Wallingford Road. It continues to flow into a heavily developed commercial area near Richards Corner, where it is joined by an unnamed stream that is the outflow of a small impoundment named Ravenswood Pond to the east.

The Mill River next flows through a swampland north of Cook Hill Road before being intersected by an unnamed stream that has its headwaters in Fresh Meadows Swamp in Wallingford. This unnamed stream drains through a small, unnamed impoundment at the Wallingford town line before flowing southwest through the impounded Cook Hill Pond. It next flows into another unnamed pond before emptying into the Mill River. The Mill River then continues south into Hamden where it is joined by the outflow from Willow Brook, Butterworth Brook, Eaton Brook, and Shepard Brook before eventually draining into New Haven Harbor. In total, the Mill River drains 38.41 square miles in the towns of Cheshire, Wallingford, Hamden, Bethany, North Haven, and New Haven.

Beaver Pond Brook

A very small portion of northwestern Cheshire (0.27 square miles) near the Waterbury city line lies in the drainage basin of Beaver Pond Brook. This area comprises only 0.80% of the land area of Cheshire, and is largely undeveloped with some residential land use. The drainage area within Cheshire drains primarily into the headwaters of Beaver Pond Brook, while the rest drains to an unnamed tributary in Waterbury that is the first stream to intersect Beaver Pond Brook.

Beaver Pond Brook has its headwaters in a swamp near Milloy Road in the northwestern 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, extending into the municipalities of Wolcott, Cheshire, Prospect, and Waterbury.

While there are no dams of note along the reach of Beaver Pond Brook, there are dams on its tributaries. The Waterbury Reservoir Dam #2 is on the Waterbury / Prospect Reservoir in Prospect, and outflows into Turkey Hill Brook. The East Mountain

Reservoir Dam outflow begins East Mountain Brook, and the Daigle Pond Dam on Daigle / DeBishop Pond also outlets into East Mountain Brook.

Mad River

A tiny portion of the land area in Cheshire (7.89 acres, 0.01 square miles, 0.04% of total land area) lies within the Mad River drainage basin. This area has a light residential land use and drains to Hitchcock Lake in southeastern Wolcott. This large impoundment drains into Hitchcock Lake Brook, and in turn flows west into Theriaults Ice Pond. Theriaults Ice Pond is a small impoundment that is the headwaters for Lily Brook, and drains northwest to join the Mad River in southwestern Wolcott.

The Mad River has its headwaters just north of Cedar Swamp Pond in the City of Bristol. It flows in a south and southwestern direction into and across the town of Wolcott into Waterbury, eventually emptying into the Naugatuck River. In total, the Mad River drains 25.93 square miles and is heavily impounded with 21 dams of note within its drainage basin.

The Mad River begins at the Cedar Swamp Pond Dam. A very small part of the drainage area includes the town of Plymouth at this point, draining into an unnamed stream that joins the Mad River before it is joined by Break Hill Brook and several other unnamed streams above the Scovill Reservoir. The Mad River is joined by Lindsley Brook, Lily Brook, and Old Tannery Brook in Wolcott.

The Mad River drains a total area of 15.8 square miles at the confluence of the Mad River and Old Tannery Brook at the Waterbury city line. It then flows to the south, entering Cemetery Pond and flowing out through the Cemetery Pond Dam to be next joined by Beaver Pond Brook at City Mills Ponds (Upper). After draining south into Scovill Pond, and through the Scovill Pond Dam, the Mad River flows northwest into Brass Pond and through the John Dees Pond Dam before turning back to the southwest near St. Marys

Hospital and draining into the Naugatuck River approximately 3,000 feet southeast of the Route 8 and Interstate 84 interchange.

2.6 *Population and Demographic Setting*

The total CNV Region population as indicated in the 2000 Census is 272,594 persons. The total land area is 309 square miles, giving a regional population density of 882 persons per square mile. Cheshire has a population density of 868 individuals per square mile. For comparison, Waterbury has the highest population density in the region with 3,757 individuals per square mile, and Bethlehem has the lowest population density in the region with 177 individuals per square mile (Table 2-2).

Table 2-2
Population Density by Municipality, Region and State, 2000

Municipality	Total Population	Land Area (square miles)	Population Density
Beacon Falls	5,246	9.77	537
Bethlehem	3,422	19.36	177
Cheshire	28,543	32.90	868
Middlebury	6,451	17.75	363
Naugatuck	30,989	16.39	1,891
Oxford	9,821	32.88	299
Prospect	8,707	14.32	608
Southbury	18,567	39.05	475
Thomaston	7,503	12.01	625
Waterbury	107,271	28.55	3,757
Watertown	21,661	29.15	743
Wolcott	15,215	20.43	745
Woodbury	9,198	36.46	252
CNV Region	272,594	309.02	882
Connecticut	3,405,565	4844.80	703

Source: United States Census Bureau, 2000 Census of Population and Housing, Summary File 1

Cheshire remained largely agricultural from its charter in 1780 until the mid-20th century. 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 Cheshire was $212,000, which is higher than the statewide median value of $166,900.

Based on the town's 2002 Plan of Conservation and Development, efforts are being made to preserve Cheshire's small town charm and limit the impact of future development. Specifically, a farmland preservation program has been established as a measure to retain open space and agriculture.

Cheshire is 33rd out of 169 municipalities in Connecticut in terms of population, with an estimated population of 28,543 in 2000. Historically, the town's population expanded by 42% from 1960-70, but growth slowed to 11% from 1990-2000. Annual growth of 0.5% is expected from 2000 through 2010. The town is the 49th most densely populated municipality in the state.

Cheshire has substantial 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 Cheshire is governed by a Council-Manager 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. The council is composed of nine elected volunteer members whose term of office is two years, with elections on odd numbered years. The chairman of the council serves as the honorary mayor and is selected by council at the beginning of each term. The Town Manager is selected by the Town Council and oversees the day-to-day management of the Town. There are 12 Town departments providing municipal services and day-to-day administration.

Figure 2-6: Cheshire Elderly Population

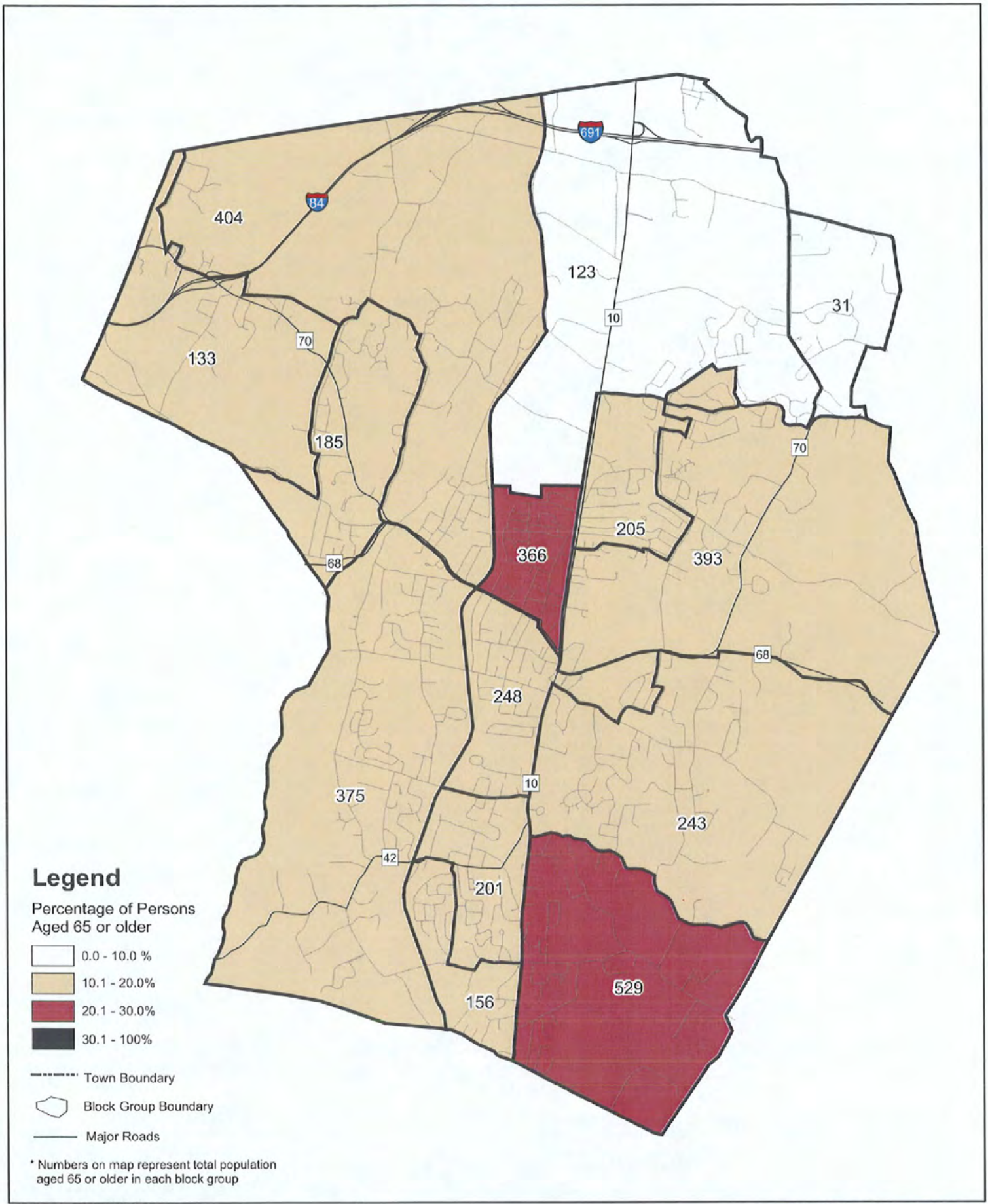
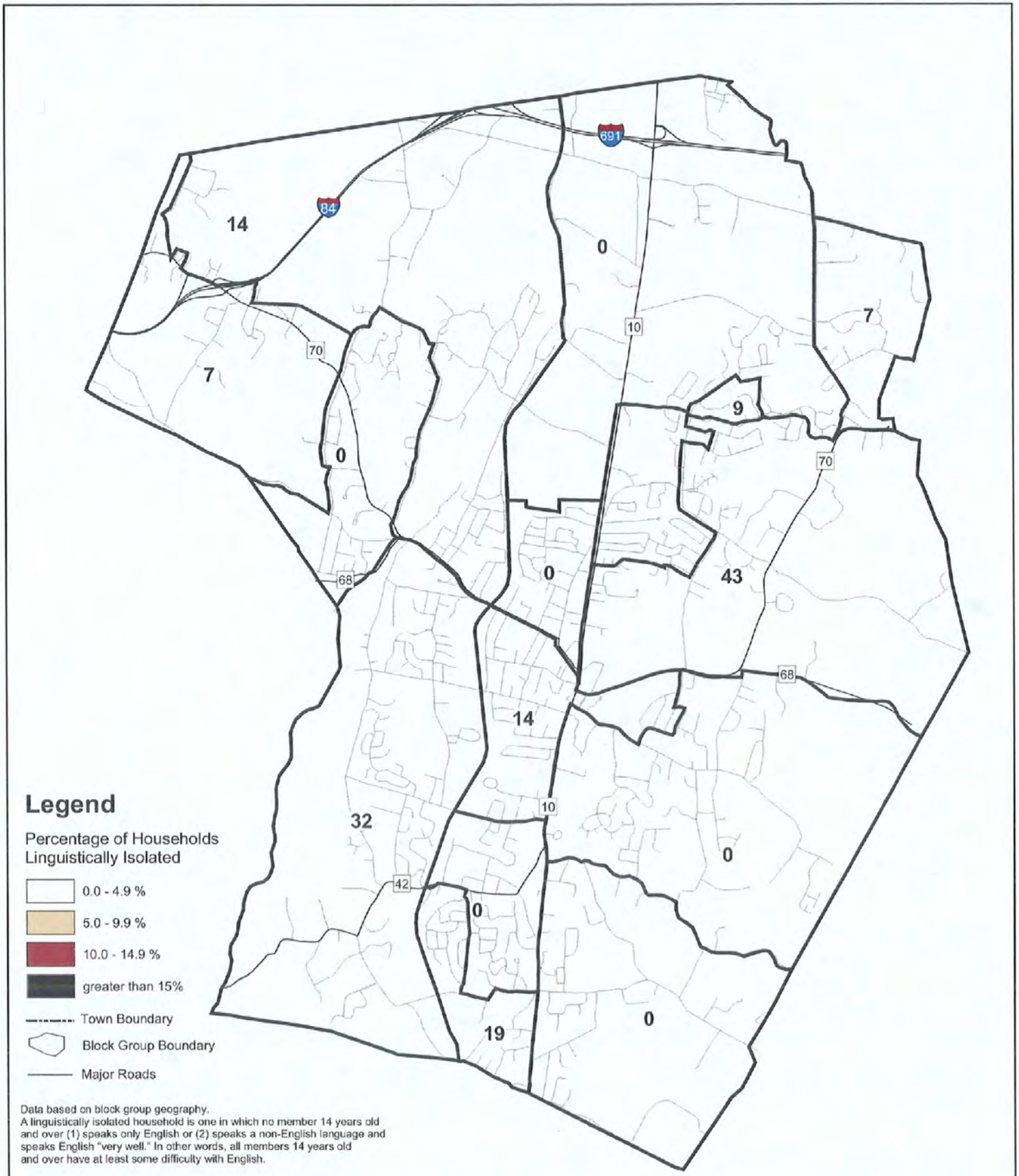


Figure 2-7: Cheshire Linguistically Isolated Households



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.
January 2008

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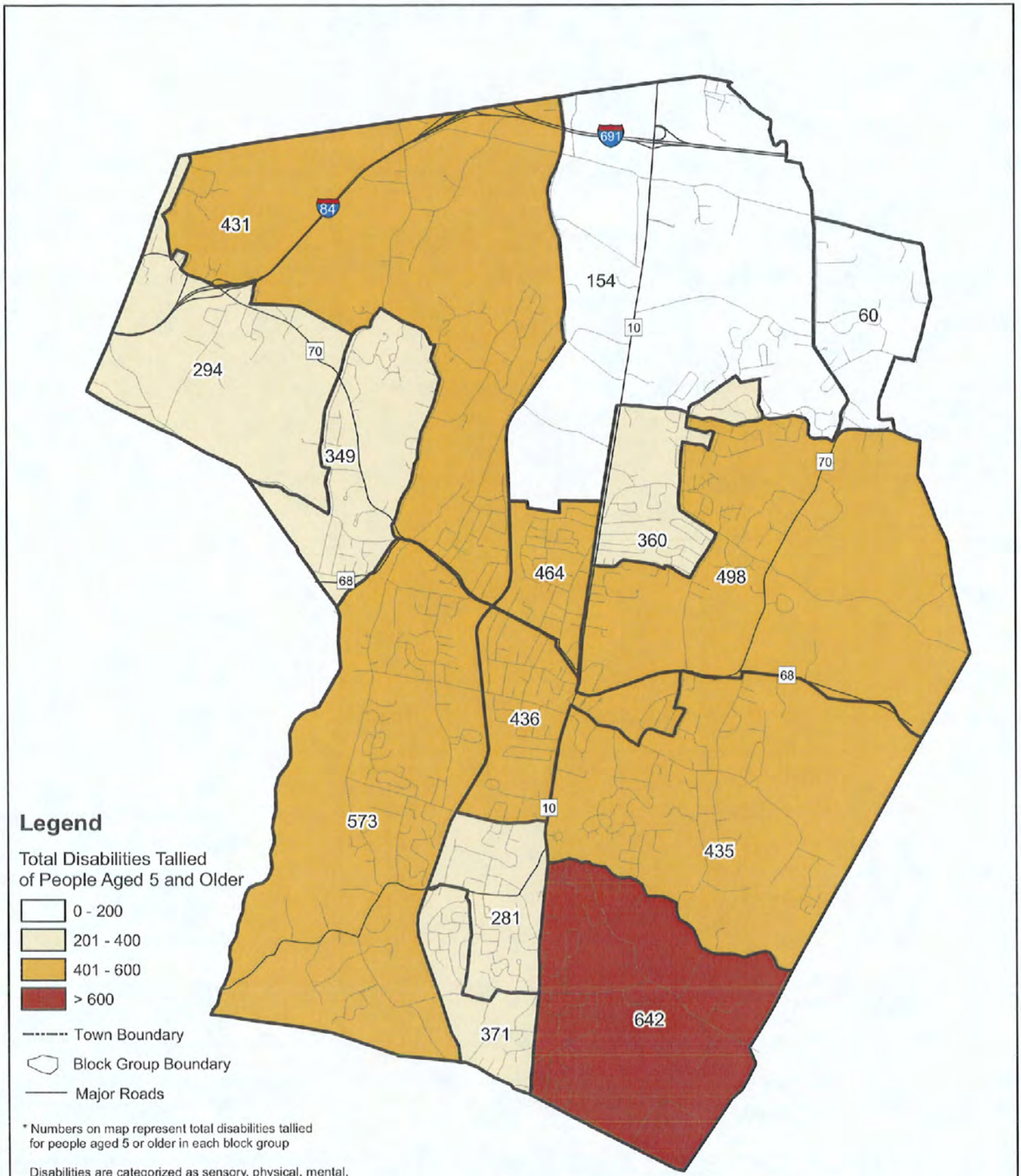
Figure 2-8: Cheshire Disabilities Map



Source: "Roads", c1984 - 2000 Tele Atlas, Rel. 10/06.
"Town Boundary", DEP
"Disability", "Block Groups", 2000 Census
For general planning purposes only. Delineations may not be exact.
January 2008

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CENTRAL NAUGATUCK VALLEY

In addition to the personnel and departments listed above, there are 22 boards, commissions and committees providing input and direction to Town Council and Town administrators. Establishment of these commissions and departments to oversee subsets of municipal affairs is authorized by the Town Charter. Many of these commissions and departments may play a role in hazard mitigation, including the Planning and Zoning Commission, the Zoning Board of Appeals, the Building Code Board of Appeals, the Energy Commission, the Environmental Committee, the Inland Wetland and Watercourses Commission, the Public Building Commission, the Public Safety Commission, the Water Pollution Control Authority/Flood and Erosion Control Board, the Chesprocott Health District, the Quinnipiac River Watershed Partnership, the Building Official, the Fire Department, the Police Department and the Public Works and Engineering Department.

In particular, the Department of Public Works handles complaints associated with natural events such as flooding; each complaint is assigned a tracking number and is addressed by a member of the department. Also of note, the Environmental Committee works closely with the residents of Cheshire regarding a variety of issues including conservation and hazard mitigation. While other departments and commissions such as the Inlands Wetlands and Watercourses Commission have primarily regulatory roles, the Environmental Committee's goals are education and outreach.

2.8 Development Trends

Industrial development began in Cheshire with the opening of rail service. The accessibility of the railroad facilitated a 19th century mining industry in the Town. The first half of the 20th century saw increasing residential development with the improvement of the roadway network. Cheshire established itself as a residential community for workers in nearby industrial cities. Suburbanization increased in the 1960s as Cheshire became a popular location for employees commuting to New Haven.

Agriculture played a significant role in shaping the town's transportation routes and zoning and land use patterns, and it remains a significant element of the local economy. Cheshire has developed an economic niche producing bedding plants for wide distribution; hence the town's slogan, "The Bedding Plant Capital of Connecticut."

The current primary land use objective is the preservation of small town character, small farms and open space. Small farms are viewed as an important component of the local economy, and innovative conservation approaches such as transfer of development rights are being enacted to preserve farmland. It is expected that the northern end of town will remain the location for the concentration of both industrial uses and farmland.

Most of the land area zoned R-20 is already developed. The R-40 and R-80 zoned areas have capacity for residential development, but growth remains slow. As a reference, in the year 2000, only 68 single-family home permits were issued. All utilities in new subdivisions are underground, making them less vulnerable to natural hazards. An estimated 40% of residential units in town are currently served by underground utilities.

The Police and Fire Departments review new subdivision plans for safety and access concerns at monthly meetings. The Town discourages driveway gates and gated subdivisions as the gates act as obstacles slowing emergency response. Cul-de-sacs in new developments are discouraged and connectivity of roads is encouraged. Subdivisions featuring cul-de-sacs offer 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. Cheshire requires a 50-foot right of way at the end of dead end streets, and dead end roads can be no longer than 1,700-1,800 feet in length. All new roads must have less than 10% grade, and if they can connect through to an existing road, they will be connected on both ends.

2.9 *Critical Facilities and Sheltering Capacity*

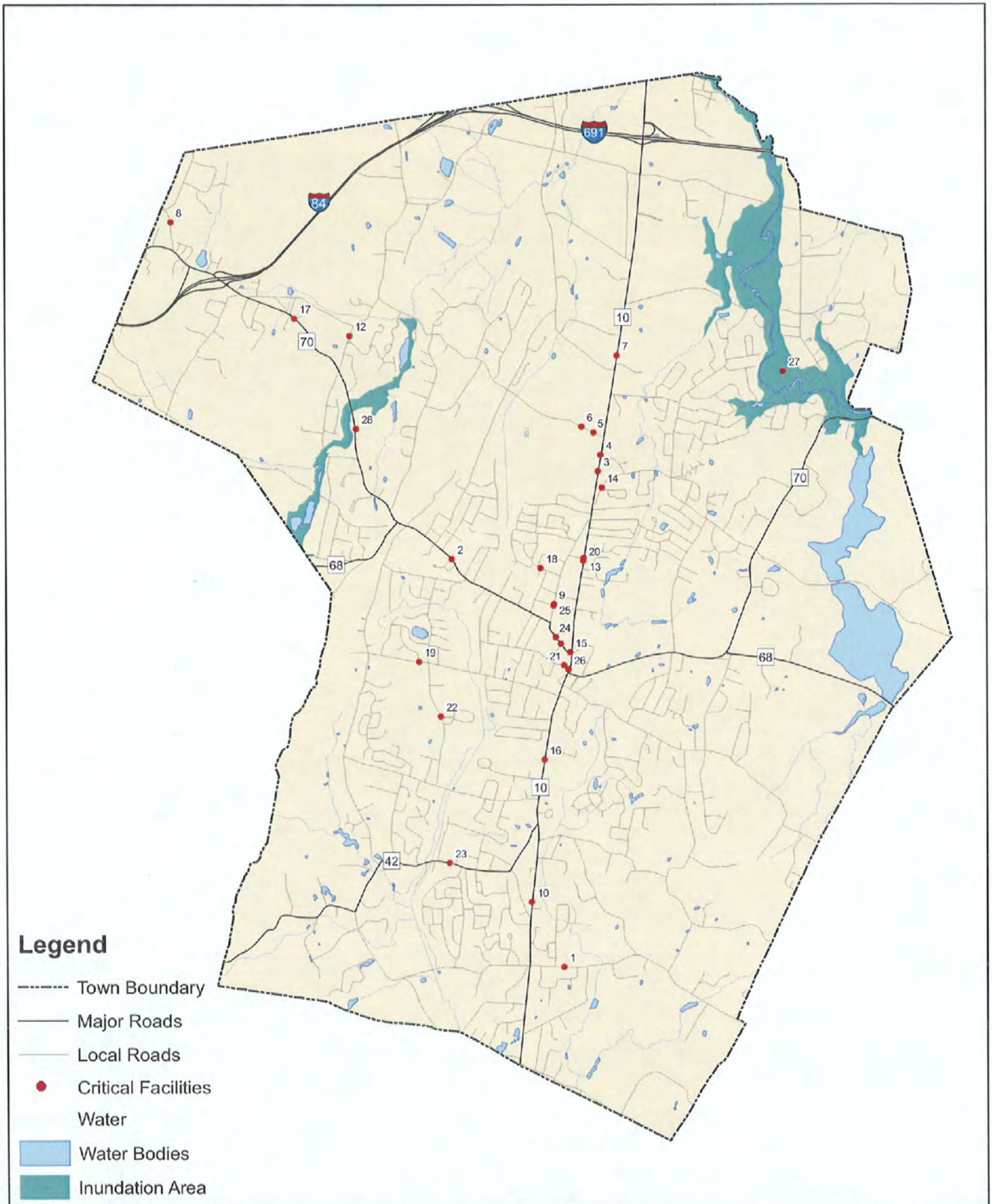
The Town considers its police, fire, medical, governmental, and major transportation facilities to be its most important critical facilities, for these are needed to ensure that emergencies are addressed while day-to-day management of Cheshire continues. Day-care facilities and convalescent homes are 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 map of critical facilities by number is shown in Figure 2-9, and the associated list of critical facilities is provided in Table 2-3. Shelters, communications, transportation, and the Department of Public Works are described in more detail below.

Shelters

Emergency shelters are also considered to be an important subset of critical facilities, as they are needed most in emergency situations. Cheshire has two designated emergency shelters. The Cheshire Senior Center is the primary shelter. The Senior Center has a generator for emergency power. It has an overall capacity of 200 individuals and can provide bedding for 100 people. The Senior Center located at 240 Maple Avenue has easy accessibility due to its location near the center of town. The secondary shelter is Cheshire High School. The High School has an overall capacity of 500 people and can provide bedding for 200 people. The High School is located on Route 10 about one-half of a mile south of the Town Hall. Its location on Route 10 makes it easily accessible from most locations in town. The Cheshire Emergency Management Team has approximately 200 cots and the Cheshire Correctional Institution (CCI) presently stores 900 emergency cots for the American Red Cross that would be used in Cheshire during an emergency.

Figure 2-9: Cheshire Critical Facilities



Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10.06.
"Town Boundary", "Hydrography", DEP
"Critical Facilities", COGCNV
For general planning purposes only. Delineations may not be exact.
January 2008

Table 2-3
Critical Facilities in Cheshire

Map Key	Type	Name	Address	Located in Floodplain?
1	Assisted Living	Elim Park Baptist Home	140 Cook Hill Road	No
2	Assisted Living	Marbridge Retirement Center/Fairwinds	665 West Main Street	No
3	Assisted Living	Highlands Health Care	745 Highland Avenue	No
4	Correctional Facility	Cheshire Correctional Institution	900 Highland Avenue	No
5	Correctional Facility	Manson Youth Institution	42 Jarvis Road	No
6	Correctional Facility	Webster Correctional Institution	111 Jarvis Road	No
7	Emergency Ops.	Chesprocott Health District	1247 Highland Avenue	No
8	Fire Department	Cheshire Fire Dept Company 2	1511 Byam Rd	No
9	Fire Department	Cheshire Fire Dept Headquarters	250 Maple Ave	No
10	Fire Department	Cheshire Fire Dept Station 3	1125 South Main St	No
11	Library	Cheshire Public Library	104 Main Street	No
12	Mobile Home Park	Wheel Estates	1147 Marion Road	No
13	Police Station	Cheshire Police Dept Headquarters	500 Highland Ave	No
14	School	Chapman School	38 Country Club Road	No
15	School	Cheshire Academy	10 Main St.	No
16	School	Cheshire High School (Secondary Shelter)	525 South Main Street	No
17	School	Darcey School	1686 Waterbury Road	No
18	School	Dodd Junior High School	100 Park Place	No
19	School	Doolittle School	735 Cornwall Avenue	No
20	School	Highland School	490 Highland Avenue	No
21	School	Humiston School	30 Spring Street	No
22	School	Legionaries of Christ Seminary	475 Oak Avenue	No
23	School	Norton School	414 North Brooksvale Rd	No
24	School	St. Bridget Elementary School	171 Main Street	No
25	Senior Center	Cheshire Senior Center (Primary Shelter)	240 Maple Avenue	No
26	Town Office	Cheshire Town Offices	84 South Main St	No
27	Waste Treatment	Sewage Treatment Plant	Cheshire Street	Yes
28	Public Works	Public Works Garage	1286 Waterbury Rd	No

Source: Council of Governments Central Naugatuck Valley

These buildings have been designated as public shelter facilities by meeting specific American Red Cross 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 American Red Cross. The Police and Fire Departments staff the shelters.

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.

Communications

As a feature of their emergency response program, Cheshire has GPS capabilities to locate incoming cell phone calls as well as "Enhanced 9-1-1." Enhanced 911 improves the effectiveness and reliability of wireless 911 calls by having wireless service providers inform the 911 operator of the wireless telephone number of the caller, and the origin of the call within a 50 to 300 meter radius. This technology allows emergency services to provide a faster response to wireless callers.

Through the Emergency Planning Committee, the COGCNV is assisting municipalities in their investigations of instituting an emergency notification system in the area to further enhance emergency response. A similar system desired by the Town is one that would send text messages to mobile phones to notify residents of emergencies. This type of system could also be used to inform residents of expected duration of power outages.

The Central Naugatuck Valley Council of Governments is investigating the possibilities of instituting an emergency notification system in the area to further enhance emergency

response. It is important to note that effective January 1, 2008, the Town of Cheshire will be in the northwest corner of Region 2 of the Connecticut Emergency Medical Service regions. Thus, it is important that Cheshire institute emergency notification systems compatible with those of Region 2, Region 3 to the north, and Region 5 to the west. Region 5 will contain most of the COGCNV municipalities.

Transportation

As a means of evacuating the area, Cheshire has convenient access to nearby towns on the following state routes that function as major transportation arteries: Route 10, Route 68, Route 70, Route 42, I-691 and I-84. The state routes, Route 10, Route 68, Route 70, and Route 42, can also be used to travel from the residential areas of Cheshire to the two designated shelters. The Police Department and Fire Department are developing a specific evacuation plan to facilitate travel from the northwest corner of Cheshire to the designated shelters via Route 70 and Route 10.

Public Works Department

The Public Works Department is a critical municipal department related to hazard mitigation because it maintains, repairs, and constructs stormwater systems and roadways. The Department is responsible for maintaining stormwater systems for proper drainage and flood mitigation, as well as clearing snow and ice and maintaining access for emergency vehicles.

Likewise, the Public Works Department believes that establishment of working inter-municipal agreements with other public works departments in nearby communities would allow for sharing of resources when disasters affect one community more than others. This Plan therefore recommends that these types of agreements be pursued.

3.0 *INLAND 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.

Inland flooding is a minor natural hazard in the Town of Cheshire. The five primary drainage basins in Cheshire are the Ten Mile River, the Quinnipiac River, Willow Brook, Broad Brook, and the Mill River. A thorough discussion of these drainage areas is included in Section 2.5. While the severity of flooding damage is usually considered to be limited except in extreme cases, the frequency of occurrence of flooding in Cheshire is considered to be likely. Areas impacted by overflow of river systems are generally limited to areas adjacent to the rivers. Indirect flooding that occurs in the floodplains adjacent to the rivers and localized nuisance flooding along tributaries are more common problems resulting from inadequate drainage and other factors.

3.2 *Hazard Assessment*

Flooding represents 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 dam failure, which is discussed in Section 9.0.

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by FEMA as the base flood for purposes of floodplain management. This flood has a one percent chance of being equaled or exceeded each year, and is expected to be exceeded once on the average during any 100-year period. The risk of having a flood of this magnitude or greater increases when periods longer than one year are considered. Similarly, a 500-year flood has a 0.2 percent chance of occurring in a given year. The 500-year floodplain indicates areas of moderate flood hazard.

Floodplains are lands along watercourses that are subject to periodic flooding; floodways are those areas within the floodplains that convey floodwaters. Floodways are subject to water being carried at relatively high velocities and forces. 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.

Flooding presents several safety hazards to people and property. 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.

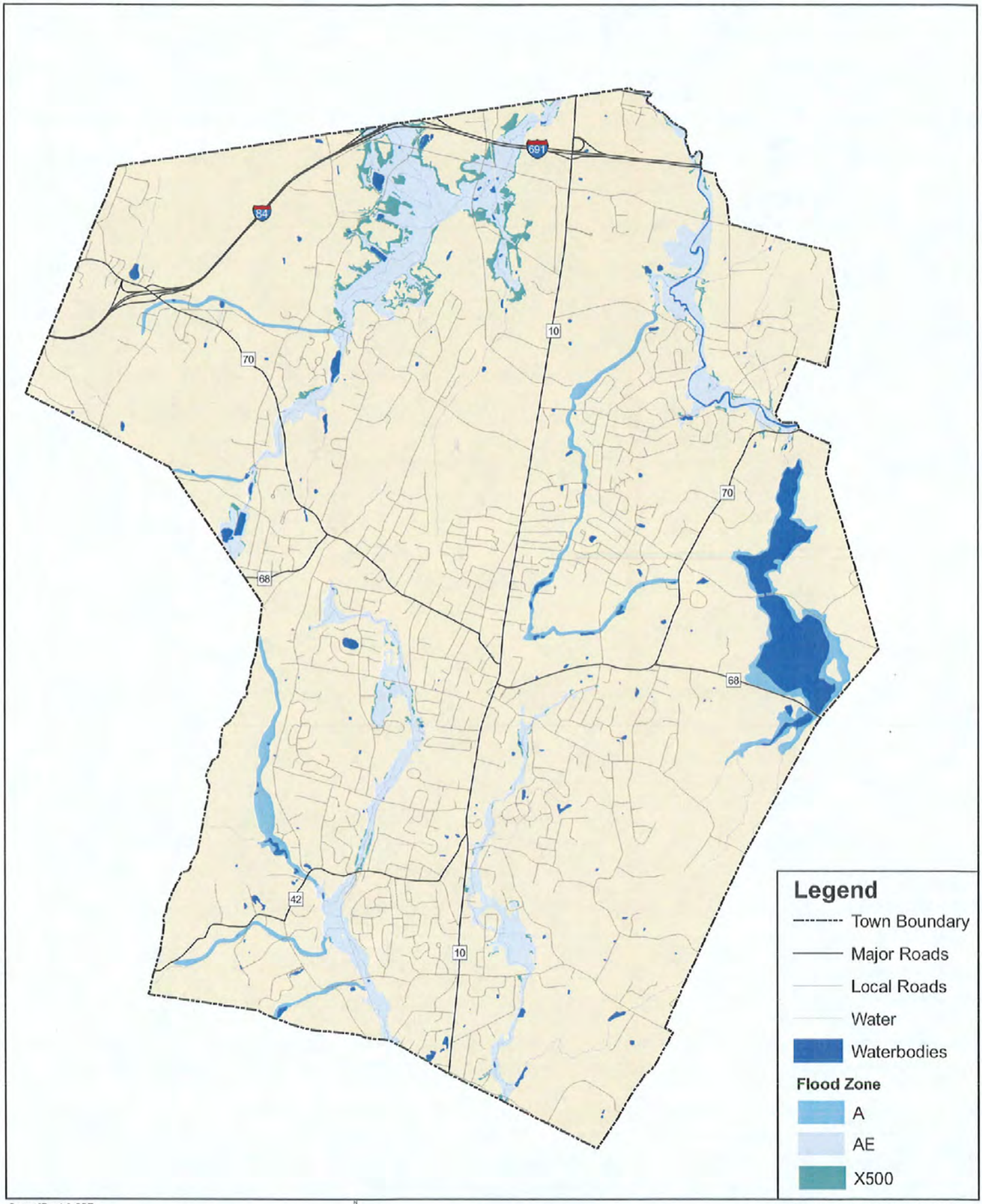
Furthermore, damp conditions trigger the growth of mold and mildew in flooded buildings, contributing to allergies, asthma, and respiratory infections. Snakes and rodents are forced out of their natural habitat and into closer contact with people, and ponded water following a flood presents a breeding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

SFHAs in Cheshire are delineated on Flood Insurance Rate Maps (FIRM) and Flood Insurance Studies (FIS). These maps demonstrate areas within Cheshire that are vulnerable to flooding. The FIRMs were published on July 16, 1981 and updated on November 3, 1989, August 2, 1995, and April 15, 2002. The FIS was originally published on July 16, 1981 and updated on November 3, 1989 and again on April 15, 2002. Refer to Figure 3-1 for the areas of Cheshire susceptible to flooding based on FEMA flood zones. Table 3-1 describes the various zones depicted on the FIRM panels for Cheshire.

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.

Figure 3-1: FEMA Flood Zones in Cheshire



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

N
W E
S

0 0.5 1 Miles

COUNCIL OF GOVERNMENTS
CENTRAL NAUGATUCK VALLEY

In some areas of Cheshire, 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 Quinnipiac River and its 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.

FEMA commenced the Flood Map Modernization program for New Haven County, Connecticut in August 2007. The "Map Mod" program will result in an updated comprehensive FIS report for New Haven County and one FIRM. It is anticipated that the Map Mod program will enable a more accurate representation of floodplains in Cheshire. However, the Map Mod program will not re-establish flood elevations.

3.3 Historic Record

In every season of the year throughout its recorded history, the Town of Cheshire 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.

Notable historic floods occurred in February 1807, May 1854, October 1869, January 1874, March 1876, September 1882, February 1886, January 1891, and March 1896. Major floods also occurred in Cheshire in March 1936, January and September 1938, January 1949, and August and October 1955. In terms of damage to the Town of Cheshire, the most severe of these was the September 1938 flood which was a 50-year flood event on the Quinnipiac River in Wallingford.

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 Cheshire area and was calculated to have a recurrence interval ranging from 100 to 500 years on streams in Cheshire. The rainfall gauge in South Cheshire recorded a four-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 following are descriptions of additional, more recent examples of floods in and around the Town of Cheshire 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 is 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.

- April 21, 2000: The Ten Mile River overflowed its banks in Cheshire around 9:45 PM due to a series of intense thunderstorms moving northeast across Fairfield and New Haven Counties. The thunderstorms dropped 3.31 inches of rain in Cheshire. The Quinnipiac River also overtopped its banks in Wallingford.

- 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 Cheshire.

- 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 Cheshire, and stream stages were believed to approximate the ten-year recurrence interval.

- April 15-16, 2007: A powerful spring nor'easter caused heavy rains of three to eight inches and severe flooding throughout Connecticut. The Town of Cheshire Fire Department responded to 80 calls for flooded basement assistance, reportedly the highest number of calls in 15 years. The Ten Mile River experienced severe flooding and streams flooded roads in the Cheshire Industrial Park.

3.4 Existing Programs, Policies, and Mitigation Measures

The Town of Cheshire has in place a number of measures to prevent flood damage. These include regulations, codes, and ordinances preventing encroachment and development near floodways. There are no major structural flood protection measures existing in Cheshire.

In general, developments in floodplains are regulated during the zoning and land subdivision application processes. The Town has several regulations, codes, and ordinances preventing encroachment and development near floodways. Regulations, codes, and ordinances that apply to flood hazard mitigation include:

- ***Flood Plain Management Regulations*** (Section 46 of Cheshire Zoning Regulations). This section is a comprehensive set of regulations governing development of floodplains in Cheshire. It relies on the FEMA FIS elevations and FIRM mapping to delineate floodplain boundaries.

- ***Soil Erosion and Sedimentation Control Regulations*** (Section 49 of Cheshire Zoning Regulations). This section outlines the Planning Commission's expectations

regarding sedimentation and erosion controls to prevent excess soil from entering watercourses.

- ***Drainage*** (Section 4.4 of Cheshire Subdivision and Other Land Use Regulations). This section outlines the Planning Commission's expectations regarding existing and proposed storm drainage systems and culverts, including design, easement rights, and effects on adjoining property.

- ***Design Standards*** (Section 5.2 and 5.3 of Cheshire Subdivision and Other Land Use Regulations). These regulations outline floodplain management and construction standards for new structures and subdivisions located within the 100-year floodplain, and define lands that are unsuitable for development.

- ***Drainage Facilities for Storm Water and All other Drainage Excluding Sanitary Drainage Facilities*** (Section 7 of Cheshire Subdivision and Other Land Use Regulations). This section outlines the design standards for stormwater and other non-sanitary drainage facilities, including location, suitable receiving water bodies, design specifications for pipes, manholes, and culverts, and the use of underdrains.

- ***Inland Wetlands and Watercourses Regulations***. The Town of Cheshire's regulations regarding development near wetlands and watercourses that are sometimes coincident with flood management zones.

The intent of these regulations is to promote the public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas of the Town of Cheshire by the establishment of standards designed to:

- Protect human life and public health;
- Minimize expenditure of money for costly flood control projects;
- Minimize the need for rescue and relief efforts associated with flooding;

- Ensure that purchasers of property are notified of special flood hazards;
- Ensure that all land approved for subdivision shall have proper provisions for water, drainage, and sewerage and in areas contiguous to brooks, rivers, or other bodies of water subject to flooding, and that proper provisions be made for protective flood control measures;
- Ensure that property owners are responsible for their actions;
- Ensure the continued eligibility of owners of property in Cheshire for participation in the National Flood Insurance Program.

The Town of Cheshire primarily attempts to mitigate flood damage and flood hazards by restricting building activities in flood-prone areas. All facilities and associated utilities require flood proofing either by design or location and all existing watercourses are to be encroached minimally or not at all to maintain the existing flood carrying capacity. The Town of Cheshire uses the 100-year flood lines from the FIRM and FIS delineated by FEMA as the official maps and report for determining special flood hazard areas. A Flood Hazard Area Permit must be issued by the Building Official for any development located in flood hazard areas. New construction or substantial improvement of buildings for human occupancy is not permitted in a flood hazard area.

Specific provisions are made for flood hazard reduction, including rules that regulate construction material and methods, anchoring, location of service facilities, and design specifications for drainage, sanitary sewer, and water supply systems. These ordinances require that all new land uses have a zero net increase in runoff, and that all structures in flood hazard areas have the lowest floor constructed above established base flood elevations. Site plan standards require that all proposals be consistent with the need to minimize flood damage, that public facilities and utilities be located and constructed to minimize flood damage, and that adequate drainage structures are provided. The Cheshire Police Department and Cheshire Fire Department review new subdivision applications for safety concerns as well, although not specifically for flooding.

The Cheshire Inland Wetlands and Watercourses Commission reviews new developments and existing land uses on and near wetlands and watercourses. Any development which may potentially impact a watercourse, as defined as being "significant activities" in Section 2 of the Town of Cheshire Inland Wetlands and Watercourses Regulations, must be approved by the Inland Wetlands Committee in the Town before being approved by the zoning board.

Most of the wetland violations in the Town are matters of encroachment due either from ignorance or disregard of the buffer zones. A 50-foot wetland buffer area is posted on land records and with permanent markers on each property. While technically this is an "upland review area," the Commission tends to review it as a non-encroachment area. Some wetlands are given a larger upland review area. Wetland complaints are tracked by paper filing. Protecting wetland buffers helps prevent nuisance flooding and is important for both habitat conservation and flood control.

The Cheshire 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 majority of the drainage structures in Town are properly sized to safely convey the 100-year flood event.

In the 1980's a comprehensive storm drainage inventory was completed for the Town, and in 1991 a Master Drainage Study was completed to evaluate existing drainage structures, provide computer models to calculate the runoff impact of land use changes, and to provide guidance on how to reduce the impact of urbanization on the riverine system. The Town uses these documents to identify potential problems and plan for maintenance and upgrades.

The Cheshire Plan of Conservation and Development summarizes several guidelines used by the Town in approving changes in land use. The following guidelines promote flood hazard mitigation:

- Retain natural vegetation, topography, infiltration, and drainage patterns;
- Avoid channelizing, piping, and filling of wetlands and watercourses;
- Minimize impervious surfaces, especially in low-traffic areas;
- Encourage sheet-flow and "soft-drainage" instead of curbing and piping;
- Maximize buffers to wetlands and watercourses;
- Follow state-recommended methods for erosion and sedimentation control.

The Town of Cheshire *Emergency Operations Plan* contains a section for addressing flood hazards. It notes the two areas in the most danger for severe flooding to be the Quinnipiac River near Blacks Road and the Sewage Treatment Plant, and the Ten Mile River downstream of Mixville Pond should Mixville Pond Dam fail. The Mill River is also noted as an area of concern. The plan outlines steps to be taken by Town personnel to mitigate further flood damage and conduct recovery operations.

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 Cheshire 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.

The Town can also access the Automated Flood Warning System to monitor precipitation totals. The Connecticut DEP installed the Automated Flood Warning System in 1982 to monitor rainfall totals as a mitigation effort for flooding throughout the state.

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 Flood Insurance Rate Maps, approximately 1,990 acres of land in Cheshire are located within the 100-year flood boundary. Indirect flooding occurs near streams and rivers throughout Cheshire 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 field visits on May 16, June 7, September 22, and October 28, 2006; and April 16, 2007.

In 1991, the Town of Cheshire conducted a drainage study in order to determine how to properly manage its drainage basins, watercourses, floodplains, and stormwater runoff. This study presented a *Storm Drainage Management Program* designed to mitigate potential impacts from runoff, and presented guidelines to reduce the impact of urbanization on the riverine system. It also provided a thorough review of the existing drainage facilities within the Town in order to determine their hydraulic adequacy. The drainage study expressed the following conclusions in regards to flood management:

- As long as Cheshire continues its policy of zero net increase in runoff, the existing waterways should be sufficient even with continuing land development. Therefore, the Town should continue to regulate stormwater rates to prevent increases in surface runoff;
- The primary drainage system, consisting of bridges, culvers, and large storm drains, was adequate for the needs of the Town, with only 20% of the existing culverts being undersized;
- High-priority culvert improvements should be corrected;
- Erosive watercourses should be periodically monitored;
- Ensure that any fill in a floodplain area be designed to have an elevation above the 100-year flood and be resistant to erosive flows;

- Best Management Practices (BMPs) should be utilized for stormwater management in new developments;
- The filling of wetland and floodplain areas and the channelization of existing watercourses should be discouraged;
- The Town should continue to use hydrologic models to simulate the impact of any future land use change.

Since this study, the Town has made several culvert improvements and generally followed these guidelines and conclusions. Other specific areas at risk of flooding, including areas at risk of localized flooding, are discussed in the following sections.

Quinnipiac River and Tributaries

The reach of the Quinnipiac River located in Cheshire is characterized as only lightly developed. The northern part of the reach is predominantly wooded, with sections of agricultural fields and marsh. It is intersected only by Route 322 and Interstate 691. The area near Blacks Road is light-density single-family residential. As the river proceeds south and curves east near Riverside Drive the area is still light-density single-family residential on the south and west side of the river, with parks and the waste treatment plant on the northeast side. Wooded areas, the occasional agricultural use, and some houses line the remainder of the river before it discharges into Meriden.

The Quinnipiac River is prone to flooding along its entire reach in Cheshire, but the flooding is generally limited to the properties adjacent to the rivers. The majority of the 100-year and 500-year floodplain is not developed. Specific instances of flooding occur near East Johnson Avenue, Blacks Road, near the Sewage Treatment Plant, and north of Riverside Drive with a frequency of approximately one time every year.

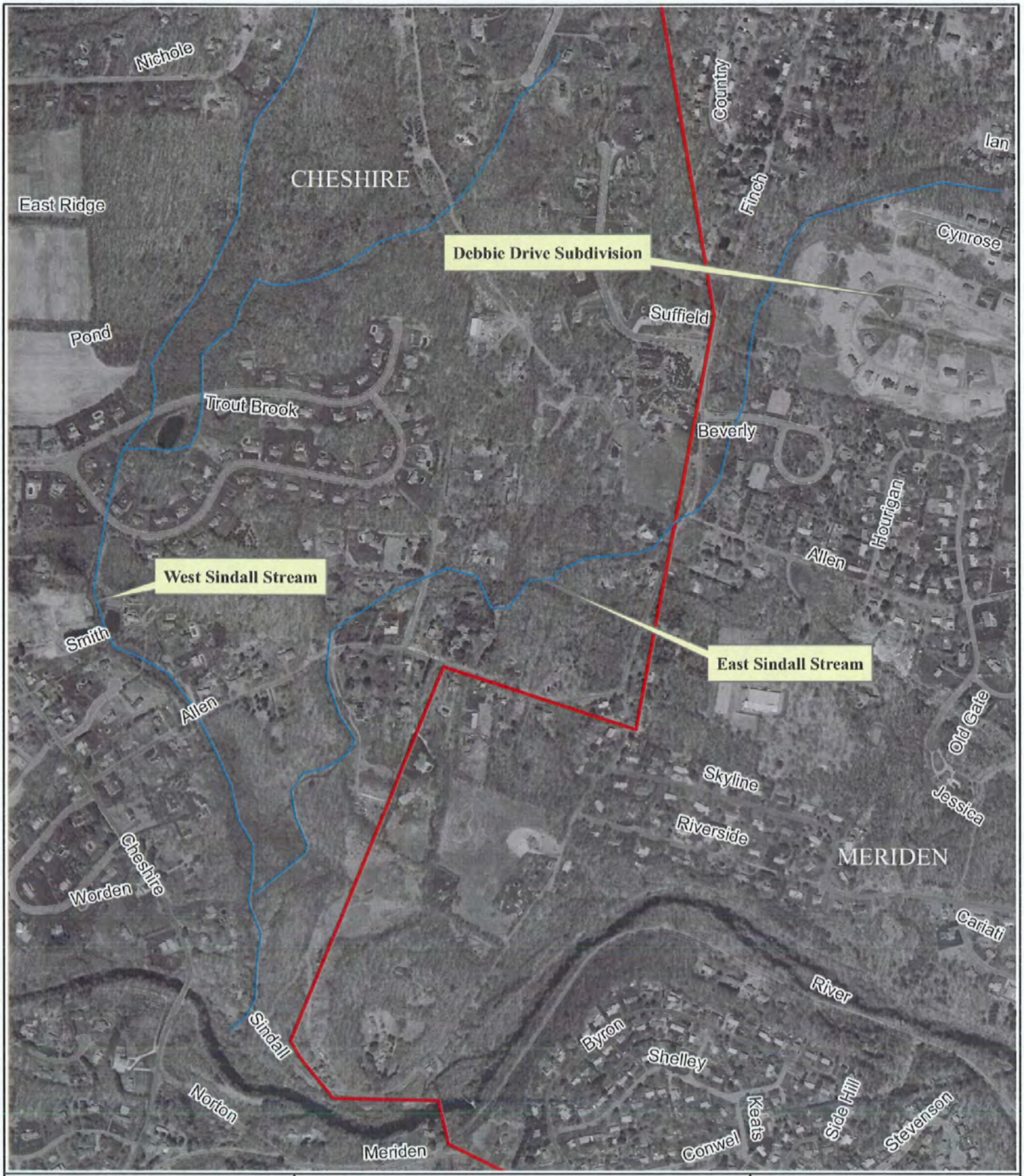
Flooding often occurs along the tributaries to the Quinnipiac River. For example, out-of-bank and near flooding conditions were observed by Milone & MacBroom, Inc. staff at

East Sindall Stream at Allen Avenue during storms. This area was also greatly impacted by the heavy rainstorm on June 2, 2006 that caused a detention pond failure near Debbie Drive in a new subdivision in the adjacent City of Meriden. This detention pond drained to a watercourse locally known as East Sindall Stream. Refer to Figure 3-2 for a depiction of this area.

According to Town personnel, the failure of the detention pond sent a torrent of water down East Sindall Stream and under Beverly Drive in Meriden. A small, privately owned dam in the run of the stream locally known as "Nun's Dam", located at 405 Allen Avenue in Meriden, was breached as it was not designed to mitigate floods. The combination of the water from the detention pond and from behind Nun's Dam continued downstream, eroding the channel and accumulating debris between Finch Avenue and Allen Court. This area was covered in outwash following the storm. The debris blocked the culvert running under Allen Court in Cheshire, causing the stream to flood the road.

The stream continued eroding and accumulating debris between Allen Court and Allen Avenue, where the reduction in gradient caused the floodwaters to slow and deposit cobbles and larger debris on the property at 815 Allen Avenue. The stream floods portions of this property at least two times per year. The stream is shallow and wide in this reach, and was overbank through this property while discharging south. The stream continues south through undeveloped marshes, and no damage was reported south of this property. Eventually, this stream joins with West Sindall Stream to form Sindall Stream, which flows underneath Sindall Road and empties into the Quinnipiac River.

The watercourse locally known as West Sindall Stream flows under Northpond Road, Troutbrook Road, and Allen Avenue before its confluence with East Sindall Stream. The stream has two branches which formerly joined together south of the current configuration of Northpond Road. When Northpond Road was installed, the eastern branch was altered to flow west alongside Northpond Road to join the west branch at the culvert running under Northpond Road. The streambed elevation of the reach running



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www.miloneandmacbroom.com

Northeast Cheshire Study Area

LOCATION: Cheshire & Meriden, CT

MMI#: 2937-01
MXD: H:3-2NECheshire.mxd
SOURCE: CT DEP, CLEAR

N

Town of Cheshire Natural Hazard Pre-Disaster Mitigation Plan

DATE: July 2007
SCALE: 1:9,000

SHEET: Figure 3-2

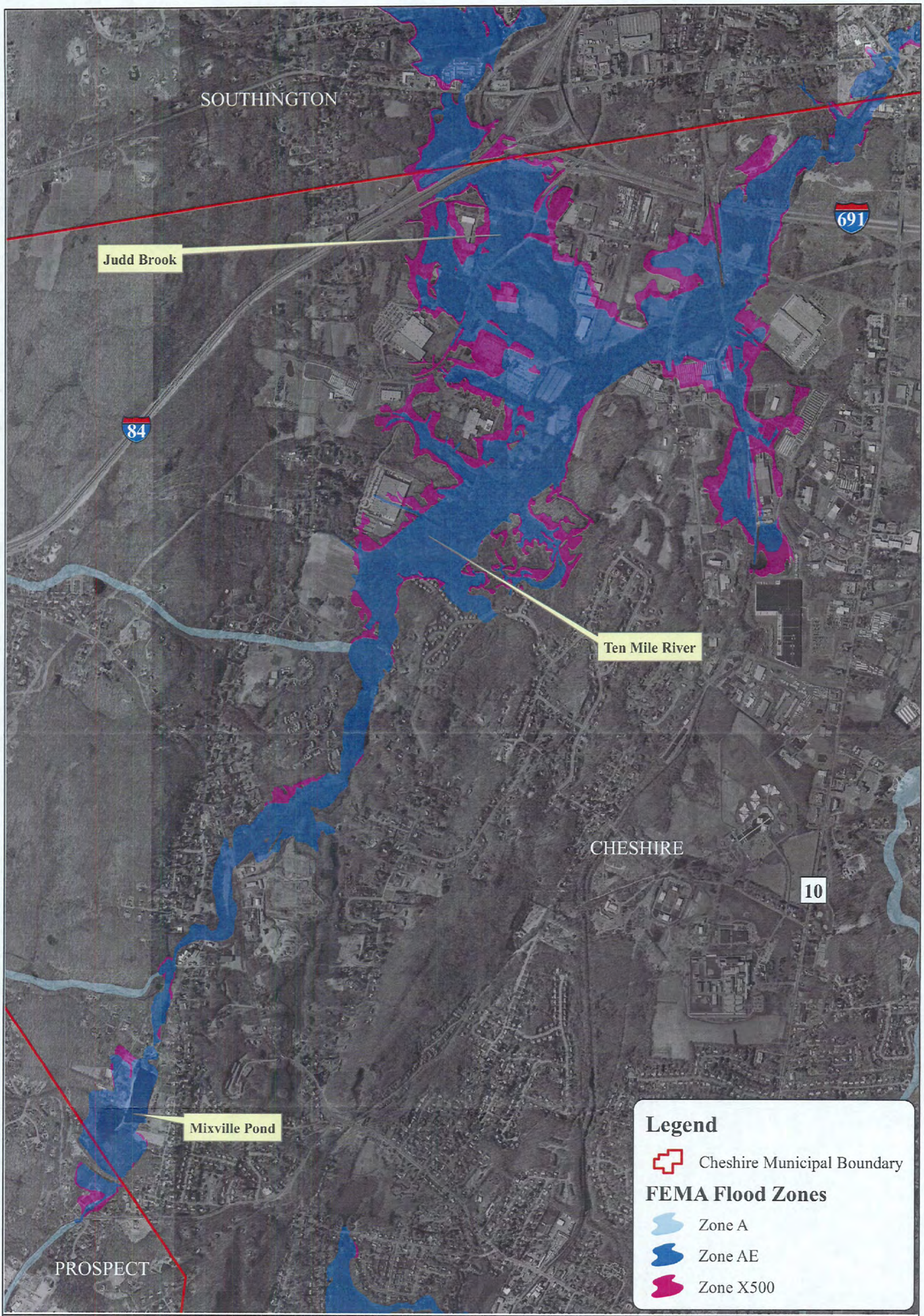
parallel to the road is about 18 inches below the road surface. The Town plans to excavate a 400-foot section of the east branch to lower the level of the stream where it runs parallel to Northpond Road in order to eliminate flooding. A review of historical USGS topographical maps indicates that this area was formerly characterized as wetlands, which may explain why this area is floodprone.

Large areas of ponded water were observed in the yards of homes on the east side of Cheshire Street across from Blacks Road. These observations were made by Milone & MacBroom, Inc. staff during the storm on October 28, 2006. This appears to be nuisance flooding without any serious effects.

Honeypot Brook is a tributary to the Quinnipiac River which drains a sizeable section of eastern Cheshire. During the field investigations by Milone & MacBroom, Inc. staff on October 28, 2006, Honeypot Brook was observed at Blacks Road. Of particular interest in this area is that the culvert elevation causes a wide backwater condition on the south (upstream) side of the road. The storm event produced 2.33 inches of rain in about 18 hours at a weather station in Southington, an amount below the two-year, 12-hour frequency storm. The water elevation is just below the street. Any additional flow here could cause flooding of the roadway.

Ten Mile River and Tributaries

The Ten Mile River enters Cheshire from the Town of Prospect and flows northeast through Cheshire before reaching its confluence with the Quinnipiac River in Southington. The majority of this reach includes undeveloped wetlands with pockets of industrial use and some single-family residential areas abutting the 100-year floodplain. Refer to Figure 3-3 for a depiction of the Ten Mile River corridor and floodplain.



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Ten Mile River Study Area

LOCATION: Cheshire, CT

MMI#: 2937-01
MXD: H:\3-3TenMile.mxd
SOURCE: CT DEP, CLEAR

N

Town of Cheshire
Natural Hazard Pre-Disaster
Mitigation Plan

DATE: July 2007
SCALE: 1:18,000

SHEET: Figure 3-3

The Ten Mile River enters Cheshire at Mixville Pond, a Town-owned recreation area. It flows through a light-density single-family residential area before passing near a commercial and industrial park. According to the FEMA mapping, the potential exists for the 100-year flood to inundate some industrial parking lots but no buildings in this reach downstream to the culvert running under Route 70.

Town personnel indicated that the Ten Mile River occasionally floods a home near Jarvis Street. According to Town personnel, this flooding occurs about once every two years. This home lacks a basement and therefore does not file insurance claims.

The reach of the Ten Mile River from Jarvis Street to Peck Lane is predominantly wetlands. A major tributary named Judd Brook joins the Ten Mile River in this reach. FEMA mapping indicates that the potential exists for the river to flood some single-family houses, agricultural fields, and part of the Cheshire Industrial Park. Although the potential exists for flooding in and near the Cheshire Industrial Park, the large amounts of undeveloped land and wetlands tend to help mitigate flood waters.

Town personnel noted that the Bloomingdale's distribution facility parking areas in the Cheshire Industrial Park have flooded in the past with an unknown recurrence period. Most recently during the April 2007 nor'easter, roads in the Cheshire Industrial Park were covered by floodwaters associated with Judd Brook.

According to Town personnel, the Ten Mile River has been known to flood Peck Lane with an approximate frequency of one time per year. Beyond Peck Lane, the river continues to flow through wetlands and light industrial areas, eventually passing under West Johnson Avenue and Interstate 691. An unnamed tributary to the Ten Mile River that joins in this reach has previously flooded both Sandbank Road and Schoolhouse Road. Flooding was observed at Sandbank Road by Milone & MacBroom, Inc. staff during a field visit on June 7, 2006 and Schoolhouse Road was observed on May 16,

2006. The stream channel at Schoolhouse Road is lined with high-density reeds and grasses that restrict flow and could exacerbate flooding conditions.

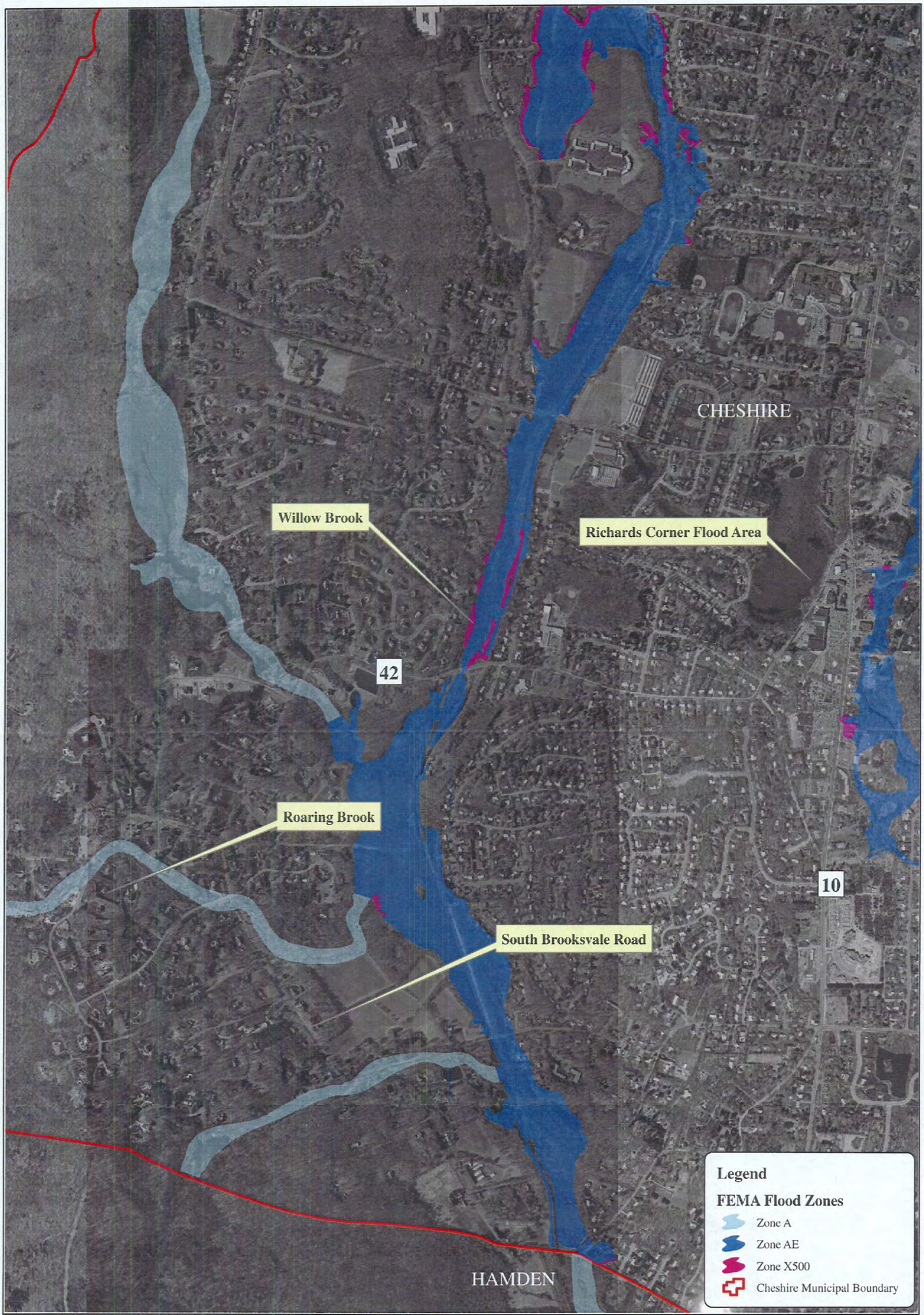
Before entering the Town of Southington, the Ten Mile River channel is constricted by a stone masonry arched culvert, which was built as part of an aqueduct for the historic Farmington River Canal. The aqueduct is currently in the form of an earthen and stone bridge over the river.

Recall from Section 3.3 that a powerful spring nor'easter of April 15-16, 2007 caused heavy rains of three to eight inches and severe flooding throughout Connecticut. During this event, the Ten Mile River experienced severe flooding and the earthen ridge and stone arch bridge failed partially, as they could not adequately convey the storm flows. An emergency bypass channel was excavated to help convey flood flows.

As part of pending development project, a permanent emergency bypass channel is planned to be constructed adjacent to the existing stone arched culvert to provide safe conveyance of high flows. Details are provided in Section 3.6.6.

Willow Brook and Tributaries

The Willow Brook watershed drains the southwestern portion of the Town of Cheshire. The dominant features along the brook include medium-density single-family residential structures, wetlands, and the Farmington Canal Linear Park, which parallels Willow Brook and the old Farmington Canal from Cornwall Avenue south to Mount Sanford Road. The majority of the flooding problems associated with Willow Brook occurs on its tributaries, and are related to poor drainage at road crossings. Refer to Figure 3-4 for a depiction of southwest Cheshire and the streams discussed in this subsection.



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Southwest Cheshire Study Area

LOCATION: Cheshire, CT

MMI#: 2937-01
MXD: H:\3-4Willow.mxd
SOURCE: CT DEP, CLEAR

N

Town of Cheshire
Natural Hazard Pre-Disaster Mitigation Plan

DATE: July 2007
SCALE: 1:12,000

SHEET: Figure 3-4

Willow Brook has its headwaters in West Cheshire near Mountain Road and proceeds generally southward into Hamden. According to FEMA mapping, the potential exists for the brook to flood two houses on Oak Avenue during the 100-year flood. The reach between Oak Avenue and Cornwall Avenue is predominantly wetlands with a wide 100-year floodplain. An industrial complex on Cornwall Avenue lies within the 100-year floodplain, as well as the parking areas for the Farmington Canal Linear Park. No flooding was observed during field investigations on May 16, 2006 by Milone & MacBroom, Inc. staff.

The brook parallels the linear park from Cornwall Avenue to Higgins Road, and some of the structures in the medium-density single-family residential neighborhood east of the park lie within the 100-year floodplain. The area near Higgins Road contains agricultural fields and light-density residential structures, along with a commercial/industrial parcel which could have its parking area inundated by the 100-year flood. Light- to medium-density residential areas flank the linear park between Higgins Road and North Brooksvale Road (Route 42).

A wetland near the Richards Corner section of Cheshire is the headwaters of an intermittent tributary that drains into Willow Brook south of Higgins Road. Flood depths of one foot occurred on Route 42 near Route 10 due to the heavy rains in April, May, and June 2006. The flood frequency for this area was estimated to be about three times per year by Town personnel. The culverts in this area are known to be undersized and the Connecticut Department of Transportation has plans to remedy the situation in the future.

South of North Brooksvale Road, the floodplain of Willow Brook contains undeveloped woodland and marshland downstream to the mouth of Roaring Brook. No flooding problems have been reported in Cheshire for Roaring Brook, which flows east from Prospect. It flows predominantly through wetlands and wooded areas in Cheshire, although there area areas of light-density single-family residential that fall within the 100-year floodplain.

South of Roaring Brook, Sanford Brook joins Willow Brook. Sanford Brook drains northeast from Prospect and Bethany down a steep gradient along Route 42. A 100-year floodplain has been delineated along Sanford Brook throughout most of its length in Cheshire. This area is mostly wooded, although a few houses near Mountain Crest Drive lie within the boundaries of the 100-year floodplain. East of Mountain Crest Drive, Sanford Brook continues through a light-density single family residential neighborhood downstream to South Brooksvale Road, which it has been known to flood during heavy rain events. According to Town personnel, this area floods about two times per year.

Downstream of South Brooksvale Road, the area extending to Sanford Brook's confluence with Willow Brook is primarily undeveloped, and only two houses lay within the defined floodplain.

The area of Willow Brook from Sanford Brook to South Brooksvale Road is undeveloped with the exception of the linear park. It is flanked to the east by a medium-density single-family residential neighborhood and agricultural fields to the west. Portions of the FEMA-defined 100-year floodplain encroach into the neighborhood and the potential exists for flooding to impact some of the structures.

Brooksvale Stream flows northeast from Hamden and enters Cheshire at a small, unnamed pond off Mountain Brook Drive. Brooksvale Stream joins Willow Brook just south of South Brooksvale Road. A 100-year floodplain has been delineated around the stream throughout its short length in Cheshire. The stream is surrounded by wooded areas and light-density single family residential structures. Brooksvale Stream has been known to flood the area around South Brooksvale Road and Mount Sanford Road during heavy rain events. According to Town personnel, this flooding occurs about twice per year. During the nor'easter of April 16, 2007, Brooksvale Stream jumped its culvert and crossed over Mount Sanford Road, damaging the roadway.

The remainder of the Willow Brook area south of South Brooksvale Road is wooded and flanked by light-density residential areas. No flooding problems have been reported in this reach despite the presence of some structures located in the 100-year floodplain. A tributary to Willow Brook in Hamden has its headwaters in a wetland south of Mount Sanford Road near a pond locally known as Mount Sanford Pond. This marsh has been known to flood Mount Sanford Road near the pond during heavy rain events, with a frequency of about one time per year.

Mill River and Tributaries

Mill River drains the southern portion of Cheshire, and the river eventually discharges into New Haven Harbor. Few flooding problems have been reported in this watershed and the area is believed to have a low potential for flooding. Nonetheless, the residential density and commercial and industrial uses in this watershed present a fair amount of potential for flood damage. No flooding was observed in the culverts along the Mill River at Mansion Road, Fawn Drive, Forest Lane, and Cook Hill Road by Milone & MacBroom, Inc. staff on May 16, 2006 during a storm event that produced 1.65 inches of rain in nine hours. This rain event was less than a two-year, 6-hour storm for the area.

A 100-year floodplain has been delineated by FEMA for the Mill River throughout its reach in Cheshire. This floodplain begins near Williamsburg Drive and passes under Surrey Drive before passing under Williamsburg Drive and extending southwest towards Hillside Cemetery. The 100-year floodplain potentially impacts one house near the cemetery access road before crossing under Wallingford Road near Wood Pond Road. The floodplain is predominantly woodlands from this point south but potentially impacts the commercial parking areas near the western end of Jinny Hill Road.

The floodplain continues to be a mixture of woodlands and commercial areas south to Mansion Road. The reach of the Mill River between Mansion Road and Forest Lane is again predominantly woodlands, with some commercial areas along Route 10 potentially

impacted by the 100-year flood. The area around Forest Lane and Fawn Drive is light-density single family residential, and an extreme flood has the potential to impact eight structures in the neighborhood. The wooded and undeveloped areas to the north and east of this neighborhood are also included in the 100-year floodplain.

South of Fawn Drive, the Mill River floodplain potentially impacts parts of Elim Park Place, a senior independent living and health care facility. Southeast of Elim Park Place, three houses are potentially impacted by the floodplain near where the Mill River passes under Cook Hill Road. The floodplain is entirely wooded south to Stonehenge Place, where it potentially impacts three single-family residential homes. The Mill River then passes through woodlands to Old Lane Road, and downstream potentially impacts one more structure before exiting the Town of Cheshire.

According to Town personnel, standing water occurs regularly during the summer and winter on Route 70 in the vicinity of Peach Tree Court. This flooding is caused by inadequate drainage from nearby greenhouses.

Broad Brook and Tributaries

Broad Brook drains northward through the eastern portion of Cheshire to its confluence with the Quinnipiac River. No flooding problems have been reported in the Broad Brook watershed. This area consists primarily of undeveloped water company land and light-density residential structures, and has a low potential for flooding. The Broad Brook Reservoir is the primary impoundment along the brook and is used for water supply. A 100-year floodplain has been defined by FEMA for Broad Brook.

Critical Facilities and Emergency Services

The Town of Cheshire Sewage Treatment Plant is the only municipal facility in the Town regularly impacted by flooding. Spring floods along the Quinnipiac River often approach

the Treatment Plant, which was built in the 100-year floodplain. The Treatment Plant utilizes the Quinnipiac River to dilute treated effluent that is discharged to the river, and therefore must be located adjacent to the river.

In regards to emergency services, new subdivisions are required to connect new roads through to other existing roads wherever possible, and as a result the majority of roads in Cheshire have multiple modes of egress. This allows rescue services to have good access to neighborhoods, and reduces the number residents likely to be stranded behind roadway flooding.

3.6 Potential Mitigation Measures, Strategies, and Alternatives

A number of measures can be taken to reduce the impact of a 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

Prevention of damage from flood losses often takes the form of floodplain regulations and redevelopment policies. These are usually administered by building, zoning, planning, and/or code enforcement offices through capital improvement programs and through zoning, subdivision, and wetland ordinances.

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 changes.

Municipal departments should identify areas for acquisition to maintain flood protection. Acquisition of heavily damaged structures after a flood may be an economical and practical means to accomplish this. Policies can also include the design and location of utilities to areas outside of flood hazard areas, and the placement of utilities underground.

Planning and Zoning: Zoning ordinances should regulate development in flood hazard areas. Flood hazard areas should reflect a balance of development and natural areas.

Floodplain Development Regulations: Development regulations encompass subdivision regulations, building codes, and floodplain ordinances.

Site plan and new subdivision regulations should 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.

Building codes should ensure 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.

Floodplain ordinances should at minimum follow the requirements of the National Flood Insurance Program for subdivision and building codes. These could be included in the ordinances for zoning and building codes, or could be addressed in a separate ordinance.

According to the FEMA, communities are encouraged to use different, more accurate base maps to expand upon the FIRMs published by FEMA. This is because many FIRMs were originally created using United States Geological Survey quadrangle maps with 10-foot contour intervals, but most municipalities today have contour maps of one or two-foot intervals that show more recently constructed roads, bridges, and other anthropologic features. Another approach is to record high-water marks and establish those areas inundated by a recent severe flood to be the new regulatory floodplain.

Adoption of a different floodplain map is allowed under NFIP regulations as long as the new map covers a larger floodplain than the FIRM. Reductions in floodplain area can only be accomplished through revised FEMA-sponsored engineering studies or Letters of Map Change (LOMC). 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.

Stormwater Management Policies: Development and redevelopment policies to address the prevention of flood losses must include effective stormwater management policies. Developers should be required to build detention and retention facilities where appropriate. Infiltration can be enhanced to reduce runoff volume, including the use of swales, infiltration trenches, vegetative filter strips, and permeable paving blocks. Generally, post-development stormwater should not leave a site at a rate higher than under pre-development 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, Cheshire 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 Cheshire *Inland Wetlands & Watercourses Commission* administers the wetland regulations whereas the *Planning and Zoning Commission* administers the Zoning and Subdivision regulations. The wetlands regulations are not directly used to regulate floodplain development; this mainly occurs as part of the Planning and Zoning Commission review. The *Building Department* is charged with ensuring that development follows the floodplain management regulations. The *Environmental Committee* provides the education and outreach that is often needed to reach owners of

properties that are not subject to regulatory programs administered by the zoning, wetland, and subdivision regulations.

Based on the above guidelines and the existing roles of the Inland Wetlands & Watercourses Commission, the Planning and Zoning Commission, the Building Department, and the Environmental Committee, the following *preventive* mitigation measures are recommended:

- Increased cooperation between the above departments is necessary with regard to controlling growth and development in flood zones. This will provide a system of checks and balances to ensure that development leads to flood-resistant structures and reduces risk to people. In particular:

    - The Planning and Zoning Commission should continue to universally and fairly apply the flood damage prevention codes within the bylaws and regulations administered by the Commission.

    - The Building Department should not be placed in a difficult position at the end of the process to enforce flood damage prevention codes when the Planning and Zoning Commission or Inland Wetlands & Watercourses Commission may have allowed for variances in building locations, structure elevations, etc.

    - The Environmental Committee should be provided with the staff and funding to provide education with regard to flood mitigation of existing properties that are not subject to permitting programs of the Inland Wetlands & Watercourses Commission, Planning and Zoning Commission, or Building Department.

- A checklist should be developed that cross-references the bylaws, regulations, and codes related to flood damage prevention that may be applicable to the proposed project. This will streamline the permitting process and ensure maximum education

of a developer or applicant. This list could be provided to an applicant at any Town department. The list of regulations and ordinances in Section 3.4 can be used as a starting point for a checklist.

3.6.2 Property Protection

Steps should be taken to protect existing public and private properties. Non-structural measures for public property protection include acquisition and relocation of properties at risk for flooding, purchase of flood insurance, and relocating valuable belongings above flood levels to reduce the amount of damage caused during a flood event.

Structural flood protection techniques applicable to property protection include the construction of barriers, dry floodproofing, and wet floodproofing techniques. Barriers include levees, floodwalls, and berms, and are useful in areas subject to shallow flooding. These structural projects are discussed in Section 3.6.6 below. Dry floodproofing refers to the act of making areas below the flood level water-tight. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents should be either permanently closed or covered with removable shields. Flood protection should only be two to three feet above the top of the foundation because building walls and floors cannot withstand the pressure of deeper water.

Wet floodproofing should only be used as a last resort. Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Furniture and electrical appliances should be moved away from advancing floodwaters.

All of the above *property protection* mitigation measures may be useful for Town of Cheshire residents to prevent damage from inland and nuisance flooding. The Environmental Committee should consider outreach and education in these areas.

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 inland flooding include:

- Forecasting systems to provide information on the time of occurrence and magnitude of flooding;
- A system to issue flood warnings to the community and responsible officials;
- Emergency protective measures, such as an Emergency Operations Plan outlining procedures for the mobilization and position of staff, equipment, and resources to facilitate evacuations and emergency flood-water control; and
- Implementing an emergency notification system that can combine 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 11.1. However, the Town of Cheshire already has followed a number of the above guidelines. For example, all Town buildings have NOAA radios, municipal officials are notified of flood warnings, and emergency responder teams can be notified of emergency situations.

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 11.1.

3.6.5 Natural Resource Protection

Floodplains can provide a number of natural resources and benefits, including storage of flood waters, 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 non-point 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; and
- Review of community programs to identify opportunities for floodplain preservation.

Measures for restoring diminished or destroyed resources and functions provide for re-establishment of an environment in which these functions can again operate. Measures that involve improving the natural condition of areas or restoring them to their previous natural state include 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 specific *natural resource protection* mitigation measures are recommended to help prevent damage from inland and nuisance flooding:

- Pursue the acquisition of additional open space properties.
- Selectively pursue conservation objectives listed in the Plan of Conservation and Development, including the creation of a greenbelt along the Quinnipiac River.
- Continue to regulate development in protected and sensitive areas.

3.6.6 Structural Projects

Structural projects include the construction of new structures or modification of existing structures (e.g. floodproofing) to lessen the impact of a flood event. Stormwater controls such as drainage systems, detention dams and reservoirs, and culverts should be employed to lessen floodwater runoff. 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 accelerate flood flows. Care should be taken when using these techniques to ensure that problems are not exacerbated in other areas of the impacted watersheds. Individuals can protect property by raising structures, and constructing walls and levees around structures.

Based on the above guidelines, the following specific *structural* mitigation measures are recommended to prevent damage from inland and nuisance flooding:

- Update the Master Drainage Study for the Town, including a full-scale inventory of culvert conditions.
- Institute a comprehensive catch basin maintenance program.

- Lower the streambed of East Sindall Stream south of Allen Avenue to increase flow capacity.

As part of a pending development project, a temporary bypass channel at the former Farmington River Canal crossing of the Ten Mile River will be turned into a permanent bypass channel. This channel will help alleviate the constriction within the Ten Mile River caused by the former Farmington River Canal. If constructed, the channel will be 50 feet wide with concrete vertical walls on each side and will have the invert set at the 100-year flood stage at elevation 136 feet, which is slightly above the top of the existing arched culvert. The bypass channel will convey the excess flows once the existing culvert reaches its maximum capacity. If the development project does not proceed, the Town of Cheshire should pursue this important flood mitigation project.

3.7 Summary of Recommended Mitigation Measures, Strategies, and Alternatives

The proposed mitigation strategies for addressing inland and nuisance flooding are listed below.

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.
- 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.
- Update the Town-wide Master Drainage Study and continue to update it at least every five years. Part of this study should include the introduction of a comprehensive catch basin maintenance program.

- Reinstate the Town in FEMA's community rating system.
- Require Flood Hazard Area, Subdivision, and commercial and industrial zoning permit applications to provide flood elevation and location data, particularly for parcels along the Ten Mile River, Mill River, the Quinnipiac River, and Willow Brook.
- New buildings constructed in flood prone areas should be protected to the highest recorded flood level, regardless of being within a defined SFHA.
- New buildings should be designed and graded to shunt drainage away from the building.
- Use the Town two-foot contour maps to develop more exact regulatory flood-hazard maps and data using FEMA flood elevations. This could be conducted as part of the Map Mod program.

Property & Natural Resource Protection

- Pursue the acquisition of additional municipal open space properties inside SFHAs.
- Selectively pursue conservation objectives listed in the Plan of Conservation and Development, including the continued creation of greenbelts.
- Continue to regulate development in protected and sensitive areas.
- Purchase private land in the 100-year floodplain and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use.

Structural Projects

- In accordance with previous studies performed by MMI, excavate East Sindall stream to a depth of 30 inches to restore original flow capacity reduced by debris deposition from upstream erosion. This work should be performed downstream of Allen Avenue along the property at 815 Allen Avenue.
- Consider raising the elevation of the bridge and increasing the conveyance capacity of the bridge over Honeypot Brook at Blacks Road.

- Support the development of a flood bypass channel at the former Farmington River Canal crossing over the Ten Mile River, or pursue the project if the land development project does not occur.
- All reports of localized flooding problems should be investigated by Town personnel to determine the cause and an appropriate solution.

In addition, mitigation strategies important to all hazards are described in Section 11.1

4.0 HURRICANES

4.1 Setting

Hazards associated with tropical storms and hurricanes include winds, heavy rains, and inland flooding. While only some of the areas of Cheshire are susceptible to flooding damage caused by hurricanes, wind damage can occur anywhere in the Town. Hurricanes therefore have the potential to affect any area within the Town of Cheshire. A hurricane striking Cheshire is considered a possible event in any given year that could cause critical damage to the Town and its infrastructure (Appended Table 2).

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 inland flooding along roadways, lakes, and streams during a hurricane.

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.

The Saffir / Simpson Scale

The Saffir / Simpson Hurricane Scale, which has been adopted by the National Hurricane Center, categorizes hurricanes based upon their intensity, and relates this intensity to damage potential. The Scale uses the sustained surface winds (1-minute average) near the center of the system to classify hurricanes into one of five categories. The Saffir / Simpson scale is provided below.

- **Category 1:** Winds 74-95 mph (64-82 kt or 119-153 km/hr). Storm surge generally 4-5 ft above normal. No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Some damage to poorly constructed signs, coastal road flooding, and minor pier damage. Hurricane Diane was a Category 1 hurricane when it made landfall in North Carolina in 1955, and weakened to a tropical storm before reaching the Connecticut shoreline. Hurricane Agnes of 1971 was a Category 1 hurricane when it hit Connecticut, and Hurricanes Allison of 1995 and Danny of 1997 were Category 1 hurricanes at peak intensity.

- **Category 2:** Winds 96-110 mph (83-95 kt or 154-177 km/hr). Storm surge generally 6-8 feet above normal. Some roofing material, door, and window damage of buildings. Considerable damage to shrubbery and trees with some trees blown down. Considerable damage to mobile homes, poorly constructed signs, and piers. Coastal

and low-lying escape routes flood two to four hours before arrival of the hurricane center. Small craft in unprotected anchorages break moorings. Hurricane Bonnie of 1998 was a Category 2 hurricane when it hit the North Carolina coast, Hurricane Georges of 1998 was a Category 2 hurricane when it hit the Florida Keys and the Mississippi Gulf Coast, and Hurricane Bob was a Category 2 hurricane when it made landfall in southern New England and New York in August of 1991.

- **Category 3:** Winds 111-130 mph (96-113 kt or 178-209 km/hr). Storm surge generally 9-12 ft above normal. Some structural damage to small residences and utility buildings with a minor amount of curtainwall failures. Damage to shrubbery and trees with foliage blown off trees and large trees blown down. Mobile homes and poorly constructed signs are destroyed. Low-lying escape routes are cut by rising water three to five hours before arrival of the center of the hurricane. Flooding near the coast destroys smaller structures with larger structures damaged by battering from floating debris. Terrain continuously lower than five feet above mean sea level may be flooded inland eight miles (13 km) or more. Evacuation of low-lying residences within several blocks of the shoreline may be required.

  The Great New England Hurricane of 1938 was a Category 3 hurricane when it hit New York and southern New England. The Great Atlantic Hurricane of 1944 was a Category 3 hurricane when it made landfall in North Carolina, Virginia, New York, and southern New England. Hurricane Carol of 1954 was a Category 3 hurricane when it struck Connecticut, New York, and Rhode Island. Hurricane Connie of 1955 was a Category 3 hurricane when it made landfall in North Carolina. Hurricane Gloria of 1985 was a Category 3 hurricane when it made landfall in North Carolina and New York, and weakened to a Category 2 hurricane before reaching Connecticut. Hurricanes Roxanne of 1995 and Fran of 1996 were Category 3 hurricanes at landfall on the Yucatan Peninsula of Mexico and in North Carolina, respectively. Hurricane Katrina of August 2005 was a Category 3 hurricane when it struck Louisiana and Mississippi, Hurricane Rita of September 2005 reached Category 3 when it struck

Louisiana, and Hurricane Wilma of October 2005 was a Category 3 hurricane when it made landfall in southwestern Florida.

- **Category 4:** Winds 131-155 mph (114-135 kt or 210-249 km/hr). Storm surge generally 13-18 ft above normal. More extensive curtainwall failures with some complete roof structure failures on small residences. Shrubs, trees, and all signs are blown down. Complete destruction of mobile homes. Extensive damage to doors and windows. Low-lying escape routes may be cut by rising water three to five hours before arrival of the center of the hurricane. Major damage to lower floors of structures near the shore. Terrain lower than 10 ft above sea level may be flooded requiring massive evacuation of residential areas as far inland as six miles (10 km).

  Hurricane Donna of 1960 was a Category 4 hurricane when it made landfall in southwestern Florida, and weakened to a Category 2 hurricane when it reached Connecticut. Hurricane Luis of 1995 was a Category 4 hurricane while moving over the Leeward Islands. Hurricanes Felix and Opal of 1995 also reached Category 4 status at peak intensity.

- **Category 5:** Winds greater than 155 mph (135 kt or 249 km/hr). Storm surge generally greater than 18 ft above normal. Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. All shrubs, trees, and signs blown down. Complete destruction of mobile homes. Severe and extensive window and door damage. Low-lying escape routes are cut by rising water three to five hours before arrival of the center of the hurricane. Major damage to lower floors of all structures located less than 15 ft above sea level and within 500 yards of the shoreline. Massive evacuation of residential areas on low ground within 5-10 miles (8-16 km) of the shoreline may be required.

Hurricane Andrew was a Category 5 hurricane when it made landfall in southeastern Florida in 1992. Hurricane Mitch of 1998 was a Category 5 hurricane at peak intensity over the western Caribbean. Hurricane Gilbert of 1988 was a Category 5 hurricane at peak intensity and is one of the strongest Atlantic tropical cyclones of record.

Table 4-1 lists the hurricane characteristics mentioned above as a function of category, as well as the expected central pressure.

Table 4-1
Hurricane Characteristics

Category	CENTRAL PRESSURE		WIND SPEED		SURGE Feet	Damage Potential
	Millibars	Inches	MPH	Knots		
1	>980	>28.9	74-95	64-83	4-5	Minimal
2	965-979	28.5-28.9	96-110	84-96	6-8	Moderate
3	945-964	27.9-28.5	111-130	97-113	9-12	Extensive
4	920-644	27.2-27.9	131-155	114-135	13-18	Extreme
5	<920	<27.2	>155	>135	>18	Catastrophic

The Saffir / Simpson Hurricane Scale assumes an average, uniform coastline for the continental United States and was intended as a general guide for use by public safety officials during hurricane emergencies. It does not reflect the effects of varying localized bathymetry, coastline configuration, astronomical tides, barriers or other factors that may modify storm surge heights at the local level during a single hurricane event. For inland communities such as the Town of Cheshire, the coastline assumption is not applicable.

According to Connecticut's Natural Hazard Mitigation Plan, a moderate Category 2 hurricane is expected to strike Connecticut once every ten years, whereas a Category 3 or Category 4 hurricane is expected before the year 2040. These frequencies are based partly on the historic record, described in the next section.

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 in the process of being reanalyzed to current scientific standards, as well as the most current hurricane data. During HURDAT's period of record, 29 hurricanes and 67 tropical storms have passed within a 150 mile radius of Newport, Rhode Island.

Since 1900, eight direct hits and two hurricanes that did not make landfall (but passed close to the shoreline) were recorded along the Connecticut coast, of which there were four Category 3, two Category 2, and two Category 1 hurricanes (two of the ten struck Connecticut before the Saffir / Simpson scale was developed). Of the four Category 3 hurricanes, two occurred in September and two occurred in August.

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 (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 River, the Farmington River, and the Quinebaug River in northeastern Connecticut caused the most damage. The flood waters caused over 100 deaths, left 86,000 unemployed, and 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.

More recently, flooding and winds associated with hurricanes have caused extensive shoreline erosion and related damage. In September of 1985, hurricane Gloria passed over the coastline as a Category 2 hurricane. The hurricane struck at low tide, resulting

in low to moderate storm surges along the coast. The storm produced up to six inches of rain and heavy winds which damaged structures and uprooted trees. Over 500,000 people suffered significant power outages. Hurricane Bob, a Category 2 hurricane making landfall in 1991, 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 recorded, and the storm was responsible for six deaths in the state. Total damage in southern New England was approximately 1.5 billion dollars (1991 USD).

The most recent tropical cyclone to hit Connecticut was tropical storm Floyd in 1999. Floyd is the storm of record in the Connecticut Natural Hazard Mitigation Plan and is discussed in more detail in Section 3.3. Tropical Storm Floyd caused power outages throughout New England and at least one death in Connecticut.

4.4 Existing Programs, Policies, and Mitigation Measures

Existing mitigation measures appropriate for inland 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 Connecticut Building Code was amended in 2005 and adopted with an effective date of December 31, 2005. The new 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 Cheshire is 100 miles per hour.

Tall and older trees and branches may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. The Town of Cheshire approaches residents on a case-by-case basis if branches appear to be hazardous. Otherwise, it performs roadside tree maintenance, and Connecticut Light & Power performs trimming near power lines as well. The Town policy is for utilities in new subdivisions to be located underground whenever possible in order to mitigate wind-related damages.

During emergencies, the Town of Cheshire currently has two un-stocked facilities available to temporarily shelter a total of 700 people. The facilities have bed space available for a total of 300 people who need long-term shelter. The facilities have the capability to feed a total of 1,250 people per meal in five sittings. 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. These shelters are described in greater detail in Section 2.9.

The website of the Cheshire Fire Department (http://www.cheshirefd.org/lepc.htm) has information for the public regarding hurricanes and actions to take to protect life and property. The Town relies on radio and television to spread information on the location and availability of shelters, and sends town vehicles along established snow removal routes to further inform the public during emergencies. 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. And as noted in Section 3.6, Town buildings have NOAA radios, municipal officials are notified of flood warnings, and emergency responder teams can be notified of emergency situations.

4.5 *Vulnerabilities and Risk Assessment*

It is generally believed that New England is long overdue for another major hurricane strike. According to the State of Connecticut Natural Hazard Mitigation Plan, a moderate Category 2 storm is expected to strike the state once per decade. The Town of Cheshire is less vulnerable to hurricane damage than coastal towns in Connecticut because it does not need to deal with the effects of storm surge.

The Town of Cheshire 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.

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 several weeks, rendering electronic devices and those that rely on utility towers and lines inoperative. According to the Connecticut DEP, this is a significant risk which can not be quantitatively estimated.

Town of Cheshire is not affected by storm surge, so 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 Cheshire will relocate.

4.6 Potential Mitigation Measures, Strategies, and Alternatives

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

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.
- Continue to review the Emergency Operations Plan for the Town and update when necessary.

4.6.2 Property Protection

Potential mitigation measures for property protection during hurricanes include designs for hazard-resistant construction and retrofitting techniques. These may take the form of increased wind and flood resistance for structures, as well as the use of storm shutters over exposed glass and the inclusion of hurricane straps to hold roofs to buildings.

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.

4.6.3 Public Education and Awareness

The public should be made aware of evacuation routes and available shelters. A number of specific proposals for improved *public education* are recommended to prevent damage and loss of life during hurricanes. These are common to all hazards in this plan, and are listed in Section 11.1.

4.6.4 Emergency Services

The Emergency Operation Plan of the Town of Cheshire 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, Cheshire 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.

4.6.5 Structural Projects

Structural projects for wind damage mitigation are not possible.

4.7 Summary of Recommended Mitigation Measures, Strategies, and Alternatives

Recommendations for mitigation of hurricane and tropical storm winds include the following:

- Increase tree limb maintenance and inspections, especially along Route 10 and other evacuation routes;
- Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas; and
- Complete evacuation plan to ensure timely migration of people seeking shelter in all areas of Cheshire, particularly the northwestern portion of Cheshire.

In addition, important recommendations that apply to all hazards are listed in Section 11.1.

5.0 SUMMER STORMS & TORNADOES

5.1 Setting

Like hurricanes and winter storms, summer storms and tornadoes have the potential to affect any area within the Town of Cheshire. 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 Cheshire is therefore susceptible to summer storms and tornadoes.

Based on the historic record, it is considered highly likely that a summer storm that includes lightning will impact the Town of Cheshire 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. Inland 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

Tornadoes are spawned by certain thunderstorms. 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. The following graphic of the Fujita scale is provided by FEMA. A description of the scale follows in Table 5-1.

Fujita Tornado Scale

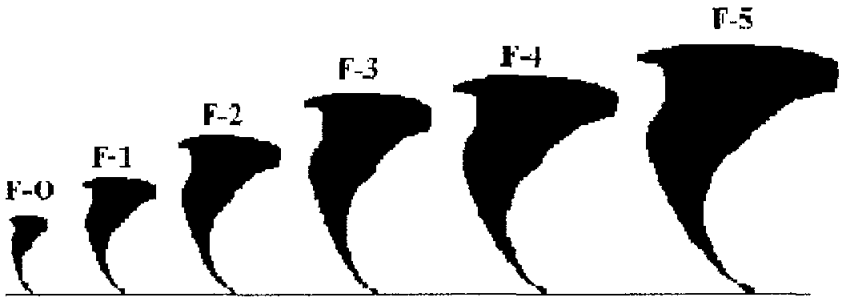


Table 5-1
Fujita Scale

F-Scale Number	Intensity	Wind Speed	Type of Damage Done
F0	Gale tornado	40-72 mph	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards.
F1	Moderate tornado	73-112 mph	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
F2	Significant tornado	113-157 mph	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
F3	Severe tornado	158-206 mph	Roof and some walls torn off well constructed houses; trains overturned; most trees in forest uprooted
F4	Devastating tornado	207-260 mph	Well-constructed houses leveled; structures with weak foundations blown off 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 debarked; steel re-enforced concrete structures badly damaged.

Table 5-1 (Continued)
Fujita Scale

F-Scale Number	Intensity	Wind Speed	Type of Damage Done
F6	Inconceivable tornado	319-379 mph	These winds are very unlikely. The small area of damage they might produce would probably not be recognizable along with the mess produced by F4 and F5 winds that would surround the F6 winds. Missiles, such as cars and refrigerators, would do serious secondary damage that could not be directly identified as F6 damage. If this level is ever achieved, evidence for it might only be found in some manner of ground swirl pattern, for it may never be identifiable through engineering studies.

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. The Enhanced F-scale is still a set of wind estimates based on damage. Its 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

The historic record of tornadoes is discussed in Section 5.3. The pattern of occurrence in Connecticut is expected to remain unchanged, according to the Connecticut DEP Natural Hazard Mitigation Plan (2004). The highest relative risk for tornadoes in the state will continue to be in the Hartford and New Haven Counties. The Town of Cheshire, being in New Haven County, is therefore at a relatively higher risk of tornadoes compared to the rest of the state.

Lightning

Lightning is a circuit of electricity that occurs between the positive and negative charges within the atmosphere or between the atmosphere and the ground. In the initial stages of development, air acts as an insulator between the positive and negative charges. However, when the potential between the positive and negative charges becomes too great, a discharge of electricity (lightning) occurs.

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

According to NOAA's National Weather Service, lightning reportedly kills an average of 80 people per year in the United States, in addition to an average of 300 lightning injuries per year. Only 15 lightning-related fatalities occurred in Connecticut between 1959 and 2005. 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.

Thunderstorms occur 18 to 35 days each year in Connecticut. In general, thunderstorms in Connecticut are more frequent in the western and northern parts of the state, and less frequent in the southern and eastern parts. Although lightning is usually associated with thunderstorms, it can occur on almost any day. The likelihood of lightning strikes in the Cheshire area is very high during any given thunderstorm, although no single area of the Town is at higher risk of lightning strikes.

Downbursts

A downburst is a severe localized wind blasting down from a thunderstorm. They are more common than tornadoes in Connecticut. These "straight line" winds are distinguishable from tornadic activity by the pattern of destruction and debris. Depending on the size and location of these events, the destruction to property may be significant. Downbursts may be categorized as microbursts (affecting an area less than 2.5 miles in diameter) or macrobursts (affecting an area at least 2.5 miles in diameter).

It is difficult to find statistical data regarding frequency of downburst activity. However, downburst activity is, on occasion, mistaken for tornado activity in Connecticut, indicating that it is a relatively uncommon yet persistent hazard. The risk to the Town of Cheshire is believed to be low to moderate for any given year. Downburst activity in New Haven County is believed to have occurred most recently on May 16, 2007.

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 a pound have been recorded. While crops are the major victims of hail, it is also a hazard to vehicles and property.

Hailstorms typically occur in at least one part of Connecticut each year during a severe thunderstorm. As with thunderstorms, hailstorms are more frequent in the northwest and western portions of the state, and less frequent in the southern and eastern portions. The risk of one hailstorm occurring in Cheshire is moderate in any given year.

5.3 *Historic Record*

The National Climatic Data Center (NCDC) lists 10 tornado events in New Haven County since 1950. This includes one F4 rated tornado, two F3 rated tornadoes, and three F2 rated tornadoes. Property damages from tornados in the county totaled approximately 280 million dollars. Table 5-3 lists the tornado events for New Haven County.

Table 5-3
Tornado Events in New Haven County Since 1950

Date	Fujita Tornado Scale	Property Damage	Wind Speed
October 24, 1955	F2	$3,000	113 – 157 mph
August 29, 1959	F-	$0	Unknown
May 24, 1962	F3	$2,500,000	158 – 206 mph
July 29, 1971	F3	$250,000	158 – 206 mph
September 18, 1973	F2	$0	113 – 157 mph
July 28, 1982	F1	$3,000	73 – 112 mph
July 10, 1989	F2	$25,000,000	113 – 157 mph
July 10, 1989	F4	$250,000,000	207 – 260 mph
May 29, 1995	F-	$10,000	Unknown
May 29, 1995	F1	$50,000	73 – 112 mph
July 23, 1995	F0	$0	40 – 72 mph
July 3, 1996	F1	$2,000,000	73 – 112 mph
May 31, 2002	F0	$0	40 – 72 mph

A limited selection of summer storm damage in the area, taken from the NCDC Storm Events database, is listed below:

- August 28, 1993 – During a thunderstorm, a dog tied to a metal chain was killed by lightning in Cheshire.

- September 9, 1994 – Thunderstorms produced damaging winds which downed a few trees in Danbury and numerous trees and power lines in Cheshire. There were also some reports of hail with the Cheshire storm. In addition a couple of homes were seriously damaged by fire after being struck by lightning.
- October 28, 1995 – A squall line passing through Cheshire produced winds of 67 mph.
- May 21, 1996 – Thunderstorms produced severe winds that knocked down trees and power lines in Cheshire.
- September 20, 1997 – A line of scattered thunderstorms produced high winds that downed trees and power lines and produced wind gusts of up to 58 mph in Cheshire.
- June 20, 1998 – Severe thunderstorms moved slowly east over the area, producing large hail, frequent lightning, and torrential rain that caused localized flooding.
- April 21, 2000 – Thunderstorms accompanied by torrential rainfall produced widespread flooding of small streams, brooks, rivers, and low-lying and poor drainage areas as brooks and rivers in New Haven County flowed over their banks. They also produced lightning strikes. Cheshire received 3.31 inches of rainfall and the Ten Mile River in Cheshire flowed over its banks around 9:45 pm EDT. Cost estimates of property damage were unavailable.
- June 11, 2000 – As a cold front swept south toward the area, lines of severe thunderstorms developed. Severe thunderstorms produced high winds that downed trees and power lines in Cromwell, Danbury, Cheshire, and Norwich. A spotter at Ledyard Center observed hail about the size of a nickel (0.88 inches). A peak wind gust of 60 mph was measured at Bridgeport Sikorsky Airport. These thunderstorms also produced torrential rain across Central New Haven, Southern Middlesex, and Central and Southern New London Counties. Some flooding of low-lying and poor drainage areas occurred. State police stated that a man was struck and injured by lightning in Bethany on Amity Road around 4 pm.
- June 30, 2003 – As a severe thunderstorm moved east, it produced high winds that damaged trees just west of the intersection of Route 10 (Highland Ave.) and West

Johnson Ave., just south of Interstate 691. Several large trees were damaged in this vicinity. This storm was also accompanied by torrential rain.

- August 21, 2004 – Trees and wires were downed by thunderstorm winds in Waterbury and Cheshire. In Cheshire, power lines fell on a house. Three miles northeast of Waterbury, a tree fell onto a truck.
- August 3, 2006 – A strong thunderstorm cell blew through Cheshire, knocking down several trees and closing about 15 streets.
- May 16, 2007 – Downburst activity in New Haven County was caused by a severe thunderstorm system moving through Connecticut.

5.4 *Existing Programs, Policies, and Mitigation Measures*

Warning is the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. A ***severe thunderstorm watch*** is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm (damaging winds 58 miles per hour or more, or hail three-fourths of an inch in diameter or greater) is likely to develop. A ***severe thunderstorm warning*** is issued when a severe thunderstorm has been sighted or indicated by weather radar. Tables 5-4 and 5-5 list the National Oceanic and Atmospheric Administration (NOAA) Watches and Warnings, respectively, as pertaining to actions to be taken by emergency management personnel in connection with summer storms and tornadoes.

Table 5-4
NOAA Weather Watches

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

Table 5-5
NOAA Weather Warnings

Weather Condition	Meaning	Actions
Severe Thunderstorm	Severe thunderstorms are occurring or are imminent in your area.	Notify personnel and watch for severe conditions or damage (i.e. downed power lines and trees. Take appropriate actions listed in 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 are employed in Cheshire. 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 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 Cheshire, the local electric utility (Connecticut Light & Power) is responsible for tree branch removal and maintenance above and near power lines. In addition, all new developments in Cheshire must place utilities underground wherever possible. The Department of Public Works (DPW) has the responsibility of maintaining trees on municipal property. The DPW is responsible for trimming over roadways, and DPW staff routinely monitor for downed tree limbs 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.
- 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.

5.5 Vulnerabilities and Risk Assessment

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.

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. Cheshire is particularly susceptible to damage from high winds due to its heavily treed landscape and high residential density.

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 drought conditions. Most downed power lines in Cheshire 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.

5.6 *Potential Mitigation Measures, Strategies, and Alternatives*

Both the FEMA and the NOAA websites contain valuable information regarding preparing for a protecting oneself during a tornado, as well as information on a number of other natural hazards. This information is available at:

FEMA

http://www.fema.gov/library/prepandprev.shtm.

NOAA

http://www.nssl.noaa.gov/NWSTornado/

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.

NOAA information includes a discussion of family preparedness procedures and the best physical locations during a storm event. Although tornadoes pose a legitimate threat to public safety, their occurrence is considered too infrequent to justify the construction of tornado shelters. Residents should be encouraged to purchase a NOAA weather radio containing an alarm feature.

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 that included several tornadoes stuck 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.

Specific mitigation steps that can be taken to prevent property damage and protect property are given below.

Prevention

- Continue or increase tree limb inspection programs to ensure that the potential for downed power lines is minimized.
- Continue to place utilities underground.

Property Protection

- Require compliance with the amended Connecticut Building Code for wind speeds.
- Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards.

5.7 *Summary of Recommended Mitigation Measures, Strategies, and Alternatives*

The following actions are recommended to mitigate for winds, hail, tornadoes, and downbursts:

- Increase tree limb maintenance and inspections, especially in the downtown areas
- Continue outreach regarding dangerous trees on private property.

- Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas.
- Continue to require compliance with the amended Connecticut Building Code for wind speeds.
- Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards.

In addition, important recommendations that apply to all hazards are listed in Section 11.1.

6.0 *WINTER STORMS*

6.1 *Setting*

Similar to summer storms and tornadoes, winter storms have the potential to affect any area of the Town of Cheshire. However, unlike summer storms, winter events and the hazards that result (wind, snow, and ice) have more widespread geographic extent. The entire Town of Cheshire 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 storms, including those from blizzards, ice storms, heavy snow, freezing rain and extreme cold. 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.

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.

The classic winter storm in New England is the nor'easter, which is 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. Severe winter storms can produce an array

of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets, and extreme cold. The National Weather Service defines a blizzard as having winds over 35 mph with snow and blowing snow reducing visibility to near zero.

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.

The Northeast Snowfall Impact Scale (NESIS) was developed by Paul Kocin and Louis Uccellini (Kocin and Uccellini, 2004) and is used by NOAA to characterize and rank high-impact Northeast snowstorms. These storms have large areas of snowfall accumulations of ten inches and above. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements, thus giving an indication of a storm's societal impacts.

NESIS values are calculated within a geographical information system (GIS). The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score, which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers. Table 6-1 presents the NESIS categories, their corresponding NESIS values, and a descriptive adjective.

Table 6-1
NESIS Categories

Category	NESIS Value	Description
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

6.3 Historic Record

According to the NCDC, there have been 87 snow and ice events in the State of Connecticut between 1993 and 2006, 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 31and 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. The last documented winter storm event that qualified as a blizzard occurred in January of 1996. These events were recorded for various counties throughout the state.

With regard to major winter nor'easters, seven have occurred in Connecticut during the past 30 years (in 1979, 1983, 1988, 1992, 1996, 2003, and 2006). The 1992 nor'easter, in particular, caused the third-highest tides ever recorded in Long Island Sound and damaged 6,000 coastal homes. Inland areas received up to four feet of snow. Winter storm Ginger in 1996 caused over two feet of snow and shut down the State of Connecticut for 24 hours. The nor'easter which occurred on February 12 and 13, 2006 resulted in 18 to 24 inches of snow across Connecticut and was rated on NESIS as a Category 3 "Major" storm across the northeast. This storm ranked 20th out of 33 major winter storms ranked by NESIS for the northeastern United States since 1956.

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. 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 of 2002 that hit Litchfield and western Hartford Counties resulted in 2.5 million dollars in public sector damages.

6.4 Existing Programs, Policies, and Mitigation Measures

Existing programs applicable to inland flooding and wind are the same as those discussed in Sections 3.0 and 4.0. Programs that are specific to winter storms are generally those related to preparing plows, 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 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).

Snow removal policies are outlined on the Town of Cheshire's website (http://www.cheshirect.org/publicworks/seasonal.html). The Town policy is to plow main roads first, and then smaller roads. All roads are generally cleared within six hours of the end of a storm. The DPW has a partial written policy of 13 snow removal routes. The state plows Routes 10, 42, 68, and 70.

The Town of Cheshire Subdivision and Other Land Use Regulations discourage the creation of cul-de-sacs whenever a feasible connection to a through street can be created.

This policy presents residents and emergency personnel with two means of egress into neighborhoods in the Town, ensuring that residents will not be cut off from critical facilities during times of need.

6.5 *Vulnerabilities and Risk Assessment*

As mentioned for summer storms, the heavily treed landscape in close proximity to densely populated residential areas in the Town of Cheshire 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 Cheshire have been identified by Town personnel as having problems with ice during the winter months. Water from nearby greenhouses collects on South Meriden Road (Route 70) near Peach Tree Court and freezes during the winter due to poor drainage in the area. The elevation, gradient, and tree cover combine to inhibit ice from melting on sections of Cook Hill Road. North Brooksvale Road (Route 42) near King Road also has icing issues due primarily to tree cover.

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

6.6 Potential Mitigation Measures, Strategies, and Alternatives

Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding. These were presented in Section 3.6. 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 recommendations for tree limb inspections and maintenance in Sections 4.0 and 5.0 are thus applicable to winter storm hazards, as well. As mentioned previously, utilities in Cheshire 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.

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 for cold and icy weather, including stocking homes, preparing vehicles, and taking care of themselves during winter storms.

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.

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.

A written policy for plowing routes should be finalized, with plowing the access to and from critical facilities being prioritized. Residents should be made aware of the plow routes in order to plan how to best access critical facilities. It is recognized that this 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 Summary of Recommended Mitigation Measures, Strategies, and Alternatives

The following recommendations are applicable to aspects of winter storms such as winds, snow, and ice:

- Increase tree limb maintenance and inspections
- Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas
- Complete evacuation plan to ensure timely migration of people to shelters from all areas of Cheshire, particularly the northwestern portion of Cheshire.
- Post a final 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 to critical facilities during a winter storm event.
- Continue to encourage two modes of egress into every neighborhood by the creation of through streets.

In addition, important recommendations that apply to all hazards are listed in Section 11.1.

7.0 EARTHQUAKES

7.1 Setting

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

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.

The following is an abbreviated description of the 12 levels of Modified Mercalli intensity from the United States Geological Survey.

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. Rail 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.

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 - 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.

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 USGS Earthquake Hazards Program, Connecticut is a region of very minor seismic activity. This assessment is based on lack of historical and instrumental reports of strong earthquakes. However, earthquakes do occur in this region. The New England states regularly register seismic events.

There were 137 recorded earthquakes in Connecticut between 1598 and 1990. 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. In October 1845, an Intensity V earthquake occurred in Bridgeport. An Intensity V earthquake would be a 4.3 on the Richter scale. Another Intensity V earthquake was reported in Stamford in March of 1953. All other seismic activity in Connecticut has ranked less than Intensity V. 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.

7.4 *Existing Programs, Policies, and Mitigation Measures*

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 Cheshire. 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 Cheshire do not address earthquake hazards.

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 Cheshire 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 Cheshire 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 and 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 Cheshire are underlain by sand and gravel. Figure 2-5 depicts surficial materials in the Town. In addition to sandy areas, some portions of Cheshire are built on old mine areas which have been filled. These locations are addressed in Section 8.0 of this Plan. 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 or filled 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 9.0.

7.6 Potential Mitigation Measures, Strategies, and Alternatives

As earthquakes are difficult to predict and can affect the entire Town of Cheshire, potential mitigation can only include adherence to building codes, education of residents, and adequate planning. The following potential mitigation measures have been identified:

- Consider preventing new residential development in historical mining areas prone to collapse.

- Consider preventing residential development on or below steep slopes (slopes exceeding 30%).
- Continue to require adherence to the state building codes.
- Consider adding earthquakes to the list of hazards covered by the Emergency Operations Plan.
- Ensure that municipal departments have adequate backup facilities in case earthquake damage occurs to municipal buildings.

In addition, important recommendations that apply to all hazards are listed in Section 11.1.

8.0 SINKHOLES

8.1 Setting

Land subsidence is the collapse of the Earth's surface elevation due to the removal of subsurface support or due to tectonic equilibration. Subsidence thus ranges from broad, regional lowering of the land surface to local collapses. Subsidence may be due to a general settling of the fill material, or to the decay and subsequent compaction of organic materials, contained in fill material, such as tree roots.

Sinkholes are localized collapses of the land surface which can occur for a variety of reasons. Land subsidence in the Town of Cheshire occasionally occurs as a result of settling of surface or fill material above former mine shafts or sinkholes, as described in this section. In general, the occurrence of a sinkhole is considered to be a possible event each year that affects a small area with potentially significant damages to residences and infrastructure.

8.2 Hazard Assessment

The term "sinkhole" is used for closed depressions in the land surface that are formed by surficial solution, or by subsidence or collapse, of surfical materials owing to the solution of near-surface limestone or other soluble rocks. Sinkholes occur in a variety of shapes ranging from steep-walled "natural wells" to funnel-shaped or bowl-shaped depressions. Sinkholes are often a product of solution-erosion processes and are analogous to valleys carved by rivers in areas underlain by insoluble elastic rocks.

Sinkholes are a natural and common geologic feature in areas underlain by limestone and other rock types that are soluble in natural water. Sinkholes are of particular interest in the Southeast, South, Midwest, Great Lakes, and Appalachian regions of the United

States. They may be one of the predominant landforms in the area, such as in Florida; their development may be sudden, resulting in possible loss of life and property; they may cause flooding during storms when the drainage capacity of natural subsurface conduits is exceeded; and because they may provide an avenue for pollutants on the land surface to move rapidly into the underlying groundwater.

The three main types of naturally occurring sinkholes include solution sinkholes, cover-subsidence sinkholes, and cover-collapse sinkholes. These sinkhole types are distinguished by their mode of formation, and the type of sinkhole that may develop in a given area is controlled largely by the geology and hydrology. Solution sinkholes result from surface dissolution of bedrock. Cover-collapse sinkholes are the result of sudden bedrock and soil collapse from subsurface dissolution when the overlying material can no longer support its own weight. Cover-subsidence sinkholes result from environmental disturbance (ground-water change, loading, etc.) creating a spalling effect where grains of soil slowly move downward in sequence to fill the space below.

Sinkholes may also develop due to anthropological changes in an area. New sinkholes have been correlated to land-use practices, especially from ground-water pumping and from construction and development practices. The overburden sediments that cover buried cavities in the aquifer systems are delicately balanced by ground-water fluid pressure. If pumping results in a lowering of groundwater levels, then underground structural failure, and thus, sinkholes, can occur.

Sinkholes may also form when natural water-drainage patterns are changed, such as when industrial and runoff-storage ponds are created. The substantial weight of the new material can trigger an underground collapse of supporting material, causing a sinkhole.

More commonly, sinkholes occur in urban areas due to water main breaks or sewer collapses when old pipes give way. The moving water erodes the soil above it through the outlet pipe, resulting in a sinkhole.

Certain areas of the Town of Cheshire are at risk of developing sinkholes due to spalling of overlying sediments into mining tunnels used in the 19th and early 20th centuries. As the timbers holding the soil and rock above the mining tunnels rot away with age, spalling occurs in a similar fashion to cover-collapse and cover-subsidence sinkholes. When the soil migrates downward, the voids migrate upward until too little structural support remains above a section of the cavity, resulting in the sudden collapse those sediments into the cavity.

Unlike natural sinkholes, sinkholes associated with mining tunnels tend to form quasi-linear patterns across the surface landscape running parallel to the horizontal shafts below. Some of these areas are well-known and undeveloped, presenting little or no hazard to existing structures. Other areas have been developed into residential neighborhoods with little or no prior knowledge of the previous mining operations, and the potential for new sinkholes presents a dangerous structural hazard.

Damage from sinkholes and land subsidence consists of direct structural damage, property loss and depreciation of land values, as well as business and personal losses that accrue during periods of repair. Generally, sinkholes present a greater risk to property than to life.

While sinkholes in Cheshire are developed through gravitational processes such as spalling and sediment settling, heavy rainfall often acts as a catalyst in the development of sinkholes. The influx of water into the soil increases the overall weight of the soil structure existing over the cavity and thus the likelihood of collapse. The influx of water also helps erode and spread the pile of collapsed soil in the shaft, weakening the column of soil above it, eventually inducing yet another sinkhole. Rainfall-induced sinkholes are more prevalent in areas where the mine shafts are closer to the surface.

With regard to future likelihood of occurrence, sinkholes and subsidence are more likely to occur in areas that have previously been mined, especially in areas above the mining tunnels where sinkholes have occurred previously. These areas are considered to be at low to moderate risk for developing a new sinkhole each year. The likelihood of sinkholes occurring in other locations in the Town of Cheshire is considered to be low.

Although addressed in this Pre-Disaster Mitigation Plan, sinkholes in Cheshire are not strictly natural hazards. They have resulted from mining activities. Although the Town of Cheshire is not responsible for preventing or providing relief from sinkhole activity, this Plan is believed to be an appropriate forum for discussing the sinkhole problem and recommending potential mitigation actions that can be undertaken.

8.3 Historic Record

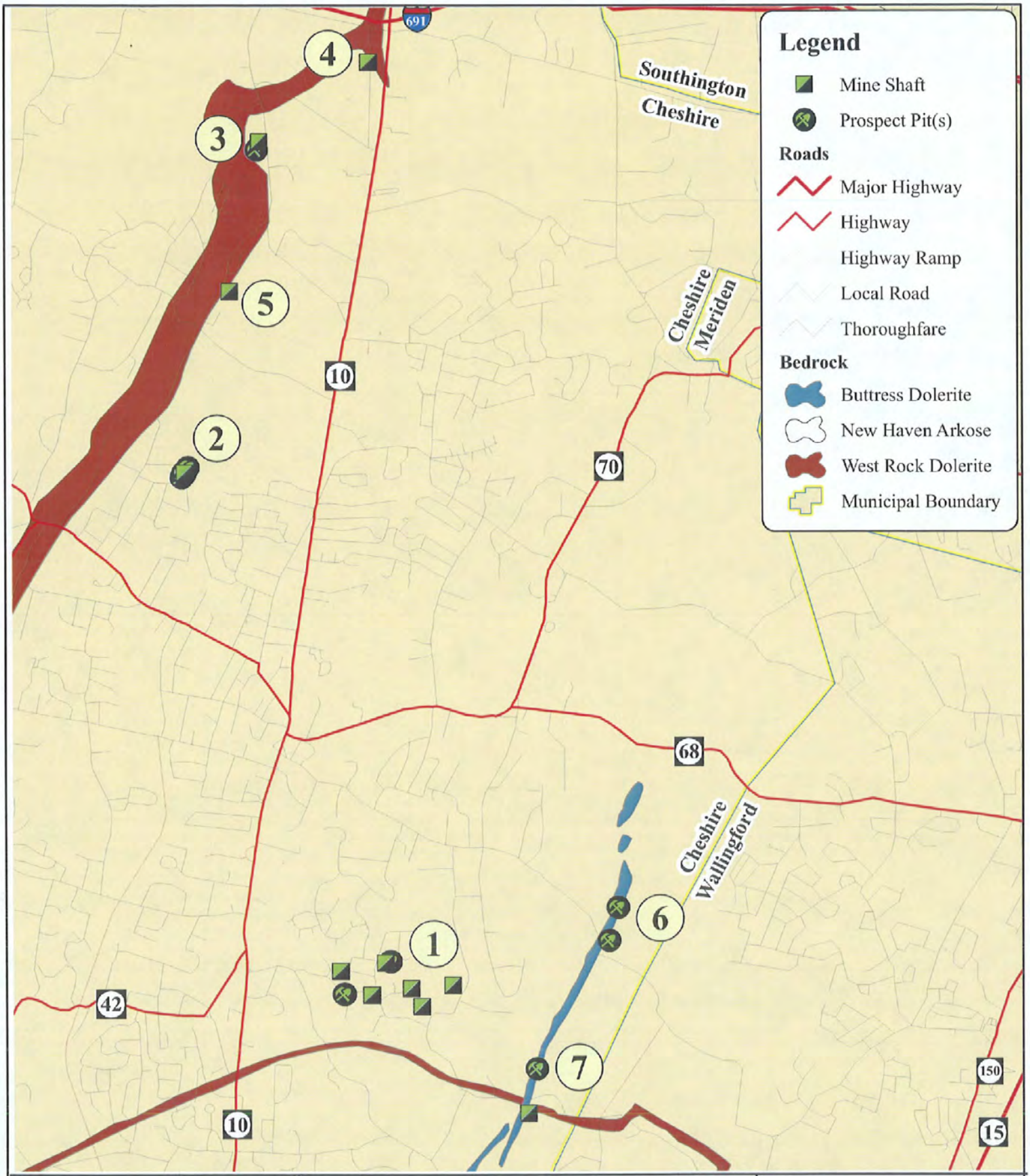
The Town of Cheshire Planning and Zoning office maintains a file of documentation related to sinkholes within the Town of Cheshire. Documentation was not available regarding the three northernmost barite mines along Peck Mountain and the copper mines in the southeastern part of Town. However, sinkhole and mining documentation was available for the former Peck Mountain mine near where Sheridan Drive is today, and for the Jinny Hill mines, the largest in the Town. Table 8-1 below outlines the mine locations (reproduced from Fritts, 1962).

Table 8-1
Description of Abandoned Mines in Cheshire (From Fritts, 1962)

Mine #	Name	Years of Operation	Description
1	Jinny Hill barite mines	1838 - 1877	Operated by Gastons (1838), Mineral & Manufacturing Co. (1839 - 1871), and Stamford Manufacturing Co. (1871 - 1877). The Cheshire Mining Co. also was active on this site from 1840 -1845.
2	Barite mine (Sheridan Drive)	1866 - 1878	Barite mine operated by Cheshire Barytes Co. (1866 - 1872) and Stamford Manufacturing Co. (1872 - 1878).
3	Barite mine (Peck Lane)	1864 - 1877	Barite mine operated by Cheshire Mining & Manufacturing Co. (1864 - 1871) and Stamford Manufacturing Co. (1876 - 1877).
4	Barite mine (Reinhard Road)	1864 - 1871	Barite mine operated by New Haven Mineral Co.
5	Barite mine (Peck Lane)	1866 - 1871	Barite mine operated by N. Booth & W. Hinman.
6	Copper Valley Mine	1712 - 1901	Operated as a copper prospecting site at various times from 1712 to 1901, mainly for the purpose of stock promotion.
7	Copper prospecting site	1710, 1901-1903	Site of first copper prospecting in the area in 1710, an unsuccessful attempt was made to mine copper from 1901 to 1903.

These locations are depicted on Figure 8-1. A partial history of mining and sinkholes in Cheshire is listed below. According to Brick (1997), mining history in Cheshire can be divided into three separate eras: copper prospecting, underground barite mining, and gravel quarrying, respectively.

- 1710: Copper prospecting performed in southeastern Cheshire.
- 1813: Barite discovered in Cheshire during copper prospecting.
- 1838 to 1877: A total of approximately 160,000 tons of barite mined in Cheshire, mostly at the Jinny Hill mines. The Peck Mountain mines contributed to this total beginning in the 1860's.



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Location of Abandoned Mines in Cheshire

LOCATION: Cheshire, CT

MMI#: 2937-01-2-3
MXD: H:8-1-Mine.mxd
SOURCE: Fritts, Brick, CT DEP

N

Town of Cheshire
Natural Hazard
Mitigation Plan

DATE: July 2007
SCALE: 1" = 3,500'

SHEET: Figure 8-1

- 1850: Minor cave-in near the north vein shaft of the Jinny Hill mines. This cave-in trapped miners underground for an entire day.
- 1860's: The depth of the Jinny Hill mine slows production due to the increased time it takes to raise ore to the top of the shafts. Other barite mines in Cheshire are opened in the hopes that it will be easier to mine the shallower deposits.
- 1878: Large quantities of European barite were shipped to the United States as ballast in the holds of sailing vessels in the 1870's, competing with domestic mining operations. Barite mining in Cheshire was formally abandoned in 1878 as it became uneconomical to mine domestic deposits.
- 20th century: The mine dumps around each mine are used as gravel quarries at various times to level road beds and structure foundations.
- 1938: A large sinkhole (10 meters across) at Jinny Hill that marks the middle shaft of the central vein is filled in with trees felled by the 1938 hurricane. Today the former sinkhole is capped with landscaping debris.
- Late 1950's: Crawford Fritts of the USGS maps the bedrock geology of the Mount Carmel Quadrangle, identifying three parallel veins of barite historically known as the north, central, and south veins near Jinny Hill.
- 1960's: South vein shaft is filled in with tree stumps by use of a bulldozer. Local residents remember dropping pebbles down this shaft, waiting to hear them splash in water at the bottom seconds later.
- 1973: Heavy rains result in the south vein shaft opening into a sinkhole 15 feet deep, necessitating further filling. Today, the sinkhole is about four meters across.
- 1978: A 30 foot long section of Sheridan Drive collapsed 20 feet overnight, curb to curb. It was filled by the Town, but collapsed again the following year. It was again filled and has reportedly been stable since.
- 1993: Mine maps drawn up by a now defunct engineering firm. These maps were not included in the mine file located in the Cheshire Planning and Zoning office. According to a copy of meeting minutes from the Town of Cheshire Solid Waste Commission included in the file, the maps have been lost.
- 1994: Reports of a sinkhole near Chestnut Street "drinking up" a nearby stream.

- 1996: A Sinkhole representing the shaft of the north vein is reported to be about four meters across. The Town of Cheshire had previously completely backfilled the sinkhole.
- 1996: A report by Robert Thorson and Greg Brick of the University of Connecticut Geology Department on file in the Cheshire Planning and Zoning office notes that a potential for collapse exists along strip of land two kilometers long, potentially impacting 16 personal residences and a condo complex. A map supporting this claim was not found in the file.
- 2003: A sinkhole occurred in the Vosburgh yard on Chestnut Street, shallow but 14 feet wide.
- 2003 – 2004: Dr. Gary Robbins of the University of Connecticut was asked to help develop a proposal for state funding for sinkhole remediation. The proposal was not funded.
- October 2005: A sinkhole occurred in the Baker yard on Sheridan Drive, 20 feet wide and 30 feet deep. The hole was filled by the owner in the spring of 2006.

Previous research has shown the barite mining operations in Cheshire to be fairly extensive, but with little physical evidence remaining of the former mining operations. According to Brick (1996), more than four miles of passageways lie beneath Cheshire, and the deepest shafts at Jinny Hill reportedly reached a depth of 600 feet. Fritts (1962) denoted five separate barite mines in the Town, with two additional areas used for copper mining and prospecting. As the mines were abandoned in the late 19th and early 20th centuries, prior to the advent of stricter environmental and mining regulations, the mine shafts were likely not properly filled.

8.4 Existing Programs, Policies, and Mitigation Measures

Sinkhole prevention programs, policies, or mitigation measures are not in place in the Town of Cheshire, as the Town is not responsible for their occurrence. However, the Town keeps a file of mining related documents in the Planning and Zoning office that the

public can access. Problems in streets and on public property are repaired by DPW as needed. Previous efforts to obtain state funding in order to investigate the abandoned mines were reportedly denied. The state government has identified over 600 mines state-wide, and in 2004 contended that dealing with mine-related subsidence is best left to individual municipalities (Malinowski, 2006).

8.5 Vulnerabilities and Risk Assessment

Subsidence is a small-scale phenomenon that affects a small number of buildings and streets in a limited number of areas. The creation of sinkholes is a slow process, although sinkholes appear to form quickly as the surface manifestation of settling becomes apparent. Direct damage from sinkholes relates to the land subsidence which can cut both aboveground and belowground utilities and undermine foundations.

Sinkholes can also redirect surface water flow patterns. When surface water enters a sinkhole, it fills the underground tunnels, causing underground erosion that leads to further subsidence. The water that enters the ground fresh eventually seeps out someplace else as mine drainage. A study performed by University of Connecticut geologists in 1996 found that the wetlands surrounding the Jinny Hill mine area in Cheshire are under no imminent threat from contamination. The hazard to other wetlands in Town due to contaminated groundwater from other mines has reportedly not been studied.

Sinkholes were mapped in 1993 by an engineering consultant to the Town, but these maps can not be located and the engineering consultant is no longer in business. Mine locations have been reconstructed using maps included in studies by Brick (1996) for the Jinny Hill mines, Hedberg (1993) for the Peck Mountain mines near Sheridan Drive, and Fritts (1962) for the remaining mines in the Town. Maps of these locations are included in the discussions below.

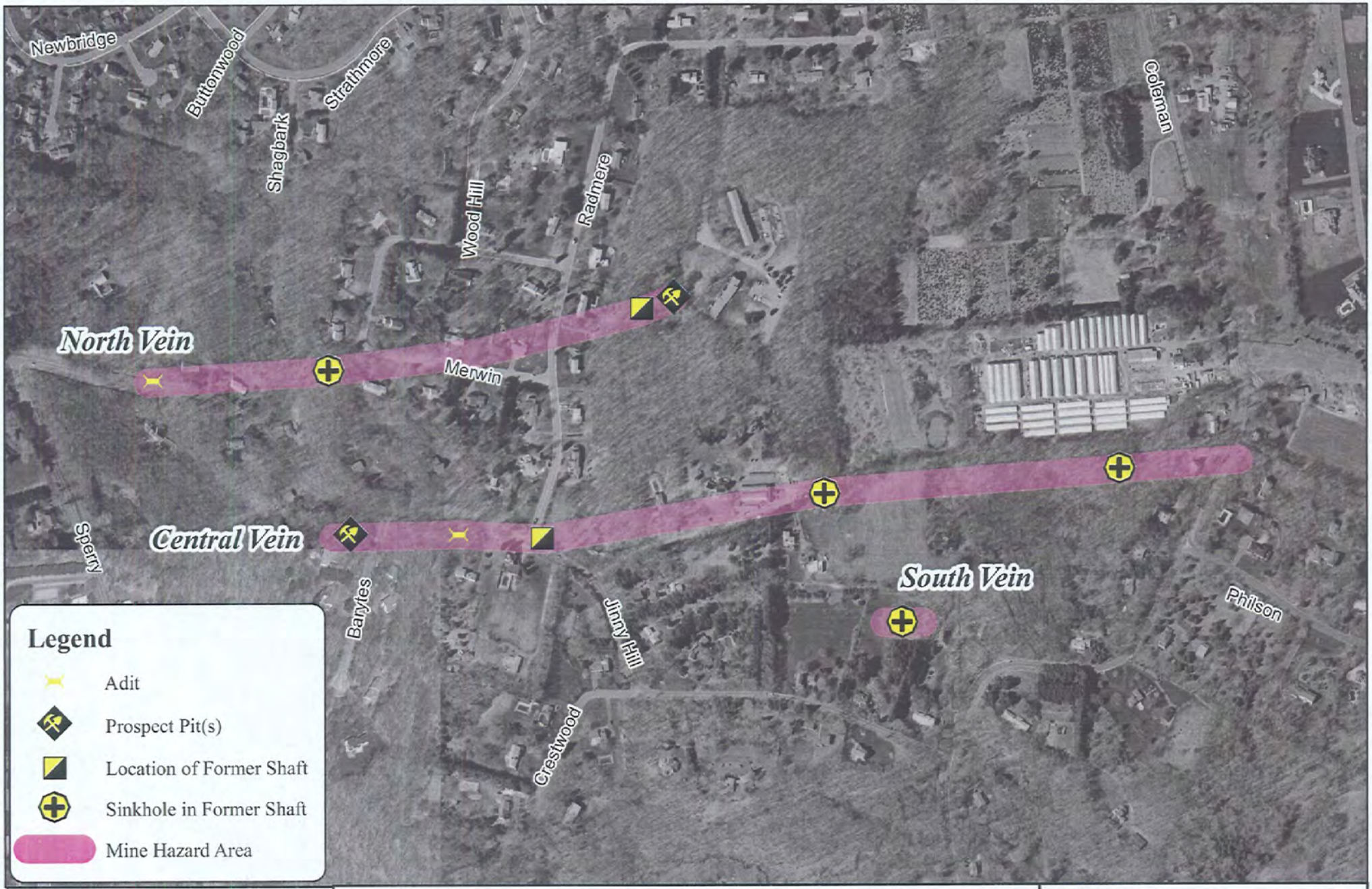
Jinny Hill Barite Mines

The barite mines at Jinny Hill consisted of six shafts – two in the north vein, three in the central vein, and one in the south vein. According to Brick (1997), four of these shafts are identifiable in the field by sinkholes which have been filled. Refer to Figure 8-2.

The mines at Jinny Hill were the first barite mines in the United States and reportedly the deepest and most extensive mines in the State of Connecticut at 600 feet. The veins of barite were nearly vertical and originally only four feet wide at the surface, accounting for the depth and linear layout of the mines. Brick (1997) believes that the veins were not interconnected by shafts during the course of mining operations. As no detailed mining records of the area have been found, the width and layout of the underground passages is unknown.

An approximate mine hazard area has been delineated in Figure 8-2 for the three veins at the Jinny Hill mining site. From west to east, mining operations in the north vein potentially impact two houses on Jinny Hill Road, a section of an unnamed road, three houses on Merwin Circle, a section of Merwin Circle, a section of Radmere Road, and a house on the east side of Radmere Road. Mining operations in the central vein potentially impact a section of Barytes Drive, the intersection of Jinny Hill and Radmere Roads, sections of an unnamed road referred to by Brick (1997) as the "Central Vein Road", a commercial or industrial enterprise along the Central Vein Road, a house on the west side of Coleman Road, and Coleman Road. The south vein likely has no impacts on any surrounding structures.

Sinkholes at Jinny Hill only occur at the locations of the main (vertical) mine shafts which have been filled. These sinkholes are related to settling and usually exacerbated by heavy rainfalls. No sinkhole documentation was found related to adits (horizontal shafts) near the mines. It is believed that the deeper mines at Jinny Hill have more depth



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Approximate Hazard Area
Jinny Hill Barite Mine

Location: **Cheshire, CT**

MMI#: 2937-01-2-3
MXD: H:\8-2-Jinny Hill.mxd
Source: Brick '97, CLEAR, DEP

N

Town of Cheshire
Natural Hazard Mitigation Plan

Date: Dec. 2006

Scale: 1" = 500'

Sheet: **Figure 8-2**

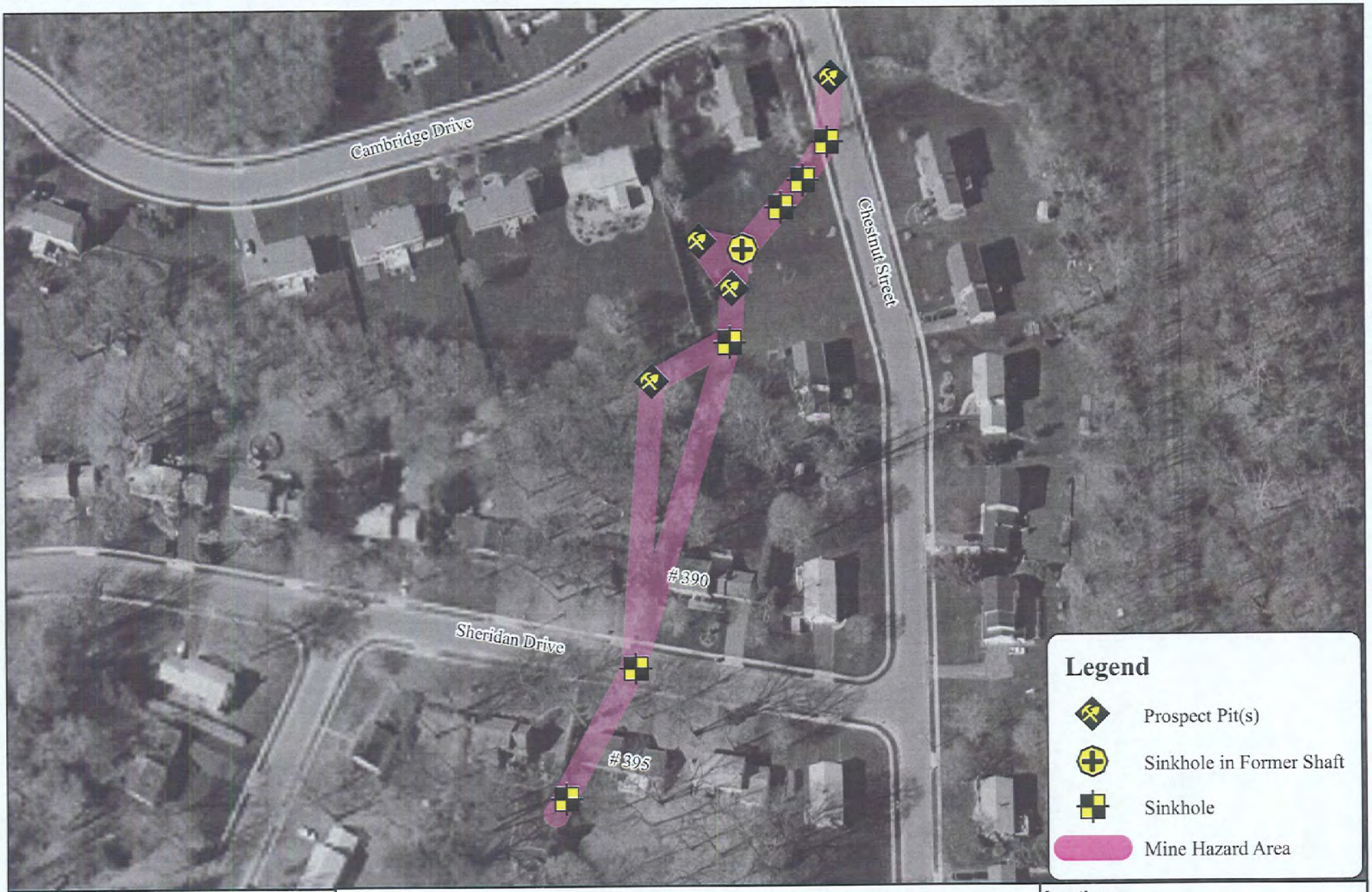
of solid bedrock supporting the ceilings over the cavities, lessening the potential development of sinkholes.

Due to the lack of accurate mining maps, it is difficult to qualify exactly which areas at the Jinny Hill mining site are more susceptible to sinkholes and their associated property damage. The location of existing sinkholes related to the former mineshafts is well known. These sinkholes have been repeatedly filled by the Town of Cheshire or individual land owners in the area over the past 70 years and the areas near the former shafts have not been developed. Based on the above information, the chance of occurrence of sinkholes around the Jinny Hill barite mines is considered to be low, and it is believed that the damage potential of the existing sinkholes is also low.

Sheridan Drive Area Barite Mine

The barite mine near Sheridan Drive consisted of one main shaft (Fritts 1962). According to Hedberg (1993), the main shaft was visible in the field by the presence of a large sinkhole. It is assumed that the vein of barite here was vertical, similar to Jinny Hill. Records of the mining operations at this site have not been found.

Existing sinkholes and excavations assumed to be prospect pits in this area were mapped in 1993 for an engineering study performed during the extension of Chestnut Street. These sinkholes are depicted in Figure 8-3. An approximate mine hazard area is also depicted. From south to north, the sinkhole mapping indicates that mine shafts may potentially impact the building at 395 Sheridan Drive, a section of Sheridan Drive, 390 Sheridan Drive, an open lawn area, and a section Chestnut Street. The sinkholes at this mine appeared related to the central mine shaft and its related adits. These adits are at a shallower depth than at the Jinny Hill mines and thus the surface is more prone to developing sinkholes, especially during heavy rains.



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Approximate Hazard Area
Sheridan Drive / Chestnut Street Barite Mine

Location: **Cheshire, CT**

MMI#: 2937-01-2-3
MXD: 8-3-Sheridan.mxd
Source: Hedberg '92, CLEAR

N

Town of Cheshire
Natural Hazard Mitigation Plan

Date: Dec. 2006

Scale: 1"= 120'

Sheet: **Figure 8-3**

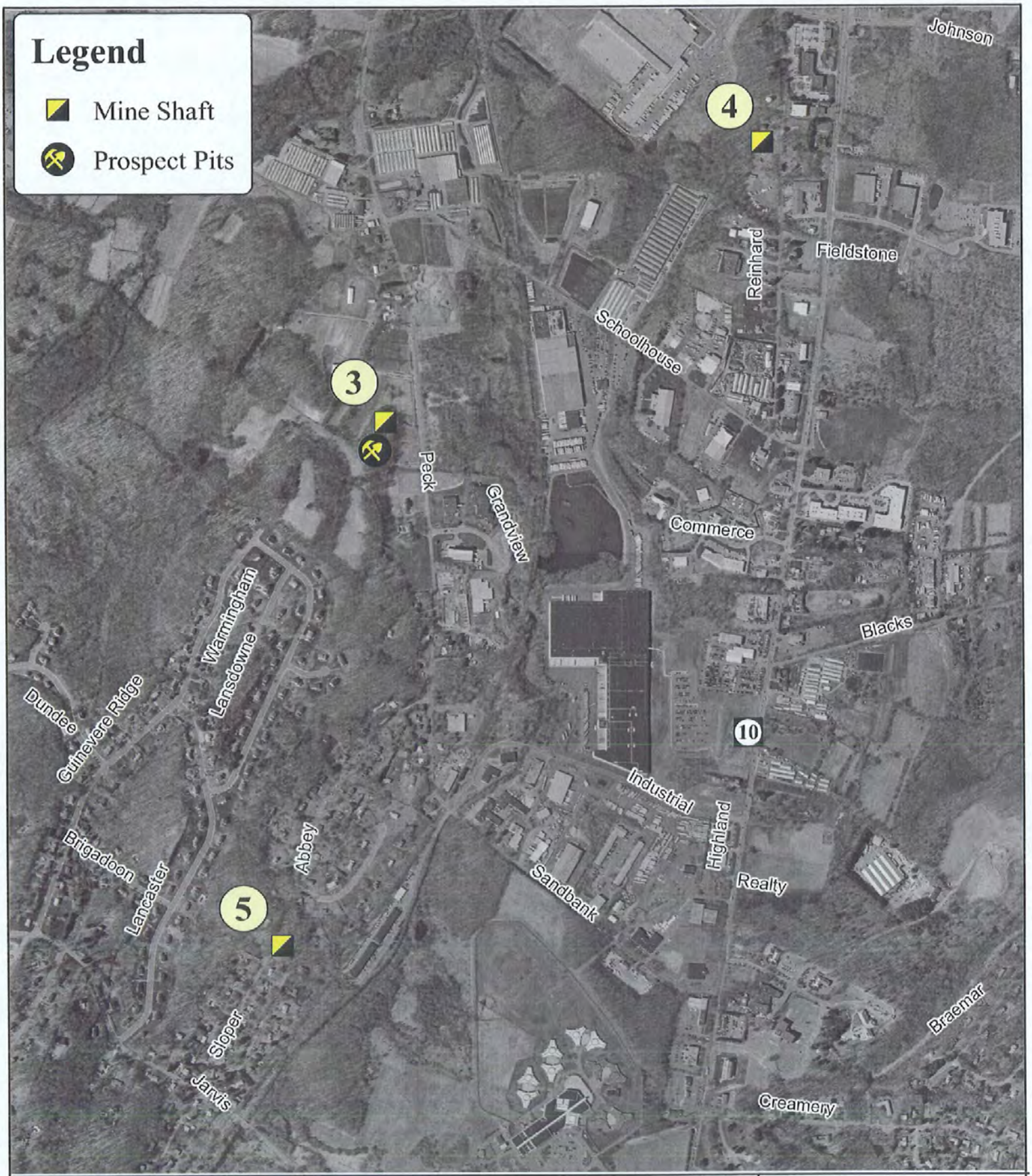
The Town of Cheshire filled in the sinkholes delineated in the 1993 study before Chestnut Street was extended north and developed into single-family residential homes. The Town also filled in the sinkholes related to the collapse of Sheridan Drive. Other sinkholes have been filled in by individual property owners, and any small sinkholes (a few feet in width and depth) likely go unreported. Due to the lack of accurate mining maps, it is difficult to qualify exactly which areas at the Sheridan Drive / Chestnut Street barite mining site are more susceptible to sinkholes and their associated property damage. Based on the above information, there appears to be a low to moderate chance of occurrence of sinkholes around the mine.

In terms of damage potential, it appears that two houses on Sheridan Drive have the potential to be impacted by the mines, and depending on the location of the adits, other houses may be impacted as well. Should a sinkhole develop suddenly, damage could range from negligible (a sinkhole occurring in a wooded area), to very low (a small sinkhole appearing in a yard with no one present), to significant, where an entire house is undermined.

Other Peck Mountain Barite Mines

Mining records for the three northernmost barite mines in the Town of Cheshire are not available. According to Fritts (1962), each of these mines had one main shaft. It is assumed that the mines and the deposit were laid out similar to the mine at Sheridan Drive / Chestnut Street. No documentation was found with reports of sinkholes in the area of these abandoned mines.

Figure 8-4 depicts the area of the mines. The area of approximate risk for these mine shafts is unknown. The damage potential of any sinkholes occurring near mine #3 is believed to be very low, as the mine and prospect pit are surrounded by woodlands and agricultural fields. Mine #4 appears to be located near some structures, but also in a wooded area. A sinkhole occurring here could undermine a structure, but sinkholes



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Location of Other Abandoned Barite Mines in Cheshire

LOCATION: **Cheshire, CT**

MMI#: 2937-01-2-3
MXD: H:8-4-Other Barite.mxd
SOURCE: Fritts, DEP, CLEAR

N

Town of Cheshire Natural Hazard Mitigation Plan

DATE: Dec. 2006
SCALE: 1" = 1,000'

SHEET: **Figure 8-4**

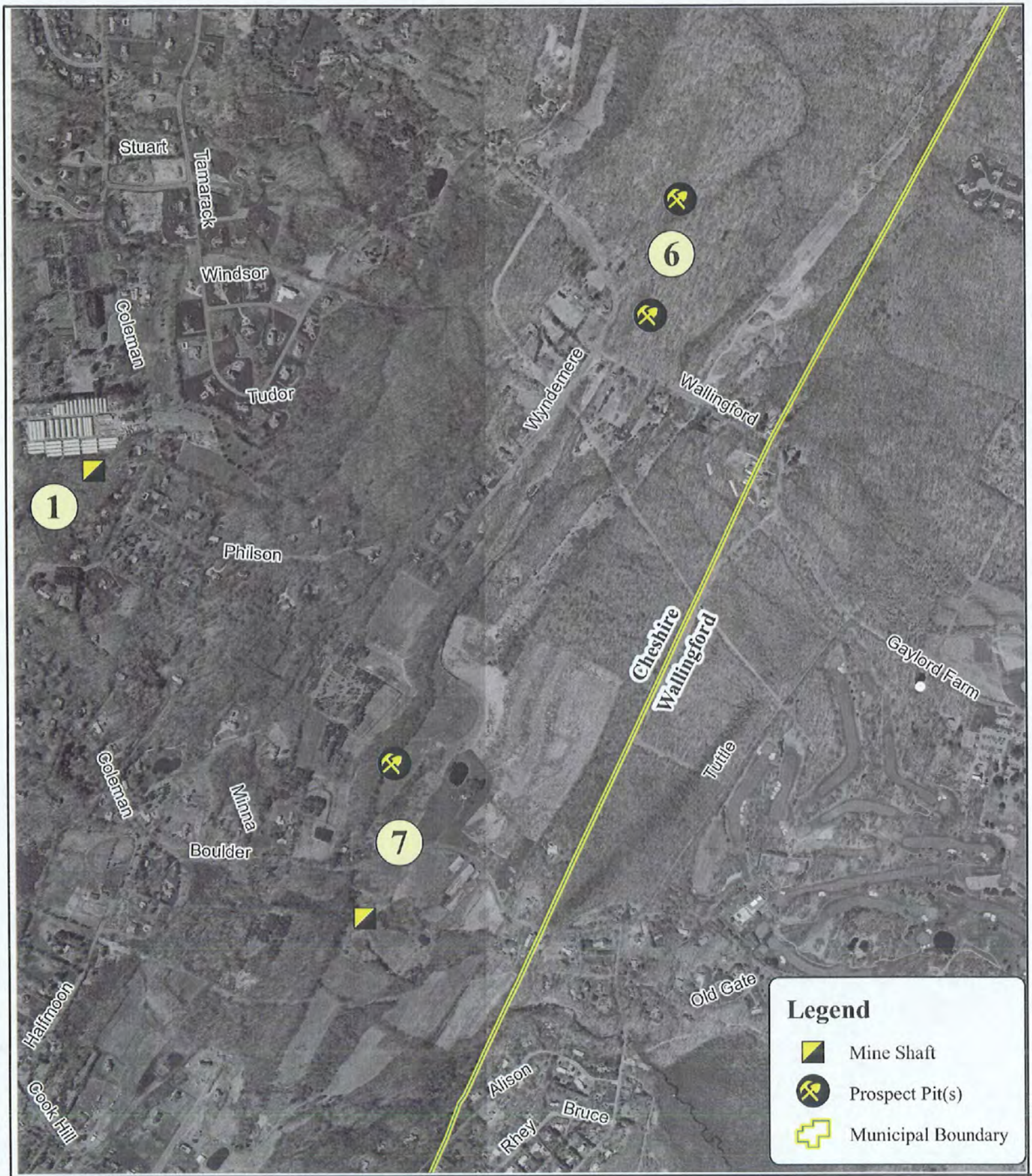
occurring anywhere else nearby would cause negligible damage. The damage potential of sinkholes associated with this mine is considered to be low. Mine #5 appears to be in a residential area on Peck Lane South of Abbey Court. The mine appears to be in a wooded area, but there are structures around the mine which potentially could be undermined. The damage potential of sinkholes associated with this mine is considered to be low.

Copper Prospecting and Mining Sites

Mining records are not available for the abandoned copper mines in the southeastern section of Cheshire. Figure 8-5 depicts the area of the mines. According to Fritts (1962), the northern area was used primarily for prospecting, and some adits were dug into the hillside. The southern area was used for both prospecting and mining and had one main shaft. No documentation was found with reports of sinkholes in the area of these abandoned copper mines. The area of approximate risk is unknown. In general, the damage potential of sinkholes occurring in these areas is considered to be very low due to the extensive wooded areas surrounding the mine shafts.

8.6 *Potential Mitigation Measures, Strategies, and Alternatives*

The mines in Cheshire have been abandoned for more than a century, and many of the mineshafts are assumed to have collapsed. Also, many of the old mining sites are located on private and developed property. Therefore, it would be prohibitively expensive for the Town of Cheshire to fund an excavation of old mining sites with the intention to properly fill the areas of the former shafts. Any such excavations would have to be site-specific and would likely require state and federal funding assistance. Other potential mitigation measures for sinkholes include:



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Location of Abandoned Copper Mines in Cheshire

LOCATION: Cheshire, CT

MMI#: 2937-01-2-3
MXD: H:8-5-Copper.mxd
SOURCE: Fritts, DEP, CLEAR

N

Town of Cheshire Natural Hazard Mitigation Plan

DATE: Dec. 2006
SCALE: 1" = 1,000'

SHEET: Figure 8-5

- Improve the tracking of settling problems to distinguish them from potholes and sinkholes caused by failing utilities;
- Apply a categorical classification system to historical complaints in any DPW records to distinguish sinkholes from other types of subsidence;
- Conduct an in-depth study to identify sinkhole prone areas, including mapping out the abandoned mine workings, determining site-specific threats to safety and property, and implementing appropriate safeguards where possible;
- Require potential developers to review historical atlases, maps, aerial photographs, this study, the above sinkhole study, and any other related reports for evidence that subsidence could occur as part of the Site Plan Review process;
- Increase public awareness regarding problem areas and associated potential hazards;
- Adjust local zoning ordinances to account for potentially hazardous conditions, including a new Site Plan Review hazard mitigation checklist.

Restorative actions may include site re-grading and repairs to homes and structures, although these are more accurately classified as response than as pre-disaster hazard mitigation.

9.0 *DAM FAILURE*

9.1 *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 15 registered dams and potentially several other minor dams in the Town, dam failure can occur almost anywhere in Cheshire. 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 (Appended Table 2).

9.2 *Hazard Assessment*

The Connecticut DEP designates a classification to each 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 mainly with the possible effects of failure of Class C dams, although others are considered as well. Failure of a class C dam has the potential for loss of life and property damage totaling millions of dollars.

Fifteen registered dams are located in the Town of Cheshire, of which six are Class A, three are Class BB, two are Class B, two are Class C, and two are undefined. These are listed in Table 9-1.

Table 9-1
Dams Registered with the DEP in the Town of Cheshire

Number	Name	Class
2501	Broad Brook Reservoir Dam	C
2502	Mixville Pond Dam	C
2503	Lake Percivel Dam	BB
2504	Larsens Pond Dam	B
2505	West Johnson Ave. Pond Dam	A
2506	Cuff Brook Pond Dam	A
2507	Weeks Pond Dam	A
2508	Cook Hill Pond Dam	A
2509	Mount Sanford Road Pond Dam*	BB
2510	Honey Pot Brook Pond Dam*	BB
2511	Hicock Pond Dam	A
2513	Tyler Pond Dam	A
2515	Ravenswood Dam	B
2516	Cheshire Park Pond Dam	-
2518	Thomas Pond Dam	-

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

The two Class C dams in Cheshire are the Broad Brook Reservoir Dam in the eastern part of town and the Mixville Pond Dam in the western part of town, depicted on Figures 9-1 and 9-2, respectively.

9.3 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 recent history:

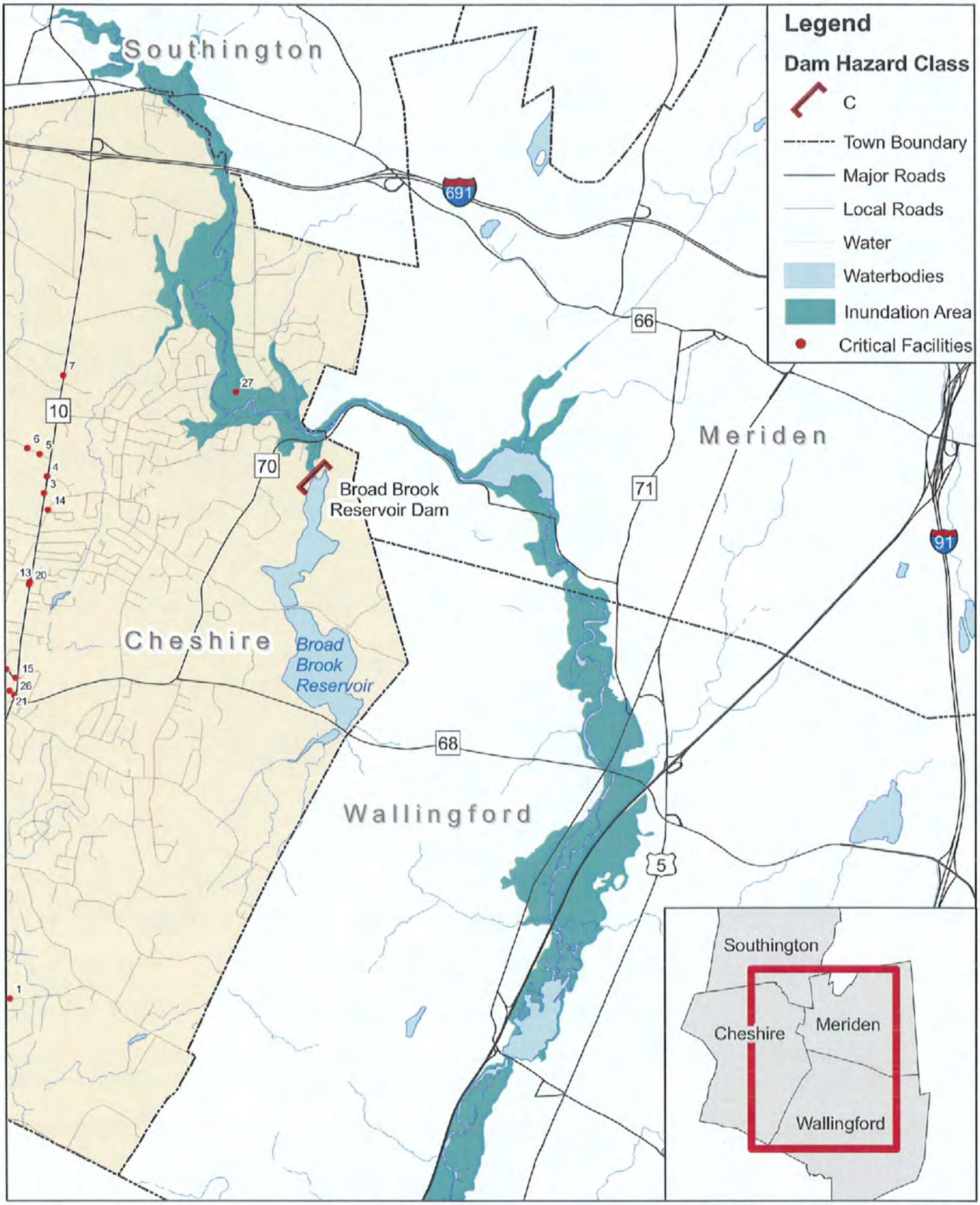
- 1963: Failure of the Spaulding Pond Dam in Norwich caused six deaths and six million dollars in damage.
- 1982: Failure of the Bushy Hill Pond Dam in Deep River caused 50 million dollars in damages.

More recently, the Connecticut DEP reported that the sustained heavy rainfall from October 7 to 15, 2005 caused two dam failures, four partial breaches, and damage to four other dams throughout the State. These are summarized in Table 9-2:

Table 9-2
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

Figure 9-1: High Hazard Dams in Cheshire



Source: "Roads", c1984 - 2006 Tele Atlas, Rel. 10.06.
"Town Boundary", "Hydrography", DEP
"Critical Facilities", COGCNV
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January 2008

Miles
0 0.5 1

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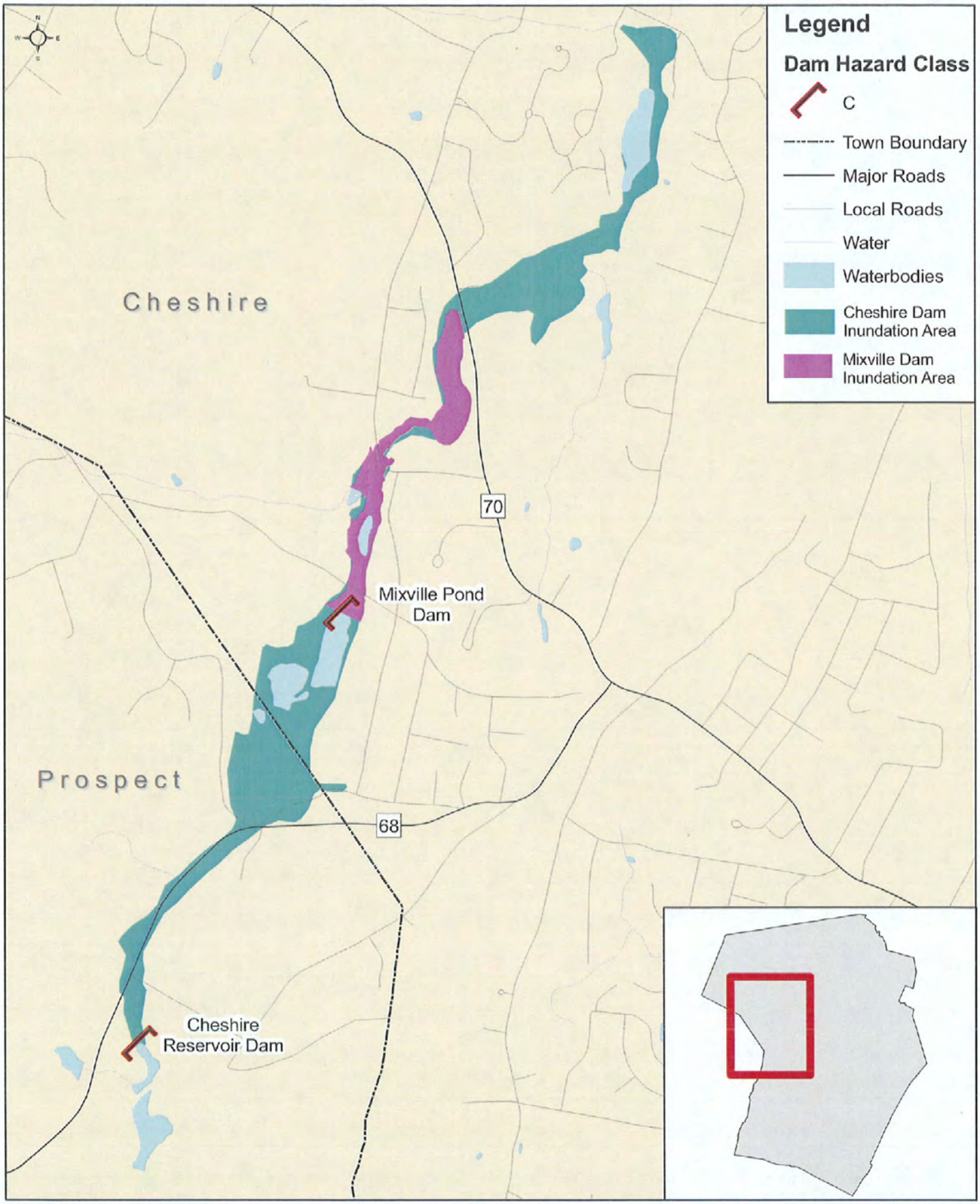
Figure 9-2: High Hazard Dams in Cheshire



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

0 500 1,000 Feet

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No major dam failures have occurred in the Town of Cheshire. During the July 14, 2006 data collection meeting, Town personnel described the Mount Sanford Road Pond Dam, a Class A dam at the Hamden Town Line, as "leaking." However, failure of the Mount Sanford Road Pond Dam would only affect a downstream pond and possibly some infrastructure. A loss of life is not believed to likely.

Section 3.5 presents a documentation of the damage caused by two small dams that failed in sequence upstream of the northeast section of Cheshire in the City of Meriden. Specifically, the failure of the detention pond sent a torrent of water down East Sindall Stream and under Beverly Drive in Meriden. A small, privately-owned dam in the run of the stream locally known as "Nun's Dam," also located in Meriden, was breached as it was not designed to mitigate floods.

The combination of the water from the detention pond and from behind Nun's Dam continued downstream, eroding the channel and accumulating debris between Finch Avenue and Allen Court. This area was covered in outwash following the storm. The debris blocked the culvert running under Allen Court in Cheshire, causing the stream to flood the road. The stream continued eroding and accumulating debris between Allen Court and Allen Avenue, where the reduction in gradient caused the floodwaters to slow and deposit cobbles and larger debris on the property at 815 Allen Avenue.

9.4 Existing Programs, Policies, and Mitigation Measures

The dam safety statues 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 registered by the owner with the DEP, according to Connecticut Public Act 83-38.

Dam Inspection Regulations require that over 600 dams in Connecticut be inspected annually. The DEP currently prioritizes inspections of those dams which pose the greatest potential threat to downstream persons and properties. 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 DEP 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 DEP Commissioner is empowered by statute to remove or correct, at the expense of the owner, any unsafe structures which present a clear and present danger to public safety.

Owners of Class C dams are required to maintain emergency operations plans. The Meriden Water Department maintains such a plan for the Broad Brook Reservoir Dam. According to the dam safety files at the Connecticut DEP, the Town of Cheshire owns Mixville Pond Dam and as of September 2005 needed to update its Emergency Operations Plan. According to Town personnel, DEP also would like a mitigation study performed for Mixville Pond Dam.

9.5 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 Cheshire, Mixville Pond Dam presents the highest damage potential to Town residents, while the Broad Brook Reservoir Dam presents an extreme damage potential to residents downstream on the Quinnipiac River in Meriden and Wallingford, but will also cause backwater flooding upstream into Southington. A serious dam failure on Broad Brook Reservoir would also impede the City of Meriden's ability to provide water to its residents, as discussed below.

Broad Brook Reservoir Dam

Broad Brook Reservoir is owned and operated by the City of Meriden. It covers a surface area of approximately 314 acres and has a storage capacity of 2951 acre-feet. This reservoir typically supplies up to 50% of the total system demand for the Meriden Water Department and is one of Meriden's primary drinking water sources. The outflow from Broad Brook Reservoir flows approximately 0.4 miles to the north before reaching its confluence with the Quinnipiac River.

The area downstream of Broad Brook Reservoir is mainly residential, with the stream forming a boundary between the Broad Brook Treatment Plant to the east and a single-family subdivision on Cornerstone Court to the west. Broad Brook then flows underneath Route 70 before entering the Quinnipiac River.

The Quinnipiac River flows southeast through Quinnipiac Gorge in Meriden and into Hanover Pond. Hanover Pond is impounded by a Class C Dam, and a dam failure at Broad Brook during a period of heavy flooding could cause Hanover Pond Dam to dangerously overtop or fail, with a high potential for increasing damage downstream in Meriden and Wallingford. Note that Hanover Pond Dam was partially breached during the extended rainfall of October 2005. Thus, a dam failure at Broad Brook Reservoir has the potential to undermine a public water supply as well as damage a large area downstream, although these areas are not in the Town of Cheshire. A dam failure would also cause a backwater condition along the Quinnipiac River that would potentially reach upstream into Southington. This backwater condition would cause flooding at properties along the river in Cheshire, including at the Cheshire Waste Treatment Plant.

Mixville Pond Dam

Mixville Pond is encompassed by the Mixville Recreation Area and owned by the Town of Cheshire. The Ten Mile River is the primary inflow and outflow from Mixville Pond,

which eventually drains to the Quinnipiac River as described in Section 2.5. The area downstream of Mixville Pond Dam is lightly developed, consisting primarily of single-family residential combined with light and medium-density industrial areas.

Several houses and structures would be seriously damaged by flood waters should the dam at Mixville Pond fail. Four houses are located in the 100-year floodplain immediately downstream of the dam, and a failure would likely cause Marion Road to flood. Rising floodwaters and debris would also impact industrial areas and several side streets to Route 70. The extensive wetlands in the vicinity of West Johnson Avenue would likely diminish the flood stage and mitigate additional damage downstream in Southington.

Figure 9-2 also shows the probable inundation area for the failure of the Cheshire Reservoir Dam located upstream of Mixville Pond Dam in Prospect, Connecticut. The failure of this dam would likely cause damage to the Mixville Pond Dam, exacerbating the possible flooding conditions reaching downstream to West Johnson Avenue.

Cheshire Reservoir Dam

Two Class C dams are located in the Town of Prospect, adjacent to the Town of Cheshire to the west. The failure of the Class C dam retaining the Cheshire Reservoir would have few impacts in the Town of Prospect but potentially significant impacts downstream in the Town of Cheshire.

A dam failure at Cheshire Reservoir would send a torrent of water down the Ten Mile River. The sudden increase in water levels would likely cause Mixville Pond Dam to fail. This subsequent failure of Mixville Pond Dam would cause a significant amount of damage to infrastructure and residential and industrial properties downstream in the Towns of Cheshire and Southington, as discussed above.

Other Dams

The remaining dams in Cheshire are not class C. Nevertheless, a failure of one of the other dams may have repercussions to both property owners and Town infrastructure downstream.

For example, Sections 3.5 and 9.3 present a documentation of the damage caused by two small dams that failed in sequence upstream of the northeast section of Cheshire in the City of Meriden. Although these impoundments were not believed to be significant threats if they failed, the same type of damage could occur elsewhere in the Town of Cheshire downstream of any of the other class A, B, or BB dams. Furthermore, Town of Cheshire personnel do not precisely know the locations of some of the dams such as Tyler Pond or Hicock Pond, the types of structures are involved, or the implications of dam failure.

9.6 Potential Mitigation Measures, Strategies, and Alternatives

The Dam Safety Section of the DEP 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 registered and periodically inspected to assure that their continued operation does not constitute a hazard to life, health, or property.

The Town of Cheshire should work in conjunction with private dam owners and the Connecticut DEP to ensure that all dams in the City are in safe and functional working order. In this regard, having a written operation and maintenance plan for all dams is essential. This is especially important for Class C dams. There also are other preventive mitigation strategies suggested for the Class C dams in the Town of Cheshire, as described below:

With regard to the Mixville Pond Dam, the Town of Cheshire should move forward and update the Emergency Operations Plan for the dam, and prepare a new dam failure analysis if appropriate. The Town should also complete the mitigation report as per DEP request. Both Class C dams in the Town should continue to be regularly inspected by their respective owners, with maintenance performed as required to keep the dams in safe and functional order.

Concerning the Cheshire Reservoir Dam, the Town should coordinate with the Town of Prospect and the South Central Connecticut Regional Water Authority to ensure that regular maintenance is performed as required to keep it in safe and functional order. These recommendations have been outlined in the Town of Prospect Natural Hazard Pre-Disaster Mitigation Plan, coordinated by Council of Governments Central Naugatuck Valley under the same FEMA PDM grant used to develop the subject Plan.

The Town of Cheshire should continue correspondence with the Meriden Water Department and the DEP to ensure that proper maintenance is being performed on this dam.

Finally, with regard to the class A, B, and BB dams, the Town of Cheshire should consider conducting a reconnaissance of these dams to plot their locations and record the general conditions of the dams and the land use located downstream of each. The reconnaissance should lead to a prioritization of further investigation or repairs, depending on the findings.

The Town of Cheshire should also consider implementing an emergency notification system. Emergency notification system combines 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.

In addition, several suggested potential mitigation strategies are applicable to all hazards in this plan. These are outlined in the Section 11.1.

10.0 WILDFIRES

10.1 Setting

The ensuing discussion about wildfires is focused on the undeveloped wooded, shrubby, or grassland areas of Cheshire, 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.

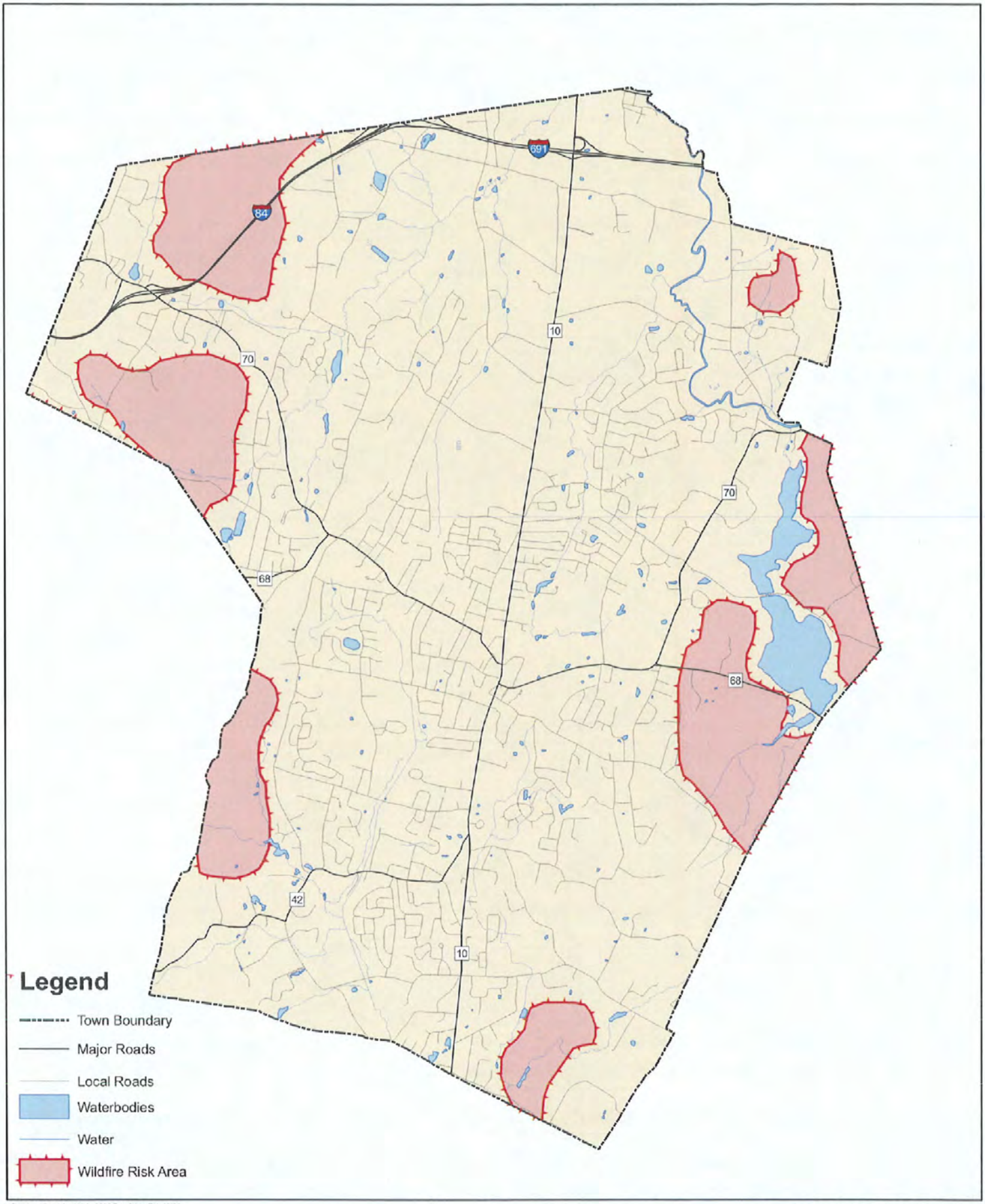
The Town of Cheshire is a low-risk area for wildfires. Wildfires are of particular concern in wooded areas and other areas with poor access for fire-fighting equipment. Figure 10-1 depicts wildfire risk areas for the Town of Cheshire. Hazards associated with wildfires include property damage and loss of habitat. Wildfires 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.

10.2 Hazard Assessment

Wildfires are well-defined by the Massachusetts Hazard Mitigation Plan as being "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."

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 mostly by lightning.

Figure 10-1: Cheshire 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

Miles
0 0.5 1

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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.

10.3 Historic Record

Connecticut enacted its first state-wide forest fire control system in 1905, when the state was largely rural with very little secondary growth forest. By 1927, the state had most of the statutory foundations for today's forest fire control programs and policies in place, such as the State Forest Fire Warden system, a network of fire lookout towers and patrols, and regulations regarding open burning. The severe fire weather in the 1940's prompted the state legislature to join the Northeastern Interstate Forest Fire Protection Compact with its neighbors in 1949. Today, most of Connecticut's forested areas are secondary growth forests. According to the Connecticut DEP, forest has reclaimed over 500,000 acres of land that was used for agriculture in 1914.

The technology used to combat wildfires has significantly improved since the early 20th century. An improved transportation network, coupled with advances in firefighting equipment, communication technology, and training, has improved the ability of firefighters to minimize damage due to wildfires in the state.

According to the USDA Forest Service Annual Wildfire Summary Report for 1994 through 2003, an average of 600 acres per year in the United States was burned by wildfires. In general, the fires are small and detected quickly, with most wildfires being contained to less than 10 acres in size. The number one cause of wildfires is arson, with about half of all wildfires being intentionally set.

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 1,733 acres of Connecticut burned in 345 separate wildfires, an average of about five acres per fire. Only one wildfire occurred between 1994 and 2003 that burned over 300 acres, and a wildfire in 1986 in the Mattatuck State Forest in the Town of Watertown burned 300 acres.

10.4 Existing Programs, Policies, and Mitigation Measures

Existing mitigation for wildland fire control is typically focused on Fire Department training and maintaining an adequate supply of equipment. The Town of Cheshire has a brush truck capable of accessing remote fires, and several pumpers 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 Cheshire Fire Department goes to the fires. This proactive approach of going on the offense is believed to be effective for controlling wildfires. The fire department has some water storage capability, but primarily relies on the Regional Water Authority's (RWA) water service. Approximately 80% of the Town

of Cheshire has water service that includes fire protection hydrants. This measure speeds the containment time for most fires occurring in the Town.

Education is also an important element of existing mitigation. Information is available through the Cheshire Fire Department's website (http://www.cheshirefd.org), including information about how to protect your home from fires.

The DEP Forestry Division uses the rainfall data recorded by the Automated Flood Warning system (see Section 3.4) to compile forest fire probability forecasts. This allows the Division and local municipalities to monitor the drier areas of the state in an effort to reduce forest fire risk.

Locally, the Cheshire Fire Department and Cheshire Police Department review all new subdivision applications to provide safety comments relative to fire risks and firefighting capabilities. The Town Subdivision Regulations also call for creating through streets in new developments, increasing the amount of egress available to the fire department for combating wildfires.

10.5 Vulnerabilities and Risk Assessment

As the most common causes of wildfires are arson, lightning strikes, and electrical fires from downed trees, wildfires have the potential to 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 10.3, 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 large water service area in the Town 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 10-1 were defined as being contiguous wooded areas greater than 50 acres in size without access to public water service. These areas are generally near the Town Boundaries of Cheshire, and each 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. The northwestern wildfire risk area also borders a portion of Cheshire's industrial zone, increasing the vulnerability of these workers to the effects of wildfires.

Despite having a large amount of forest/urban interface, the overall risk of wildfires occurring in the Town of Cheshire is also considered to be low. Such fires fail to spread far due speed of detection and strong fire response. As 80% of the Town has water service, a large amount of water pressure is available for fire fighting equipment. As stated above, the creation of through streets increases the range of fire fighting and emergency equipment, and increased public awareness has further mitigated the risk.

Recall from Figure 2-7, Figure 2-8, and Figure 2-9 that significant elderly, linguistically isolated and disabled populations reside in the Town of Cheshire. In comparing these figures with the wildfire risk areas presented in Figure 10-1, it is possible that over 500 elderly people, and hundreds of people with disabilities could be affected by a wildfire in Cheshire. Though very few linguistically isolated households are located near the wildfire risk areas, it is important for the Cheshire Fire Department to be prepared to assist all of these special populations during a wildfire emergency.

10.6 Potential Mitigation Measures, Strategies, and Alternatives

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. The following recommendations could be implemented to mitigate fire risk:

- The RWA and the Town of Cheshire should continue to extend the public water supply systems into areas that require water for fire protection, where appropriate.
- The RWA and the Town of Cheshire should continue to identify and upgrade those portions of the public water supply systems that are substandard from the standpoint of adequate pressure and volume for fire-fighting purposes.
- 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. This task would be best designated to the Department of Public Works.

Other potential mitigation strategies for preventing wildfires include:

- Continue to promote inter-municipal cooperation in fire fighting efforts;
- Ensure personnel are prepared to provide assistance to a possibly significant number of elderly, linguistically isolated, and/or disabled populations;
- Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment;
- Continue to review subdivision applications to ensure new neighborhoods and driveways are properly sized to allow access of emergency vehicles;
- Provide outreach programs including tips on how to properly manage burning and campfires on private property;
- Patrol Town-owned open space and parks to prevent unauthorized campfires;
- 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;
- Enforce regulations and permits for open burning; and
- Continue to place utilities underground.

In addition, specific recommendations that apply to all hazards are listed in Section 11.1.

11.0 RECOMMENDATIONS

11.1 Additional Recommendations

Recommendations that are applicable to two, three, or four hazards were discussed in the applicable subsections of Sections 3.0 through 10.0. For example, placing utilities underground is a recommendation for hurricane, summer storm, winter storm, and wildfire mitigation. A remaining class of recommendations is applicable to all hazards, because it includes recommendations for improving public safety and planning for emergency response. Instead of repeating these recommendations in section after section of this Plan, these are described herein.

Informing and educating the public about how to protect themselves and their property from natural hazards is essential to any successful hazard mitigation strategy. The Local Emergency Planning Commission should be charged with the creation and/or dissemination of informational pamphlets and guides to public locations such as the library, post office, senior center, and town hall. One such guide entitled "Are You Ready? An In-Depth Guide to Citizen Preparedness." co-published by the American Red Cross, NOAA, and FEMA provides useful information regarding fire, flooding, heat waves, hurricanes, thunderstorms, tornadoes, and winter storms. Other useful guides should include, at a minimum, the following subjects:

- Food, water, and other disaster supplies
- Creating a family disaster plan
- Disaster preparation for people with disabilities and other special needs
- Helping children cope with disaster
- Helping adults cope with disaster-related stress

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. Thus, the implementation of an emergency notification system would be beneficial in warning residents of an impending hazard. In addition, the Town Emergency Operations Plan should continue to be reviewed and updated regular basis, at least once annually.

In addition, several pages should be added to the Town website regarding emergency planning and shelter locations so that the public can prepare family emergency plans within the framework of the Cheshire emergency procedures.

The Public Works Department should develop working inter-municipal agreements with other public works departments in nearby communities. This would allow for sharing of resources when disasters affect one community more than others.

11.2 Summary of Specific Recommendations

Recommendations have been presented throughout this document in individual sections as related to each natural hazard. This section lists specific recommendations of the Plan without any priority ranking. Recommendations that span multiple hazards are only reprinted once in this section under the most appropriate hazard event. Refer to the matrix in Appendix A for recommendations with scores based on the STAPLEE methodology described in Section 1.0.

Inland Flooding

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.
- Continue to coordinate with neighboring municipalities regarding new subdivisions that could impact properties within Cheshire (for upstream municipalities) and downstream of Cheshire.
- Urge or petition FEMA to more critically evaluate LOMA and LOMC applications that are received such that redevelopments do not potentially cause increased flooding to other properties.
- Update the Town-wide Master Drainage Study and continue to update it at least every five years. Part of this study should include the introduction of a comprehensive catch basin maintenance program.
- Reinstate the Town in FEMA's community rating system.
- Require Flood Hazard Area, Subdivision, and commercial and industrial zoning permit applications to provide flood elevation and location data, particularly for parcels along the Ten Mile River, Mill River, the Quinnipiac River, and Willow Brook.
- New buildings constructed in flood prone areas should be protected to the highest recorded flood level, regardless of being within a defined SFHA.
- Zoning, subdivision, and other land use regulations should be reviewed to determine if revisions could prevent localized flooding damage. New buildings should be designed and graded to shunt drainage away from the building.
- Use the Town two-foot contour maps to develop more exact regulatory flood-hazard maps and data using FEMA flood elevations. This could be conducted as part of the Map Mod program.

Property & Natural Resource Protection

- Pursue the acquisition of additional municipal open space properties inside SFHAs.
- Selectively pursue conservation objectives listed in the Plan of Conservation and Development, including the creation of greenways.
- Continue to regulate development in protected and sensitive areas.
- Purchase private land in the 100-year floodplain and set it aside as greenways, parks, or other non-residential, non-commercial, or non-industrial use.

Structural Projects

- In accordance with previous studies performed by MMI, excavate East Sindall stream to a depth of 30 inches to restore original flow capacity reduced by debris deposition from upstream erosion. This work should be performed downstream of Allen Avenue along the property at 815 Allen Avenue. The existing cobbles could be reused to line the channel.
- Consider raising the elevation of the bridge and increasing the conveyance capacity of the bridge over Honeypot Brook at Blacks Road.
- Support the development of a flood bypass channel at the former Farmington River Canal crossing over the Ten Mile River, or pursue the project if the land development project does not occur.
- All reports of localized flooding problems should be investigated by Town personnel to determine the cause and an appropriate solution.

Wind Damage Related to Hurricanes, Summer Storms, and Winter Storms

- Increase tree limb maintenance and inspections, especially along Route 10 and other evacuation routes

- ❑ Continue to require that utilities be placed underground in new developments and pursue funding to place them underground in existing developed areas
- ❑ Complete evacuation plan to ensure timely migration of people seeking shelter from all areas of Cheshire, particularly the northwestern portion of Cheshire
- ❑ Continue to require compliance with the amended Connecticut Building Code for wind speeds.
- ❑ Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards.

Winter Storms

- ❑ Post a final 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 to critical facilities during a winter storm event. Prioritize plowing to critical facilities, such as emergency services, shelters, and out-of-town hospitals.
- ❑ 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 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.
- ❑ Continue to encourage two modes of egress into every neighborhood by the creation of through streets.

Earthquakes

- ❑ Consider preventing new residential development in areas prone to collapse.
- ❑ Consider preventing residential development on or below steep slopes (slopes exceeding 30%).
- ❑ Continue to require adherence to the state building codes.

- ❑ Consider adding earthquakes to the list of hazards covered by the Emergency Operations Plan.
- ❑ Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs.

Sinkholes

- ❑ Improve the tracking of settling problems to distinguish them from potholes and sinkholes caused by failing utilities;
- ❑ Apply a categorical classification system to historical complaints in any DPW records to distinguish sinkholes from other types of subsidence;
- ❑ Conduct an in-depth study to identify sinkhole prone areas, including mapping out the abandoned mine workings, determining site-specific threats to safety and property, and implement appropriate safeguards where possible;
- ❑ Require potential developers to review historical atlases, maps, aerial photographs, this Plan, the sinkhole studies referenced in Section 8, and/or any other related reports for evidence that subsidence could occur as part of the Site Plan Review process;
- ❑ Increase public awareness regarding problem areas and associated potential hazards;
- ❑ Amend local zoning ordinances to account for potentially hazardous conditions, including a new Site Plan Review hazard mitigation checklist.

Dam Failure

- ❑ 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.
- ❑ With regard to the Mixville Pond Dam, the Town of Cheshire should move forward and update the Emergency Operations Plan for the dam, and prepare a new dam failure analysis if appropriate. The Town should also complete the mitigation report as per DEP request.
- ❑ Consider implementing Town inspections of Class A, AA, B, and BB dams.

- Work with the Connecticut DEP 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.

Wildfires

- The RWA and the Town of Cheshire should continue to extend the public water supply systems into areas that require water for fire protection.
- The RWA and the Town of Cheshire should continue to identify and upgrade those portions of the public water supply systems that are substandard from the standpoint of adequate pressure and volume for fire-fighting purposes.
- 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.
- Continue to promote inter-municipal cooperation in fire fighting efforts;
- Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment;
- Continue to review subdivision applications to ensure new neighborhoods and driveways are properly sized to allow access of emergency vehicles;
- Provide outreach programs including tips on how to properly manage burning and campfires on private property;
- Patrol Town-owned open space and parks to prevent unauthorized campfires;
- 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;
- Enforce regulations and permits for open burning; and
- Continue to place utilities underground.

11.3 Sources of Funding

The following sources of funding and technical assistance may be available for the priority projects listed above. Funding requirements and contact information is given in Section 12.0.

Flood Mitigation

- FEMA Flood Mitigation Assistance (FMA) Program – *grants for pre-disaster flood hazard mitigation planning and projects.*
- 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 Environmental Protection – assistance to municipalities to solve flooding and dam repair problems through the Flood and Erosion Control Board Program.

Hurricane Mitigation

- FEMA State Hurricane Program - *financial and technical assistance to local governments to support mitigation of hurricanes and coastal storms.*
- FEMA Hurricane Program Property Protection – *grants to hurricane prone states to implement hurricane mitigation projects.*

General Hazard Mitigation

- FEMA Hazard Mitigation Grant Program (HMGP) – *funding for hazard mitigation projects following a presidentially-declared disaster.*

- FEMA Pre-Disaster Mitigation Grant Program (PDM) – *funding for hazard mitigation projects on a nationally competitive basis.*
- Americorps – *teams may be available to assist with landscaping projects such as surveying, tree planting, restoration, construction, and environmental education.*

Wildfire Mitigation

- Assistance to Firefighters Grant Program – *pre-disaster grants to organizations such as fire departments that are recognized for expertise is fire prevention and safety programs.*

Erosion Control and Wetland Protection

- U.S. Department of Agriculture – *technical assistance for erosion control.*
- CT Department of Environmental Protection – *assistance to municipalities to solve beach erosion problems through the Flood and Erosion Control Board Program.*
- 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.*

12.0 PLAN IMPLEMENTATION

12.1 Implementation Strategy and Schedule

The Council of Governments of the Central Naugatuck Valley is authorized to update this hazard mitigation plan as needed, coordinate its adoption with the Town of Cheshire, and guide it through the FEMA approval process.

As individual recommendations of the hazard mitigation plan are implemented, they must be implemented by the municipal departments that oversee these activities. The Town Manager, the Department of Public Works, and the Planning Department in the Town of Cheshire will primarily be responsible for developing and implementing selected projects. 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 Town Manager 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 Town Manager will be responsible for assigning appropriate Town officials to update the Plan of Conservation and Development, 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 Plan of Conservation and Development 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.

Finally, 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.

12.2 Progress Monitoring and Public Participation

The Town Manager will be the party responsible for monitoring the successful implementation of the Plan as part of his/her oversight of all municipal departments. Such monitoring may include periodic reports to the COG regarding certain projects, meetings, site visits, and telephone calls as befits the project being implemented. The Council of Governments of the Central Naugatuck Valley will coordinate an annual review of the plan. Participants in this review may include representatives of the departments listed in Section 12.1.

Matters to be addressed at this meeting will include a review of the goals and objectives of the original plan, a review of hazards or disasters that occurred during the preceding year, a review of the mitigation activities that have been accomplished to date, a discussion of reasons that implementation may be behind schedule, and recommendations for new projects and revised activities. The meeting will be conducted in October or November, at least two months before the annual application cycle for pre-disaster grants (applications are typically due in January of any given year). This will enable a list of possible projects to be circulated for Town Departments to review, with sufficient time for developing an application.

Continued public involvement will be sought regarding the monitoring, evaluating, and updating of the Plan. Public input may be solicited through community meetings and input to web-based information gathering tools. Public comment on changes to the Plan may be sought through posting of public notices, and notifications posted to the website of the Council of Governments of the Central Naugatuck Valley, as well as of the Town of Cheshire.

12.3 Updating the Plan

The Council of Governments of the Central Naugatuck Valley will update the hazard mitigation plan if a consensus to do so is reached by the Town Council of Cheshire and a request is presented to the Council of Governments of the Central Naugatuck Valley, or at least once every five years. A committee will be formed consisting of representatives of many of the same departments solicited for input to this plan. In addition, local business leaders, community and neighborhood group leaders, relevant private and non-profit interest groups, and the seven neighboring municipalities will be solicited for representation, including the following:

- The Central Naugatuck Valley Emergency Planning Committee, managed by the COGCNV;
- Quinnipiac River Watershed Association;
- Cheshire Chamber of Commerce;
- City of Waterbury Office of the Mayor;
- Town of Prospect Office of the Mayor;
- Town of Wolcott Local Emergency Planning Commission (LEPC);
- Town of Southington;
- City of Meriden;
- Town of Wallingford;
- Town of Hamden

Updates may include deleting recommendations as projects are completed, adding recommendations as new hazard impacts arise, or modifying hazard vulnerabilities as land use changes. In addition, the list of shelters and critical facilities should be updated as necessary, or at least every five years.

12.4 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
(877) 336-2734
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; and
- *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;
- *Severe Repetitive Loss Program (SRL)*, which provides funding to reduce or eliminate the long-term risk of flood damage to "severe repetitive loss" structures insured under the National Flood Insurance Program;
- *Community Rating System (CRS)*, a voluntary incentive program under the National Flood Insurance Program that recognizes and encourages community floodplain management activities; and
- *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 in place several *Technical Assistance Contracts (TAC)* 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.

- *The Wind and Water Technical Assistance Contract (WAWTAC)*-supporting wind and flood hazards reduction program needs. Projects include recommending mitigation measures to reduce potential losses to post-FIRM structures, providing mitigation policy and practices expertise to States, incorporating mitigation into local hurricane program outreach materials, developing a Hurricane Mitigation and Recovery exercise, and assessing the hazard vulnerability of a hospital.

- *The National Earthquake Technical Assistance Contract (NETAC)* – supporting earthquake program needs. Projects include economic impact analyses of various earthquakes, vulnerability analyses of hospitals and schools, identification of and training on non-structural mitigation measures, and evaluating the performance of seismically rehabilitated structures, post-earthquake.

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
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
360 Rainbow Boulevard South, 3rd Floor
Niagara Falls, NY 14303
800-659-2955
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 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 DEP, Bureau of Water Management, Planning and Standards Division.

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 flood prone 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 the Floodplain Management Services Program (FPMS). Various flood protection measures such as beach re-nourishment, stream clearance and snagging projects, floodproofing, and flood preparedness are funded on a 50/50 matching basis by Section 22 planning Assistance to States program. They are authorized to relocate homes out of the floodplain if it proves to be more cost effective than a structural flood control measure.

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 non-structural 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 provide 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 (formerly SCS)
Connecticut Office
344 Merrow Road, Suite A
Tolland, CT 06084-3917
(860) 871-4011

The Natural Resources Conservation Service provides technical assistance to individual land owners, 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, non-profit organizations, and the private sector.

State Resources

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 Environmental Protection
79 Elm Street
Hartford, CT 06106-5127
(860) 424-3706
http://www.dep.state.ct.us/
The Connecticut DEP 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.

- *State Hazard Mitigation Officer (shared role with the Department of Emergency Management and Homeland Security)*: Hazard mitigation planning and policy; oversight of administration of the Hazard Mitigation Grant Program, Flood Mitigation Assistance Program, and Pre-Disaster Mitigation Program.

- *Flood Warning and Forecasting Service*: Prepares and issues flood, severe weather, and coastal storm warnings. Staff engineers and forecaster can work with communities on flood warning issues and can give technical assistance in preparing flood warning plans.

- *Flood & Erosion Control Board Program*: Provides assistance to municipalities to solve flooding, beach erosion and dam repair problems. Certain non-structural 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 non-competitive basis.

- *Stream Channel Encroachment Line Program*: Similar to the NFIP, this state regulatory program places restrictions on the development of floodplains along certain major rivers. This program draws in environmental concerns in addition to public safety issues when permitting projects.

- *Inland Wetlands and Watercourses Management Program*: Provides training, technical and planning assistance to local Inland Wetlands Commissions, reviews and approves municipal regulations for localities.

- *Dam Safety Program*: Charged with the responsibility for administration and enforcement of Connecticut's dam safety laws. 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.

- *Rivers Restoration Grant Program*: Administers funding and grants under the Clean Water Act involving river restoration, and reviews and provides assistance with such projects.

Bureau of Water Management - Planning and Standards Division - Administers the Clean Water Fund and many other programs directly and indirectly related to hazard mitigation including the Section 319 non-point 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 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 agency responsible for emergency management. Specifically, responsibilities include emergency preparedness, response & recovery, mitigation, and an extensive training program. DEMHS is the state point of contact for most FEMA grant and assistance programs. 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.

Connecticut Department of Public Safety
1111 Country Club Road
Middletown, CT 06457
(860) 685-8441
http://www.ct.gov/dps/

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 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 which 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 which could be mitigation related.

Private and Other Resources

The Association of State Floodplain Managers (ASFPM)
2809 Fish Hatchery Road
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.

Institute for Business & Home Safety
4775 East Fowler Avenue
Tampa, FL 33617
(813) 286-3400
http://www.ibhs.org/
A non-profit 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 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.

New England Flood and Stormwater Managers Association, Inc. (NEFSMA)
c/o MA DEM
100 Cambridge Street
Boston, MA 02202
NEFSMA is a non-profit organization made up of state agency staff, local officials, private consultants and citizens from across New England. NEFSMA sponsors seminars and workshops and publishes the NEFSMA News three times per year to bring the latest flood and stormwater management information from around the region to its members.

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 than cannot be funded elsewhere.

AmeriCorps - AmeriCorps is the recently installed 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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APPENDED TABLES

Appended Table 1
Hazard Event Ranking

Each hazard may have multiple effects; for example, a hurricane causes high winds and inland flooding.
Some hazards may have similar effects; for example, hurricanes and earthquakes may cause dam failure.

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

Location

1 = small	isolated to specific area during one event
2 = medium	mulitple 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 ilnesses 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%

Frequency of Occurrence, Magnitude / Severity, and Potential Damages based on historical data from NOAA National Climatic Data Center and Town records

Appended Table 2
Hazard Effect Ranking

Some effects may have a common cause; for example, a hurricane causes high winds and inland flooding.
Some effects may have similar causes; for example, hurricanes and no'easters both cause heavy winds.

Natural Hazard Effects	Location	Frequency of Occurrence	Magnitude / Severity	Rank
	1 = small 2 = medium 3 = large	0 = unlikely 1 = possible 2 = likely 3 = highly likely	1 = limited 2 = significant 3 = critical 4 = catastrophic	
Nor'Easter Winds	3	3	2	8
Snow	3	3	2	8
Blizzard	3	3	2	8
Hurricane Winds	3	1	3	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
Inland Flooding	2	2	1	5
Falling Trees/Branches	1	3	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

Location

1 = small	isolated to specific area during one event
2 = medium	mulitple 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 ilnesses 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%

Frequency of Occurrence, Magnitude / Severity, and Potential Damages based on historical data from NOAA National Climatic Data Center and Town records

APPENDIX A
STAPLEE MATRIX

Strategies Listed by Primary Report Section for Cheshire	Responsible Department[1]	Schedule A. Ongoing B. 2007-2012 C. 2012-2017 D. 2017-2022	Associated Report Sections								Category 1. Prevention 2. Property Protection 3. Natural Resource Prot. 4. Structural Projects 5. Public Information 6. Emergency Services	STAPLEE Criteria *Good = 3, Average =2, and Poor = 1*							
			Inland Flooding	Hurricanes	Summer Storms and Tornadoes	Winter Storms	Earthquakes	Sinkholes	Dam Failure	Wildfires		Socially acceptable?	Technically feasible?	Administratively workable?	Politically acceptable?	Can it be legally implemented?	Economically beneficial?	Environmentally beneficial?	STAPLEE Sum of Scores
ALL HAZARDS																			
Dissemination of informational pamphlets regarding natural hazards to public locations	Fire Department	B	x	x	x	x	x	x	x	x	1, 5, 6	3	3	3	3	3	3	3	**21**
Implementation of an emergency notification system	Police & Fire Dept.	B	x	x	x	x	x	x	x	x	1, 5, 6	3	3	3	2	3	2	3	**19**
Continue to review and update Emergency Operations Plan, at least once annually	Police & Fire Dept.	A	x	x	x	x	x	x	x	x	1	3	3	3	3	3	3	3	**21**
INLAND FLOODING																			
Prevention																			
Streamline the permitting process to ensure maximum education of developer or applicant	Planning & Zoning	B	x	x	x	x	x	x		x	1	3	2	2	3	3	3	3	**19**
Continue to coordinate with neighboring municipalities regarding developments that could impact properties within Cheshire	Town Manager	B,C,D	x	x	x	x			x		1	3	1	1	3	2	3	2	**15**
Continue to coordinate with neighboring municipalities regarding developments that could impact properties downstream of Cheshire	Town Manager	B,C,D	x	x	x	x			x		1	2	1	1	2	2	1	1	**10**
Petition FEMA to more critically evaluate Letters of Map Amendment and Letters of Map Change Applications to prevent flooding increases	Town Manager	B,C,D	x	x	x	x					1	3	2	3	3	3	3	1	**18**
Update the Town-wide drainage study and continue to update every five years	Public Works	B,C,D	x	x	x	x			x		1	3	3	2	3	3	3	1	**18**
Institute a Town-wide comprehensive catch basin cleaning and maintenance program	Public Works	B,C,D	x	x	x	x					1	3	2	2	3	3	3	1	**17**
Reinstate the Town in FEMA's Community Rating System	Town Manager	B	x	x	x	x					1	3	3	2	3	2	2	1	**16**
Require Subdivision and commercial/industrial permits applications to provide flood data, particularly for parcels along major streams	Planning & Zoning	B	x	x	x	x			x		1	2	3	2	2	3	3	2	**17**
Require new buildings constructed in flood prone areas to be protected to the highest recorded flood level regardless of SFHA	Planning & Zoning	B	x	x	x	x					1, 2	2	2	2	2	3	3	1	**15**
Review Zoning and Subdivision regulations to determine if changes can prevent localized flooding damage	Planning & Zoning	B	x	x	x	x					1	3	3	2	3	3	3	1	**18**
Require that new buildings be designed and graded to shunt drainage away from the building	Planning & Zoning	B	x	x	x	x					1, 2	2	2	3	3	3	3	1	**17**
Use Town two-foot contour maps to develop better regulatory flood maps using FEMA flood elevations; link to Map Mod program	Public Works	B	x	x	x	x					1	2	3	2	2	2	3	1	**15**
Property and Natural Resource Protection																			
Pursue the acquisition of additional open space properties within SFHAs	Town Manager	B,C,D	x	x	x	x			x		2, 3	3	2	2	3	3	3	3	**19**
Selectively pursue conservation objectives listed in the Plan of Conservation and Development, including the creation of greenways	Town Manager	B,C,D	x	x	x	x					3	3	2	2	3	3	2	3	**18**
Continue to regulate development in protected and sensitive areas	Planning & Zoning	A	x	x	x	x	x		x	x	3	2	3	3	2	3	2	3	**18**
Purchase private land in the 100-year floodplain and set it aside as greenways and parks	Town Manager	B,C,D	x	x	x	x					2, 3	3	1	2	3	3	2	3	**17**
Structural Projects																			
Excavate East Sindall Stream to a depth of 30 inches downstream of Allen Avenue to restore flow capacity	Public Works	B	x	x	x				x		4	3	3	3	3	3	3	1	**19**
Consider raising the bridge and increasing the conveyance capacity of the bridge over Honeypot Brook at Blacks Road	Public Works	C	x	x	x				x		4	2	3	3	2	3	3	1	**17**
Support the development of the bypass channel at the Farmington River Canal crossing at Ten Mile River	Public Works	A	x	x	x				x		4	3	3	3	3	3	3	3	**21**
Pursue the Farmington Canal bypass channel flood mitigation project if the development project does not occur	Public Works	B	x	x	x				x		4	3	3	2	3	2	3	3	**19**
Investigate reports of localized flooding problems to determine cause and appropriate solution	Public Works	B,C,D	x	x	x						4	3	3	2	3	3	3	1	**18**
WIND DAMAGE RELATED TO HURRICANES, SUMMER STORMS, AND WINTER STORMS																			
Increase tree limb inspections and maintenance, especially along evacuation routes, and ensure minimum potential for downed power lines	Public Works	B,C,D		x	x	x	x				1	3	2	2	3	3	3	2	**18**
Continue to require that utilities be placed underground in new developments and pursue funding to move them underground in existing areas	Planning & Zoning	A	x	x	x	x			x	x	2	3	2	2	3	3	3	2	**18**
Complete and disseminate evacuation plan to ensure timely evacuation of shelterees from all areas of Cheshire	Police & Fire Dept.	B	x	x	x	x	x		x	x	1, 5	3	3	3	3	3	3	1	**19**
Continue to require compliance with the amended Connecticut Building Code for wind speeds	Planning & Zoning	A		x	x	x					2	2	3	3	3	3	3	1	**18**
Provide for the Building Department to make literature available during the permitting process regarding appropriate design standards	Planning & Zoning	B		x	x	x	x			x	2, 5	3	3	3	3	3	3	1	**19**

Strategies Listed by Primary Report Section for Cheshire	Responsible Department[1]	Schedule A. Ongoing B. 2007-2012 C. 2012-2017 D. 2017-2022	Associated Report Sections								Category 1. Prevention 2. Property Protection 3. Natural Resource Prot. 4. Structural Projects 5. Public Information 6. Emergency Services	STAPLEE Criteria *Good = 3, Average =2, and Poor = 1*							
			Inland Flooding	Hurricanes	Summer Storms and Tornadoes	Winter Storms	Earthquakes	Sinkholes	Dam Failure	Wildfires		Socially acceptable?	Technically feasible?	Administratively workable?	Politically acceptable?	Can it be legally implemented?	Economically beneficial?	Environmentally beneficial?	STAPLEE Sum of Scores
WINTER STORMS																			
Compile and post a final list of plowing routes, prioritizing egress to shelters and critical facilities	Public Works	B				x					5	3	3	3	3	2	3	1	**18**
Provide educational materials to property owners regarding using shutters, storm windows, pipe insulators, and removing snow from flat roofs	Fire Dept.	B		x	x	x					2, 5	3	3	3	3	3	3	1	**19**
Provide educational materials with safety tips and reminders regarding cold weather	Fire Dept.	B				x					1, 5	3	3	3	3	3	3	1	**19**
EARTHQUAKES																			
Consider preventing residential development in areas prone to collapse (on fill material)	Planning & Zoning	B					x	x			1	3	3	3	3	3	3	2	**20**
Consider preventing residential development in areas on or below steep slopes (slopes exceeding 30%)	Planning & Zoning	B					x				1	2	3	3	3	3	3	3	**20**
Continue to require adherence to the state building codes	Planning & Zoning	A		x	x	x	x				1	2	3	3	3	3	3	1	**18**
Consider adding earthquakes to the list of hazards specifically identified in the EOP	Police & Fire Dept.	B					x				1	3	3	3	3	3	3	1	**19**
Ensure that municipal departments have adequate backup facilities (power generation, heat, water, etc.) in case earthquake damage occurs	Public Works	B		x	x	x	x				1	3	2	2	3	2	2	1	**15**
SINKHOLES																			
Improve tracking of settling problems to distinguish mine-related sinkholes from potholes and those caused by failing utilities	Public Works	B						x			1	3	2	3	3	3	3	1	**18**
Apply a categorical classification system to historical complaints in any DPW records to distinguish sinkholes from other types of subsidence	Public Works	B						x			1, 5	3	2	2	3	3	3	1	**17**
Conduct an in-depth study to determine sinkhole-prone areas, including mapping mine workings, determining site-specific threats, and implementing safeguards where possible	Public Works	C						x			1, 4, 5	3	1	2	2	1	1	1	**11**
Require potential developers to review historical documentation during site plan review process for evidence sinkholes could occur	Planning & Zoning	B						x			1	2	3	3	3	3	2	1	**17**
Increase public awareness regarding problem areas and associated potential hazards	Environmental Committee	B						x			5	3	3	3	1	3	1	1	**15**
Amend local zoning ordinances to account for potentially hazardous conditions, including a new Site Plan Review checklist	Planning & Zoning	B	x				x	x	x	x	1	2	3	3	3	3	2	1	**17**
DAM FAILURE																			
Continue to require or conduct regular inspections of all Class C dams and perform or require upkeep and maintenance as needed	Public Works	A	x						x		1, 2, 4	3	3	3	3	3	3	3	**21**
Update the Emergency Operations Plan for the Mixville Pond dam, and prepare a new dam failure analysis if appropriate	Public Works	B	x						x		1, 2, 4	3	3	3	3	3	2	3	**20**
Complete the Mixville Pond dam mitigation report as per DEP request	Public Works	B	x						x		1, 2, 4	3	3	3	3	3	3	3	**21**
Consider implementing Town inspections of Class A, AA, B, and BB dams	Public Works	C	x						x		1, 2, 4	2	3	2	2	1	3	3	**16**
Work with the Connecticut DEP to ensure that the owners of Class C dams have up to date EOPs and Dam Failure Analyses for each dam	Public Works	B	x						x		1, 6	3	3	3	3	3	3	3	**21**
Have copies of the Class C dam EOPs and Dam Failure Analyses on file at the Town Hall for public viewing	Public Works	B	x						x		5	3	3	3	3	3	1	1	**17**
WILDFIRES																			
Regional Water Authority and the Town to extend the public water supply systems into areas requiring water for fire protection	Town Manager	A			x					x	6	3	2	3	3	3	3	2	**19**
Regional Water Authority and the Town to upgrade portions of the system requiring water for fire protection	Town Manager	A			x					x	6	3	2	3	3	3	3	2	**19**
Explore other fire protection solutions when water main extensions are not feasible, such as the use of fire ponds	Public Works / Fire Dept.	A			x					x	6	3	2	3	3	3	3	2	**19**
Continue to promote inter-municipal cooperation in fire-fighting efforts	Fire Dept.	A			x					x	6	3	3	3	3	3	3	3	**21**
Continue to support public outreach programs to increase awareness of forest fire danger and how to use common fire fighting equipment	Fire Dept.	A								x	5	3	3	3	3	3	3	3	**21**
Distribute copies of "Is Your Home Protected from Wildfire Disaster?" booklet in the Building Department	Fire Dept.	B								x	2, 5	3	3	2	3	3	1	3	**18**
Continue to have Police and Fire Departments review subdivision applications to ensure proper access for emergency vehicles	Police & Fire Dept.	A	x	x	x	x	x		x	x	6	3	3	3	3	3	1	3	**19**
Provide outreach programs that include tips on how to properly manage burning and campfires on private property	Fire Dept.	B								x	5	3	3	3	3	3	3	3	**21**
Patrol Town-owned open space and parks to prevent campfires	Police Dept.	B,C,D								x	1, 3	2	2	2	3	3	2	3	**17**
Enforce regulations and permits for open burning	Police Dept.	B,C,D								x	1, 3	2	2	2	3	3	3	3	**18**

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 Cheshire, 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.

COGCNV field notes
Field inspection on May 16, 2006.
Notes typed June 5, 2006
Scott Bighinatti

Connecticut experienced a period of heavy rains from May 12 to the 16, 2006. On May 16, 2006, Jim MacBroom and David Murphy outlined several sites of interest in the Towns of Cheshire and Wolcott and the City of Waterbury that may have experienced flooding in the past. These sites were visited on May 16, 2006 and photographed. The sequence of photography is listed below:

Camera #1:

1. Ten Mile Brook at Route 70, Cheshire, upstream
2. Ten Mile Brook at Route 70, Cheshire, downstream
3. Willow Brook at Cornwall Ave., Cheshire, upstream
4. Willow Brook at Cornwall Ave., Cheshire, downstream
5. Error shot
6. Mill River at Mansion Road, Cheshire, upstream
7. Mill River at Mansion Road, Cheshire, downstream
8. Mill River at Forest Lane, Cheshire, upstream
9. Mill River at Forest Lane, Cheshire, downstream
10. Mill River at Fawn Drive, Cheshire, upstream
11. Mill River at Fawn Drive, Cheshire, downstream
12. Mill River at Cook Hill Rd, Cheshire, upstream
13. Mill River at Cook Hill Rd, Cheshire, downstream
14. Honeypot Brook at East Gate Drive, Cheshire, upstream
15. Honeypot Brook at East Gate Drive, Cheshire, downstream
16. Honeypot Brook at Country Club Rd, Cheshire, upstream
17. Honeypot Brook at Country Club Rd, Cheshire, upstream weir
18. Honeypot Brook at Country Club Rd, Cheshire, downstream
19. Honeypot Brook at Riverside Drive, Cheshire, upstream
20. Honeypot Brook at Riverside Drive, Cheshire, downstream
21. Quinnipiac River at Blacks Rd, Cheshire, upstream
22. Quinnipiac River at Blacks Rd, Cheshire, upstream floodplain
23. Quinnipiac River at Blacks Rd, Cheshire, downstream
24. Quinnipiac River at Quinnipiac Park, Cheshire
25. Quinnipiac River at Route 322, Southington, upstream
26. Quinnipiac River at Route 322, Southington, downstream
27. Ten Mile River at West Johnson Ave., Cheshire, downstream

Camera #2:

1. Ten Mile River at West Johnson Ave., Cheshire, upstream
2. Unnamed Stream at Schoolhouse Rd, Cheshire, upstream
3. Unnamed Stream at Schoolhouse Rd, Cheshire, downstream
4. Unnamed Stream at end of Grandview Court, Cheshire

5. Judd Brook at Knotter Drive, Cheshire, downstream
6. Judd Brook at Knotter Drive, Cheshire, upstream
7. Hitchcock Lake Brook at College Place, Wolcott, upstream
8. Hitchcock Lake Brook at College Place, Wolcott, downstream
9. Todd Lake at Central Ave., Wolcott
10. Lily Brook at Todd Rd, Wolcott, upstream
11. Lily Brook at Todd Rd, Wolcott, downstream (scoured wingwall)
12. Lily Brook at Todd Rd, Wolcott, downstream
13. Scoville Reservoir Lower Dam, Nichols Rd, Wolcott
14. Lily Brook at Woodtick Rd, Wolcott, downstream
15. Lily Brook at Woodtick Rd, Wolcott, upstream
16. Old Tannery Brook at Nutmeg Valley St., Wolcott, upstream
17. Old Tannery Brook at Nutmeg Valley St., Wolcott, downstream
18. Chestnut Hill Reservoir Spillway, Lyman Road, Wolcott
19. Chestnut Hill Reservoir Outflow (Old Tannery Brook), Lyman Road, Wolcott
20. Old Tannery Brook at Tosun Road, Wolcott, upstream #1
21. Old Tannery Brook at Tosun Road, Wolcott, upstream #2
22. Old Tannery Brook at Tosun Road, Wolcott, sliding barricade
23. Old Tannery Brook at Tosun Road, Wolcott, downstream
24. Old Tannery Brook at Nutmeg Valley St., Wolcott, water over road area
25. Mad River at Sharon Road, Waterbury, downstream #1
26. Mad River at Sharon Road, Waterbury, upstream
27. Mad River at Sharon Road, Waterbury, downstream #2

These notes follow the sequence of photography above.

a) Ten Mile Brook at Route 70, Cheshire – The bridge in this area appears more than sufficient for flood flows. The high water mark can be seen in shot 1 and far below the bottom of the bridge. There is riprap upstream and downstream of the bridge to reinforce the banks. There was some evidence of high water downstream bending plants.

b) Willow Brook at Cornwall Avenue, Cheshire – There are three circular culverts under this bridge. The recent rain event filled 60-70% of the culvert at the high water mark.

c) Mill River at Madison Road, Cheshire – This bridge is fairly recent and provides clearance for flood flows. The bridge consists of two rectangular culverts separated by a concrete support. There is a staff gauge on the downstream end of this bridge (visible in picture). Riprap is evident around the sides of the banks near the bridge on both sides.

d) Mill River at Forest Lane, Cheshire – The river here contains lots of sediment. As the upstream channel appears to be more swale than channel, it is probable that the erosion is caused by high water eroding soils that don't typically have flowing water. The existing culvert, although old, appears sufficient.

e) Mill River at Fawn Drive, Cheshire – The river is still heavily sedimented. There is a significant concrete channel between Forest Lane and Fawn Drive to protect the residential neighborhood. The river widens on the downstream side.

f) Mill River at Cook Hill Road, Cheshire – The river has lost its brown, sediment color at this point downstream. This is another twin rectangular culvert with concrete support bridge that is sufficient for flood purposes. The upstream photo depicts the debris that can get caught on the support.

g) Honeypot Brook at East Gate Drive, Cheshire – Twin culverts divert flow under this bridge. The bridge may act as a constriction; any future review of this bridge should include an analysis of its design conveyance.

Honeypot Brook at East Gate Drive (note culverts)

h) Honeypot Brook at Country Club Road, Cheshire – The brook here is flowing slightly overbank. There is a concrete weir on the upstream side of the bridge that is in disrepair but could still possibly be used for stream flow calculations. The bridge appears sufficient to handle moderate flood flows. The property owners downstream have taken great pains to reinforce the channel banks with riprap. Nearby, the wetland at the end of Stony Hill Drive is completely flooded.

Honeypot Brook at Country Club Road (upstream)

Honeypot Brook at Country Club Road (downstream)

i) Unnamed Stream at Riverside Drive, Cheshire – This sizeable stream is swollen with floodwater pouring out of the impoundment located just south of Riverside Drive. The culvert here has riprap upstream to prevent erosion. A wooden bridge spans the stream on the downstream end. The waters here flow directly into the Quinnipiac River, located just a few hundred feet downstream.

j) Quinnipiac River at Blacks Road, Cheshire – The river is very high. Upstream, there are several instances of trees and brush being underwater. The floodplain to the northwest of the bridge is also inundated in places and has a small stream flowing out of it, entering the river just above the bridge. This stream may be due to overbank flow upstream or just from rainwater flowing out of the floodplain. There is further evidence of trees being underwater downstream. Flow was eroding the bank in front of the northeast upstream wingwall.

k) Quinnipiac River at Quinnipiac Park, Cheshire – A sewer manhole was placed here on the bank at some point, but it now acts as an island a few feet into the river. The river is high, but not overbank here. This spot was accessed by walking behind the red wall on the soccer field and walking down the trail to the river.

l) Quinnipiac River at Route 322, Southington/Cheshire – The river here is very high and overbank. Inundation was occurring on both sides of the bridge. The upstream wingwalls on both sides of the stream are underwater. The sides of the banks may need to be reinforced with riprap, but the upstream side is outside of the study area.

m) Ten Mile River at W. Johnson Ave, Cheshire – The river here is very high, practically overbank. There is evidence of inundation upstream.

n) Unnamed Stream at Schoolhouse Rd, Cheshire – This stream is probably very low most of the time, evidenced by the thick brush growing in the channel. At the moment the stream is flowing slowly due to the wetland plants, compared to the faster velocities upstream (see Grandview Court, below). The plants downstream are also inundated, but the bridge appears adequate for the demand.

o) Unnamed Stream at Grandview Court, Cheshire – The stream is impounded slightly by a railroad bridge above this point, and flows rapidly out of that constriction and down the slope at the end of the road. The water is high, but not overbank.

p) Judd Brook at Knotter Drive, Cheshire – Judd Brook flows out of Southington to this point before going through the Cheshire Industrial Park where it joins the Ten Mile River. The river is overbank here, but the culvert appears adequate.

q) Hitchcock Lake Brook at College Place, Wolcott – The high water in Hitchcock Lake is causing this overflow to flow rapidly from the Lake. The bridge appears to be more than adequate and streambed is rocky such that erosion is not an issue.

r) Todd Lake at Central Ave., Wolcott – The floodwaters in Todd Lake have risen to the point of flowing over the road. The water is only 1"-2" inches deep in most of the picture. Reportedly, flooding happens here quite frequently.

Todd Lake at Central Avenue

s) Lily Brook at Todd Rd, Wolcott – The brook is not extremely high. The bridge has a badly scoured wingwall on the downstream side.

t) Scoville Reservoir Lower Dam, Wolcott – The water is flowing over the dam.

u) Lily Brook at Woodtick Road, Wolcott – With the addition of the waters of Finch Brook, Lily Brook has swelled compared to its size at Todd Road. The culvert here is too low to support a flood flow event. The water in the picture is less than one foot from the bottom of the bridge.

v) Old Tannery Brook at Nutmeg Valley St, Wolcott – There was a "road closed" sign up at the site, although the flood waters had receded by the point photos were taken. There is evidence of overbank flow in many areas, and the wetland near the street was still inundated with standing water.

Old Tannery Brook at Nutmeg Valley Street

Old Tannery Brook at Nutmeg Valley Street (note blocked culvert)

w) Chestnut Hill Reservoir Spillway and Outflow, Wolcott - The water in the reservoir was not above the emergency spillway in the photo, but there was evidence of recent water in the spillway. The outflow from the reservoir was flowing slowly.

x) Old Tannery Brook at Tosun Road, Wolcott – The brook is near bankfull in the pictures, but was higher in the near past. The high water mark on the bridge is over a foot higher than where the water is in the picture. A guard rail on the hill near the stream was damaged by what looks like an auto accident. The bending of the guard rail supports produced an opportunity for runoff to erode the side of the hill rather than continuing down the road. This area is prone to inundation.

y) Mad River at Sharon Road, Waterbury – The river here is slightly overbank and very wide. The bridge appears to be a recent construction and appears suitable for handling a sizeable flood event.

COGCNV field notes
Field inspection on June 7, 2006.
Notes typed June 19, 2006.
David Murphy

Connecticut experienced heavy rain on June 7, 2006 due to a spring "nor'easter." This rainfall event occurred only five days after a powerful storm caused flooding and landslides in the City of Waterbury. Thus, sites in Cheshire, Wolcott, and Waterbury were observed on June 7 to check for potential flooding and/or continued landslide activity. Notes from the May 16, 2006 inspections were used to guide the observations in Cheshire and Wolcott. The June 4, 2006 article in the *Waterbury Republican* was used to guide observations in Waterbury.

Photographs:

1. "Water Over Road" signs on Sandbank Road in Cheshire.
2. Marion Road in Southington (on the way to Wolcott); watercourse flowing over road.
3. Todd Lake at Central Avenue in Wolcott.
4. Mad River at Garthwait Road, Wolcott; note riprap at bend in river.
5. Condominiums at northwest corner of Mad River and Sharon Road in Waterbury.
6. River's Edge Apartments at southeast corner of Mad River and Sharon Road in Waterbury.
7. Same as #6
8. Facing south on Charles Street near 4th Street in Waterbury.
9. Damage at 5th Street and Greenmount in Waterbury.
10. Facing east on 5ht Street from the location of damage.
11. Facing down Highview toward Highland in Waterbury.
12. Jersey Road near Pearl Lake Road.
13. Jersey Road near Pearl Lake Road.
14. Jersey Road near Pearl Lake Road.
15. Jersey Road near Pearl Lake Road.
16. Jersey Road near Pearl Lake Road.
17. East Mountain Road.
18. East Mountain Road.
19. East Mountain Road.
20. East Mountain Road.

These notes follow the sequence of photography above.

a) Sandbank Road, Cheshire – Motorists are warned about shallow pools of water on the road by signs that read "Water Over Road" (Photo #1).

1. Warning sign on Sandbank Road in Cheshire

b) Todd Lake at Central Avenue, Wolcott – This location was inspected on May 16, but the water level in the lake is slightly lower and flooding of the road is not occurring (Photo #3).

c) Mad River parallel to Garthwait Road, Wolcott – An older neighborhood lies between the road and the river. Some of the homes are in the floodplain, and some backyards appeared to be partly flooded. The most upstream building along the road lies at a bend in the river (Photo #4) where riprap has been used to control erosion.

4. Mad River near an older residential area in Wolcott

d) Mad River at Sharon Road, Waterbury – Condominiums and apartments are clustered in the floodplain of the Mad River upstream and downstream of Sharon Road. The condos at the northwest corner of the river and the road lie several feet above the river elevation (Photo #5). The condos at the northeast corner of the river are similar in elevation and layout. The large apartment complex (River's Edge) at the southeast corner of the river and the road has expansive common areas that were partly underwater, and some of the paved areas were close to the water elevation, although some of the building appear to be at least ten feet higher than the water elevation (Photos #6, 7). These residential areas reportedly have a history of flooding.

7. Minor flooding at apartment complex along Mad River

e) Areas west of downtown Waterbury that flooded on June 2, 2006 were inspected. Damage to a street near the hospital was viewed. Riverside Street was then followed to Charles Street (at the foot of 4th and 5th Streets) where flooding occurred. This area (Photo #8) is at the base of a very steep hillside and is shaped like a trough due to the location of Route 8. It is easy to see how a rain event that exceeded the storm drainage capacity could cause rapid flooding.

8. Charles Street at base of 4th Street

5th Street was followed uphill to view the sinkhole/pothole damage from June 2 (Photos #9, 10) where Bank Street, 5th Street, and Greenmount Terrace intersect. This neighborhood was exceedingly difficult to navigate due to the damage, slopes, narrow streets, one-way streets and location of Route 8, which together cause conditions that are contradictory to hazard mitigation.

9. Damage to 5th Street & Bank Street

Eventually Highland Avenue was reached, and the stretch between Highview and Nichols was viewed. Evidence of storm damage was observed. However, it appears that recent construction has been underway in this area, so it was difficult to separate construction impacts from storm impacts (Photo #11, for example).

f) While following Pearl Lake Road back to Interstate 84, two areas of damage were "discovered" that had not been reported in the June 4 newspaper. The first of these involves Jersey Street near Hopeville Pond Brook. An excessive amount of water was viewed flowing down along Jersey Street toward, and into, the brook (Photos #12 through 16). The flow was sufficiently strong that asphalt damage was occurring. The water was originating from a catch basin. A resident remarked that it was a brook that begins in the Town of Naugatuck and is piped underground. It is possible that the brook culvert was clogged and the water was escaping to the next-nearest outlet (the catch basin). The resulting condition was quite hazardous.

12. Water discharging from stormwater catch basin on Jersey Street

14. Water flowing down Jersey Street

g) The second area of damage involves East Mountain Road. While approaching the end of the road from the west along Pearl Lake Road, an excessive amount of water was observed flowing downhill along the side of Pearl Lake Road. This water was flowing from the north end of East Mountain Road, and the road was closed with a barricade. A brief reconnaissance of the road was undertaken, and a severe condition was observed where a landslide/gully had caused the road to fail (Photos #17 through 20). Potholes and sinkholes were scattered in various nearby locations. While this area is not within a mapped floodplain or floodway, it appears that a small watercourse flowing from the northeast has caused this damage.

17. Northwest end of East Mountain Road (note flowing water)

20. Damaged section of East Mountain Road

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 CHESHIRE
Council of Governments Central Naugatuck Valley
Initial Data Collection Meeting
July 25, 2006

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
- Jack Casner, Fire Chief, Cheshire Fire Department
- Mark Cunningham, Cheshire Public Works
- Lisa Murphy, Cheshire Planning & Zoning

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

David briefly 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.

III. Discussion of Hazard Mitigation Procedures in Effect & Problem Areas

A. Emergency Response Capabilities & Evacuation Routes

Shelters – The Senior Center is the primary shelter, and Cheshire High School is the secondary shelter. The Town is in the process of revamping evacuation routes. The Police and Fire Departments staff the shelters.

Evacuation Plan – Deputy Chief of Police has the current evacuation routes.

Emergency Operations Plan – only 10-20% of population will relocate in case of power outage.

Virginia says CNV Region is looking into "Reverse 911". They are waiting for a list of approved vendors.

Cheshire has GPS capabilities to locate incoming cell phone calls and "Enhanced 911".

B. Zoning and Subdivision Regulations

Cul-de-Sacs in new developments are discouraged. Cheshire requires a 50-ft right of way at end of dead end streets. All dead end roads can be no longer than 1700-1800' in length. All new roads must have less than 10% grade, and if they can connect through to an existing road they will be connected on both ends.

The Police and Fire Departments review new subdivision plans for safety and access concerns at monthly meetings.

Cheshire has no driveway width requirements. The Town doesn't like driveway gates or gated subdivisions. No law against them, but are reviewed and discouraged on a case by case basis.

All utilities in new subdivisions are underground. An estimated 40% of residential units in town are served by underground utilities.

Building Inspector, Burt Schiroli (spelling?), is the enforcement officer of permit regulations. Not all regulations get enforced to the fullest.

C. Roadways

In general, culverts and bridges have been operating as necessary. The clearing of culverts and bridges is not performed regularly, but rather on an "as-needed" basis.

Tree Maintenance – The town will approach residents on a case by case basis if branches look hazardous. Otherwise, it only performs roadside maintenance, and CL&P performs trimming near power lines as well.

Plowing Routes – Main roads are plowed first, then smaller roads. Town has a partial written policy (George) with 13 routes, this could be improved. The state plows Routes 10, 42, 68, and 70.

D. Noted Problem Areas

1. Blacks Road (actually Allen Avenue Ext?) – a structural failure (Nuns Dam) on a Quinnipiac Tributary from Meriden recently caused flooding in a new subdivision.
2. North Brooksvale Road – 1' of water during recent storms
3. Brooksvale Stream floods at South Brooksvale Road during heavy rain events
4. Mixville Dam – DEP wants a mitigation study done (Class C dam)

5. Hamden Town Line (flooding)
6. Water crossing road – ice problem in winter and standing water in summer on Route 70 at Applewood or Peachtree Road. Water is from nearby "Greenhouses"
7. Icing on Cook Hill Road. Not a summer flooding problem.
8. Home gets flooded on backside of condominiums off Jarvis Street. The home does not have a basement, and so cannot make an insurance claim.
9. Blacks Road at Quinnipiac River (flooding)
10. Quinnipiac River (possible flooding)
11. Another Quinnipiac River (flooding)
12. Peck Lane – upper part (flooding)
13. Drainage on Route 42 – State may be fixing this area in 2009. Culverts are insufficient
14. Jinny Hill area mines (sinkholes)

Mount Sanford Road Dam (Cheshire/Hamden Boundary) is "leaking".

Peck Lane, West Johnson Avenue, and Dickerman Road are "ok"

Route 42 at King Road has icing issues. There is a plan to rebuild this road around 2009.

Department of Public Works handles complaints, which are logged into excel. They are meeting with a database company today ("I-Works"). Complaints are assigned a number and are responded to. Many are not necessary to check in regards to hazard mitigation.

Suzanne from Inland Wetlands Commissions is a good person to contact. She has responded to complaints and has knowledge of problem areas. *Need to call Suzanne.

IV. Acquisitions

- Copy of Zoning Regulations: Adopted April 8, 1970, last amended May 22, 2006.
- Copy of Subdivision Regulations: Adopted December 20, 1971, last amended May 27, 2003.
- Copy of Inland Wetlands and Watercourses Regulations: Adopted June 24, 1974, last amended May 17, 2005.
- Copy of Plan of Conservation and Development: Adopted 1993, last amended October 28th, 2002.
- Sam will talk to Police Department regarding evacuation routes.
- Jack will provide Emergency Operations Plan via email. (Emailed 11/29/06).

Meeting Minutes

NATURAL HAZARD MITIGATION PLAN FOR CHESHIRE
Council of Governments Central Naugatuck Valley
Second Data Collection Meeting
September 22, 2006

I. Welcome & Introductions

The following individuals attended the data collection meeting:

- David Murphy, P.E., Milone & MacBroom, Inc. (MMI)
- Scott Bighinatti, Milone & MacBroom, Inc. (MMI)
- Virginia Mason, Council of Governments Central Naugatuck Valley
- Suzanne Simone, Environmental Planner, Town of Cheshire

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

David briefly 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 the need to identify types of projects took place intermittently throughout the meeting.

III. Discussion of Hazard Mitigation Procedures in Effect & Problem Areas

Suzanne discussed her previous involvement with Planning and Zoning and her role as the Town Environmental Planner. Most of the complaints the town receives in regards to wetlands, watercourses, and drainage issues involve:

- (Most recently) Nun's Dam failure in Meriden, which caused flooding downstream in Cheshire near Allen Avenue
- Incorrect procedures on construction sites in regards to sedimentation and erosion controls
- Erosion due to poor drainage

Most of the wetlands violations in town are matters of encroachment, which occur due to either ignorance or disregard of the buffer zones (especially by new property owners). Wetlands complaints are tracked by paper filing. The 50' wetland boundary is to be posted both on land records and with permanent markers on the site, and while technically this is an "upland review" area it is generally used by the Commission as a "non-encroachment" area. Sometimes wetland areas have a review area of 100'. There are no moderate to severe drainage issues in Town involving wetlands, but there are dumping issues in several of the wetlands in Town (such as on Peck Lane).

The Inland Wetlands Commission's goals are primarily regulatory; the Environmental Committee's goals are education and outreach. Suzanne's goal is to help facilitate these groups to work together in regards to community outreach and education programs, such as education on the effects of fertilizer on aquifers. The Environmental Committee distributed water quality information at the Cheshire Fall Festival in September.

IV. Acquisitions

- Scott will meet with Suzanne on Monday, September 25th at 10 A.M. to look at drainage complaints.

COGCNV field notes
Field inspection on September 22, 2006.
Notes typed September 25, 2006.
Scott Bighinatti

Sites on the Meriden / Cheshire municipal boundary were investigated to visualize information provided about the Nuns Dam breach which flooded a Cheshire subdivision. Based on field observations, Nuns Dam is located on a small impoundment on Finch Avenue in Meriden just south of Beverly Drive. The dam is located on private property and within a cover of thick vegetation. Photographs were taken of the unnamed stream which passes through Nuns Dam at two locations, shown below.

Photographs:

19. Site 1: Unnamed stream at 815 Allen Avenue, Cheshire (downstream).
20. Site 1: Unnamed stream at 830 Allen Avenue, Cheshire (upstream).
21. Site 2: Unnamed stream at Finch Avenue, Meriden (upstream).
22. Site 2: Unnamed stream at Finch Avenue, Meriden (downstream).

These notes follow the sequence of photography above.

Site 1: The unnamed stream flows through a good-sized culvert underneath Allen Avenue in Cheshire. There is clear streambank erosion and cobbles left behind from higher flows in the stream bed. The house at 815 Allen Avenue has a large pile of gravel at the end of the gravel driveway, but it is for an undetermined use. The upstream side has a very large culvert in the yard of 830 Allen Avenue. There is some evidence of higher flows from the deposition of cobbles.

Site 2: The unnamed stream flows through a culvert underneath Finch Avenue in Meriden. This culvert is immediately downstream of the dam. There is evidence of severe bank scour on the downstream end of this culvert.

Nuns Dam: There is a marked earthwork buildup visible from the Finch Avenue that marks the side of the impoundment. This site is heavily vegetated but is clearly filled with water when viewed on an aerial photo. The current state of the dam is unknown.

Natural Hazard Pre-Disaster Mitigation Plan Cheshire, Connecticut

Presented by:

David Murphy, P.E. – Associate
Milone & MacBroom, Inc.

Samuel Eisenbeiser, Senior Planner
Fitzgerald & Halliday, Inc.

October 18, 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

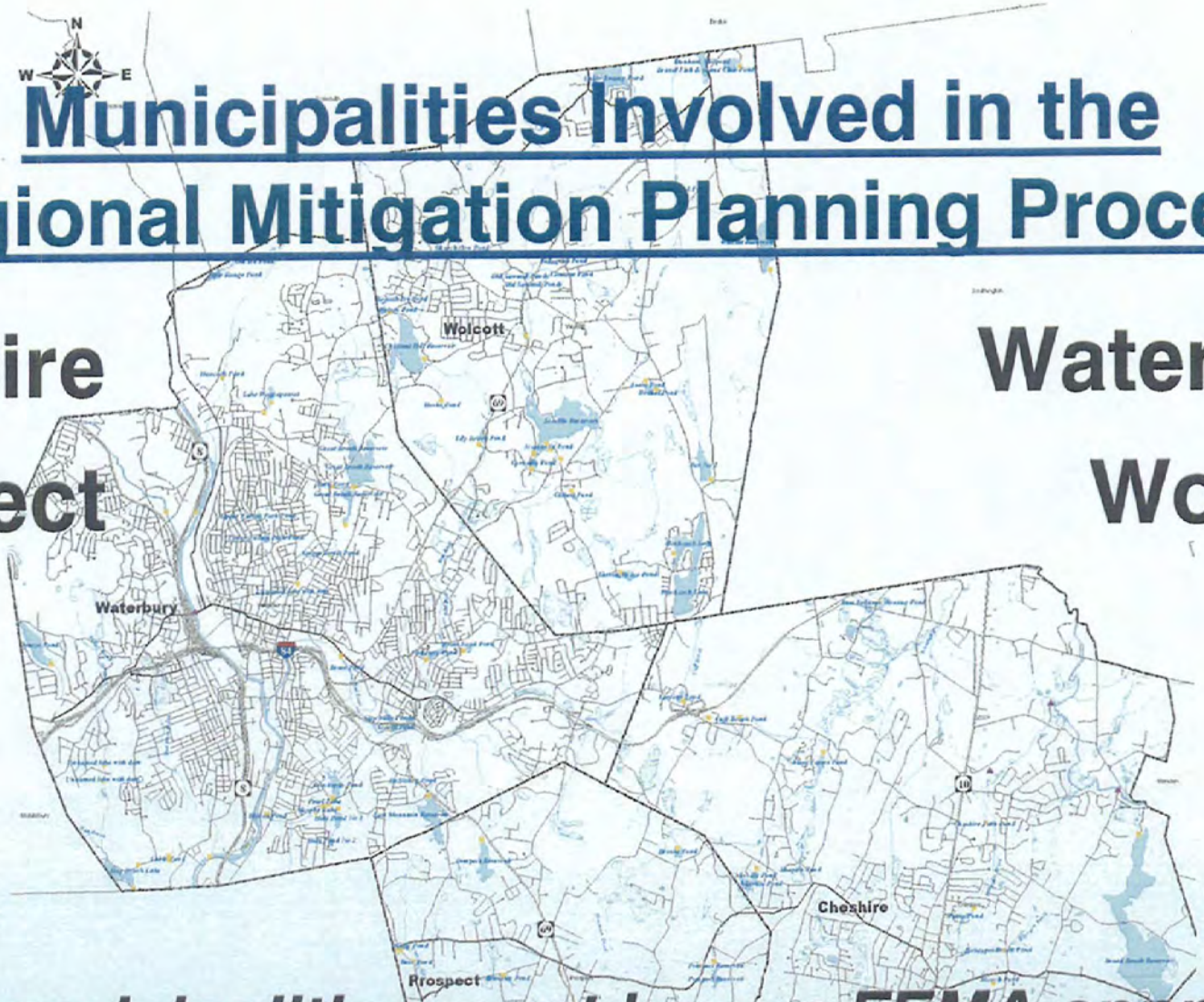
Municipalities Involved in the Regional Mitigation Planning Process

Cheshire

Prospect

Waterbury

Wolcott



Local municipalities must have a FEMA approved Hazard Mitigation Plan in place to receive federal grant funds for hazard mitigation projects.

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

What is a Natural Hazard ?

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

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

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 and along the shoreline

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.)

Components of Hazard Mitigation Planning Process

- Identify natural hazards that could occur in Cheshire
- 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

Cheshire's Critical Facilities

- Emergency Services – Police, Fire, Ambulance
- Municipal Facilities – Town Hall, Municipal Buildings, Department of Public Works
- Senior Center (Primary Shelter
- High School (Secondary Shelter)

Cheshire Fire Headquarters

Cheshire Town Hall

Cheshire's Critical Facilities

- Health Care and Assisted Living
- Water Utilities – Tanks, Pumping Stations
- Wastewater Utilities – Pumping Stations, Treatment Plants
- Transportation

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

Riprap reinforcement of channel banks on Riverside Drive

Natural Hazards Facing Cheshire

- Inland flooding
- Winter storms, nor'easters, heavy snow, blizzards, ice storms
- Hurricanes
- Summer storms, tornadoes, thunderstorms, lightning,
- Dam failure
- Wildfires
- Sinkholes

Flooding on the Quinnipiac River

Hurricanes

- Winds
- Heavy rain / flooding

1955 Flooding

Summer Storms and Tornadoes

Lightning over Boston

Tornado in KS

- Heavy wind / tornadoes / downbursts
- Lightning
- Heavy rain
- Hail

Flooding in MN

Winter Storms

- Blizzards and nor'easters
- Heavy snow and drifts
- Freezing rain / ice

Blizzard of 1978 - CT

Dam Failure

- Caused by severe rains or earthquakes
- Possibility of loss of life and millions of dollars in property damage

Unnamed Stream at Allen avenue

Wildfires

- Cheshire has low to moderate risk of wildfires
- Fire
- Heat
- Smoke

Photo courtesy of FEMA

Earthquakes

- Cheshire is in an area of minor seismic activity
- Can cause dam failure
  - Shaking
  - Liquefaction
  - Secondary

    (Slides / Slumps)

Photos courtesy of FEMA

Area-Specific Problems

- Flooding along streams and rivers
- Flooding caused by poor drainage
- Dam issues
- Snow and ice problem areas
- "Sinkholes"

Flooding Along Streams and Rivers

- Quinnipiac River near Blacks Road, East Johnson Avenue
- Brooksvale Stream at South Brooksvale Road
- Mount Sanford Brook at South Brooksvale Road
- Ten Mile River at Peck Lane
- Home near Ten Mile River near Jarvis Street
- Unnamed Stream at Schoolhouse Road

Quinnipiac River at Blacks Road

Flooding Caused by Poor Drainage

- Route 42 near Richards Corner
- Unnamed Stream at Sandbank Road
- South Meriden Road (Route 70) near Peach Tree Court (greenhouses)

Flooding on Sandbank Road

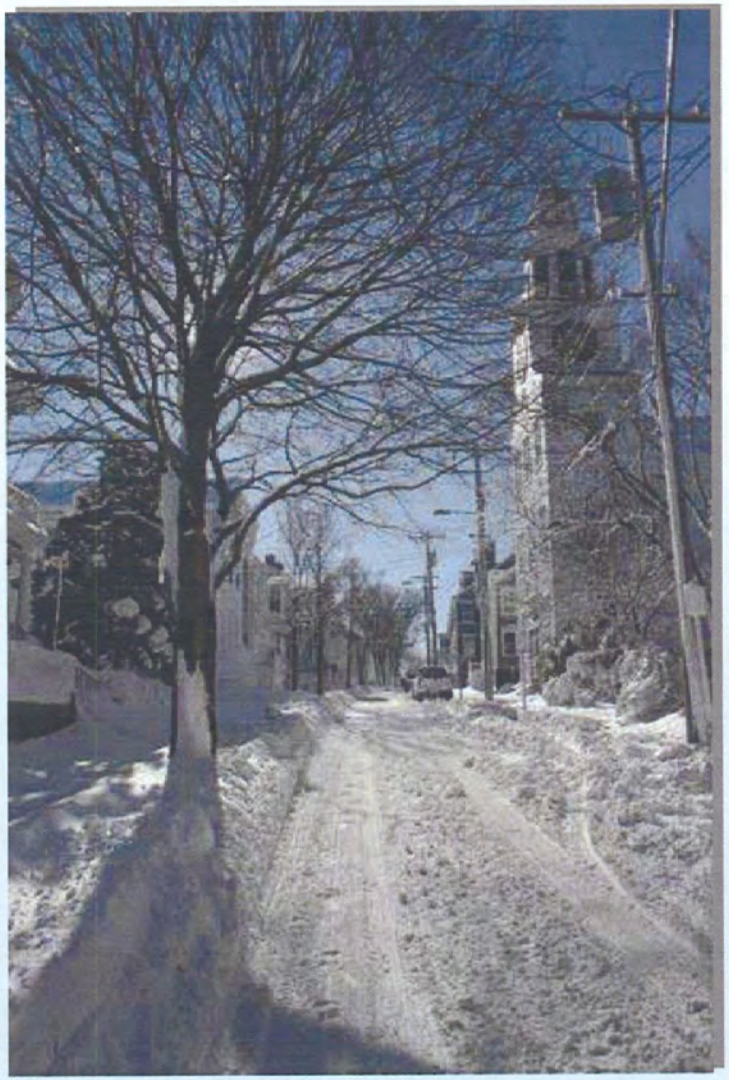
Dam Issues

- Nuns dam breach in Meriden
- Mixville dam mitigation
- Mount Sanford Road dam leakage

Unnamed Stream at Allen avenue

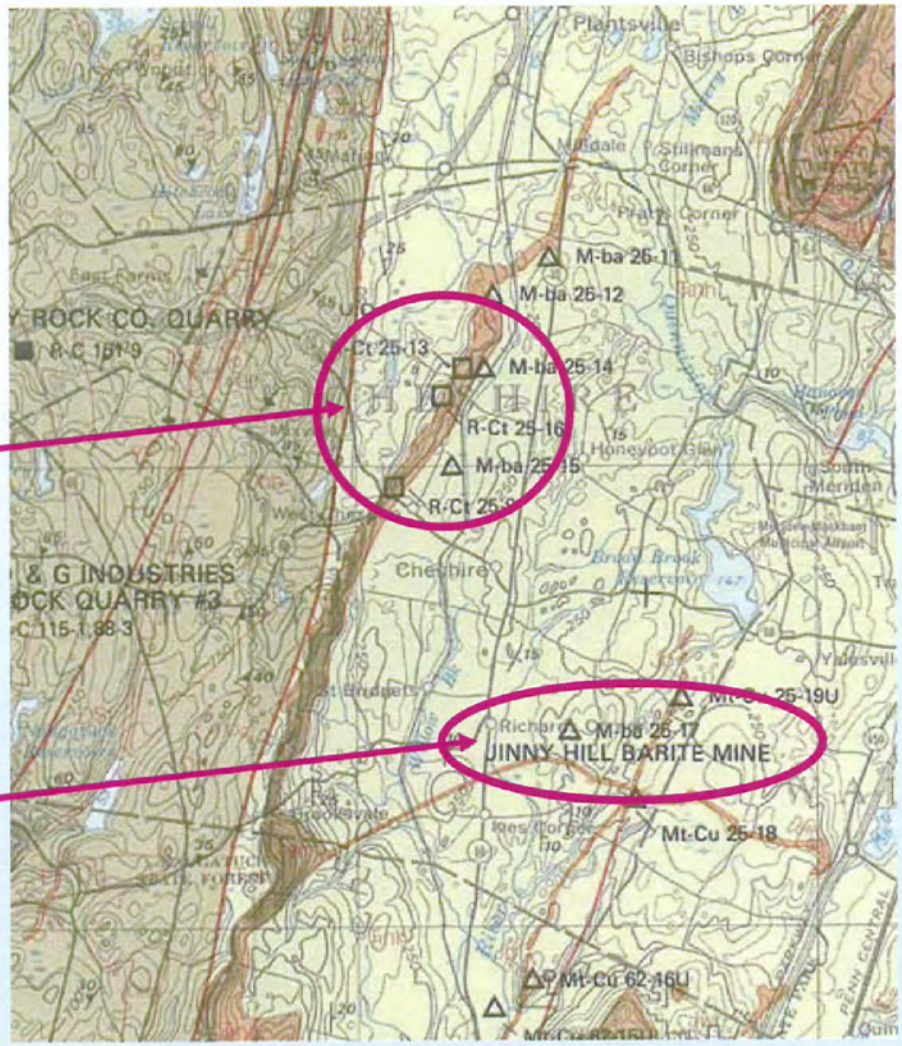
Snow and Ice

- Cook Hill Road
- Route 42 at King Road



Sinkholes

- Jinny Hill
- Sheridan Drive



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

Questions and Additions

Meeting Minutes

NATURAL HAZARD MITIGATION PLAN FOR CHESHIRE
Council of Governments Central Naugatuck Valley

PUBLIC INFORMATION MEETING – OCTOBER 18, 2006

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
- ❑ Jack Casner, Cheshire Fire Department
- ❑ Suzanne Simone, Environmental Planner, Town of Cheshire
- ❑ Bob Deasy, Environmental Commission
- ❑ Matt Levine, Environmental Commission
- ❑ Anna-Lynn Mancini, Environmental Commission
- ❑ Roland Roy, Environmental Commission
- ❑ Bonnie Mayer, Environmental Commission
- ❑ ___ Cassidy, Environmental Commission
- ❑ Tali Maidelis, Environmental Commission

Virginia introduced the project team and the project, explaining the COG's role in the project as well.

II. Power Point: "Natural Hazard Pre-Disaster Mitigation Plan, Cheshire, Connecticut"

David and Sam presented the power point slideshow *(copy to be appended to notes during Plan compilation).*

III. Discussion

Two hazards were discussed after the presentation – flooding and mine sinkholes. The members of the commission believes that these are the most significant issues facing the Town that should be addressed in the Plan, and could be eligible for pre-disaster mitigation funds.

Sinking and Settling Above the Mines

Matt Levine explained that throughout his involvement with the mine issue (through the environmental commission and also through his employer), a consistent problem has been a lack of funding to deal with the sinking and settling hazards. Based on the presentation provided at this meeting, he believes that this hazard should be included in the plan and that

FEMA pre-disaster mitigation funds are likely the most appropriate for dealing with the mine hazards. Other members of the commission were in agreement.

David indicated that it has been difficult to obtain information about the exact nature and locations of the sinking and settling. Suzanne indicated that the Town Manager's office is the clearinghouse for all mine-related reports. Another member of the commission indicated that the Cheshire Herald also might have information because the newspaper has been reporting about the issue for quite some time. The commission members agreed that the more significant problem at this point is the Peck Mountain mine and the affected homes on and near Sheridan Drive, rather than the Jinny Hill mine. Everyone agreed that the mine settling issue needs a closer look, and now is the time for that to take place.

Flooding Downstream of Meriden in the Northeast Corner of Cheshire

Similar to the mine hazards, David indicated that it has been difficult to obtain information about the exact nature of the flooding problem north and east of the Quinnipiac River near the Meriden city line. To date, the project team has heard about recent flooding of homes in this area, and has also heard about a dam breach (with the dam located in Meriden) that could have worsened the problem. A culvert has been replaced or repaired several times *(see map for location).*

Members of the commission indicated that the crux of the problem is development in the City of Meriden in the headwaters of the drainage basin. Two streams appear to flow from this area into the affected neighborhood in Cheshire. One of the commission members believes that Milone & MacBroom conducted a study of this area; David indicated that this might have been a part of the Town-wide drainage study completed several years ago. The Meriden Water Department has reportedly been involved with the runoff/flooding problem recently, and may be a good place to begin looking for information on the Meriden side.

Tenmile River

Flooding along the Tenmile River was discussed briefly. In the northern portion of the river corridor near the commercial/industrial park, one member of the commission has seen flooding across the floodplain.

COGCNV Data Collection Notes
October 19, 2006
Scott Bighinatti

Suzanne Simone (Environmental Planner, Town of Cheshire) informed David Murphy of the existence and availability to review the Cheshire Barite Mines file and the Sindell Drive Study located at the Planning and Zoning office in the Cheshire Town Hall. A copy was obtained of the Sindell Drive Study dated October 1993. The mine file was in partial disarray and contained no original maps and only copies of 8.5" x 11" maps, which would prove useful for locating sinkhole-prone areas of Cheshire.

The mine file contained several meeting minutes of the Solid Waste Commission in 1994 where sinkholes were discussed in terms of available information, probability of occurrence, liability of the town vs. the individual property owner, and possible courses of action. It was in these files that it was discovered that the original maps produced in the 1993 Town-wide study were missing. Other elements in the mine file included:

- Fritts, Crawford E. 1962. The Barite Mines of Cheshire. Cheshire Historical Society. This document is not an original. It is missing pages and the maps contained within are poor. This document is on-sale from the Cheshire Historical Society for $10.00, so a copy will be obtained for the firm. According to Thorson and Brick's 1996 report, this document is not entirely accurate in terms of where mine dumps, tailings, and shafts formerly existed.

- Fejes, A. J. et. al., 1985. Subsidence Information for Underground Mines – Literature Assessment and Annotated Bibliography. Department of the Interior, Bureau of Mines, Information Circular 9007. This document is mostly a bibliography of subsidence studies.

- Hedberg, Ronald M. 1992. Nature and Extent of 19th Century Mining Operations, William Peck Barite Mine, Skabeikis Property, Cheshire, CT. Robert L. Jones & Associates. This engineering-style report was done as on a subdivision near Chestnut street because mining tunnels were found during excavation. It contained a section on the history of sinkholes in the Peck Mountain Area (copied) with a crude map (copied). This map could be reproduced, crudely, in GIS. The Town of Cheshire filled the tunnels on the Skabeikis area in 1993 (after this study), and the area is considered structurally sound.

- Jones, Robert L., Hedberg, Ronald M. 1993. Cheshire Town-wide Investigation of Mines and Adits. Robert L. Jones & Associates. This study didn't really provide any different information, but the map that is missing would be useful.

- Thorson, Robert M., Brick, Greg A. 1996. Landscape Archeology of the Jinny Hill Mining District, Town of Cheshire, CT. Department of Geology and Geophysics, University of Connecticut (Storrs). A solid report of the Jinny Hill area, but no maps of sinkholes. In general, the sinkholes in this area appear to be the old mining shafts. The

tunnels are so deep at Jinny Hill that the bedrock above is solid enough to maintain the tunnel. (On the other hand, the Peck Mountain mines are shallow, and any overlying bedrock material is weaker, leading to more sinkholes.) Sinkholes in the Jinny Hill area seem to occur on previously filled shafts due to subsidence of the fill material. This reduces the hazard in this area since the sinkholes are better known and repetitive.

- Brick, Greg A. 1997. Geoarcheology of the Jinny Hill Mines, Cheshire, CT. M.S. thesis. Department of Geology and Geophysics, University of Connecticut (Storrs). This thesis doesn't say anything different from the 1996 report, does not map any sinkholes, has no information about Peck Mountain, and is incomplete in the file.

- Assorted Town Memorandums on the subject. A letter from Diane Visconti to Town Attorney John Knott is in the file, but his response was not found. According to the "Baker files", Knott sent a letter to the Town saying that the Town should map out the problem areas and set up a type of notification system.

A stop in the Public Works Department to obtain information about the Nun's Dam issue revealed the town's printed storm drainage maps (that are available to the public) to be out of date. The drainage maps are on 1975 topographic maps and do not have any of the newer subdivisions. The file given to me by the secretary may not have been the most updated file.

The stop in the PWD did result in a later phone call from Joseph Michaelangelo to discuss the Nun's Dam area. The flooding issues in the North Pond Road / Troutbrook Drive area and the Allen Avenue area are unrelated and coincidential. A new subdivision in Meriden (partially on the 2004 aerial photos as a construction site) had a detention pond that failed during the June 2nd storm. This is believed to be Westfort Road and Debbie Drive area. This sent a torrent of water down "East Sindall Stream," which caused Nun's Dam to fail. Nun's Dam is privately owned and was not created to mitigate floods. This torrent continued downstream, washing debris and rocks from the area between Finch Avenue and Allen Court. This area was covered in outwash following the storm. The debris piled up on the culvert running under Allen Court, causing the road to flood. Downstream near Allen Avenue, the gradient is milder, and the flow began to slow, resulting in the deposition of large cobbles and boulders visible in the pictures taken 9-22-06. A large section of this area was still covered in outwash from the high water.

Over on Northpond Road, Mr. Michaelangelo believes that the eastern branch of "West Sindall Stream" was altered and that there is only one culvert under North Pond Road. This alteration resulted in the stream running parallel to the road, east to west, at a depth of about 18" below the road surface. The intense rain event on June 2nd caused this stream to overtop the road, resulting in the flooding reports heard about in other meetings. West Sindall Stream flows downstream through a site known as the Carriage House Development that Darin Overton of MMI is working on, so Darin may have more information about West Sindall Stream in that area. Mr. Michaelangelo believes that excavating a 400' section of the east branch where it runs parallel to North Pond Road will eliminate the flooding risk by lowering the level of the stream. This section doesn't appear to be particularly hazardous.

COGCNV field notes
Field inspection on October 28, 2006.
Notes typed October 30, 2006.
David Murphy

Connecticut experienced a relatively significant rainstorm from October 27 (late) through October 28, 2006. Rainfall totals through the afternoon of October 28 were on the order of two inches state-wide. Although flood warnings were not issued for the state, the storm provided an opportunity to check additional sites in Cheshire and Wolcott that had been discussed at meetings with municipal officials. Sites were checked for potential flooding during the later part of the storm on October 28.

- Northeast Cheshire Flood Area – Given the recent discussions of this area with Suzanne from the Planning Department, and during the public information meeting, it was important to observe the problems during a storm event. The area was approached from Finch Avenue in Meriden, driving south and west along Allen Avenue. The following roads were also checked: Allen Court, Smith Place, Worden Circle, Cheshire Street, Sindall Road, Marks Place, North Pond Road, and Trout Brook Road. Out-of-bank conditions were not observed at Finch Avenue, North Pond Road, and Trout Brook Road. However, out-of-bank conditions and near-flooding were observed at Allen Avenue (photos 1-5). In particular, high flows of the easterly stream were approaching driveways at Allen Avenue (photos 2-3).


1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3

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5

Flows were high but not overbank at Sindall Road (photos 6-7).

6

7

Drainage systems were not observed anywhere along Cheshire Street, but the area is very flat. Large areas of ponded water were observed in the yards of homes on the east side of Cheshire Street across from Blacks Road (photos 8-9). This appears to be nuisance flooding without any serious effects.

8

9

- Honeypot Brook at Blacks Road – While leaving the northeast Cheshire area, Honeypot Brook was crossed on Blacks Road. Of particular interest in this area is that the culvert elevation causes a wide backwater condition on the south (upstream) side of the road. The

water elevation is just below the street. Any additional flow here could cause flooding of the roadway (photos 10-12).

10

11

12

- Cheshire Industrial Park – On the way to Wolcott, a reconnaissance of the industrial park was undertaken based on reports of water all around the Bloomingdale's facility during significant storms. The industrial park is located where several streams come together in the floodplain of the Tenmile River. Nevertheless, the large amounts of open space appear to be handling the water. Street and parking lot flooding was not observed. A grassy area on the east side of Knotter Drive was flooded and a stream appeared to be overbank (no photos).

- Southeast Wolcott (322 and Meriden Road) – The area of Maple Avenue and Grove Avenue reportedly floods during rainstorms due to poor drainage. No flooding was observed.

- Lindsley Brook, Wolcott – Yards in the stream corridor reportedly flood during storms. The area was observed from Lindsley Drive at Woodtick Road, all the way to Bound Line Road. Few homes are located on the east side of Woodtick Road, north of Center Street/Route 322. The vulnerability of this area is generally very low.

  The potential for driveway flooding was observed just upstream of Lindsley Drive (photo 18) with the culvert completely submerged. Flows were very high but overbank conditions were not occurring anywhere, including at Lindsley Drive (photo 17) and at Center Street (photos 13 and 14).

13

14

17

18

An impoundment was high and encroaching on a yard downstream of Center Street (photos 15 and 16).

15

16

South of Center Street/Route 322, where the brook is on the east side of the road, numerous homeowners must cross the brook on bridges and culverts. Thus, flooding could affect access to individual lots during very severe storms, so the vulnerability is somewhat higher. Still, no flooding was observed during this visit.

- Frisbie School, Wolcott – The fields at the school are indeed in a low area with only one apparent point of drainage (to the south). However, no flooding was observed. It is likely that the problem here is very temporary, occurring during (but not after) downpours.

- Townline Road, Nutmeg Valley Road, and Tosun Road in Southwest Wolcott – This area was previously observed on May 16, 2006. Since that date, meetings with municipal officials have shed additional light on the nature of the problem in the area. Specifically, residents on Tosun Road can become isolated because Tosun Road Extension and Nutmeg Valley Road are industrial park roads located in the floodplain of the Mad River and Old Tannery Brook. At the time of the visit, the flow of Old Tannery Brook was higher than it was on May 16, with the two concrete culverts at Nutmeg Valley Road operating and the water elevation close to the road elevation (photos 19-21). Two similar concrete culverts are also located just downstream at Town Line Road, but the water elevation is lower relative to the road. A drainage ditch along the north side of Town Line Road was full but the gradient is very flat. An area of ponded water at its headwaters (photo 22) is basically at the road elevation.


19


20


21


22

Photographs:

1. Eastern brook at Allen Avenue, Cheshire
2. Eastern brook at Allen Avenue, Cheshire
3. Eastern brook at Allen Avenue, Cheshire
4. Western brook at Allen Avenue, Cheshire
5. Western brook at Allen Avenue, Cheshire
6. Combined brook at Sindall Road, Cheshire
7. Combined brook at Sindall Road, Cheshire
8. Area of yard flooding east of Cheshire Street across from Blacks Road, Cheshire
9. Area of yard flooding east of Cheshire Street across from Blacks Road, Cheshire
10. Honeypot Brook at Blacks Road, Cheshire
11. Honeypot Brook at Blacks Road, Cheshire
12. Honeypot Brook at Blacks Road, Cheshire
13. Lindsley Brook at Center Street, Wolcott
14. Lindsley Brook at Center Street, Wolcott
15. Lindsley Brook downstream of Center Street, Wolcott
16. Lindsley Brook downstream of Center Street, Wolcott
17. Tributary of Lindsley Brook at Lindsley Drive, Wolcott
18. Tributary of Lindsley Brook slightly upstream of Lindsley Drive, Wolcott
19. Old Tannery Brook at Nutmeg Valley Road, Wolcott
20. Old Tannery Brook at Nutmeg Valley Road, Wolcott
21. Old Tannery Brook at Nutmeg Valley Road, Wolcott
22. Corner of Nutmeg Valley Road and Town Line Road (ponding), Wolcott

APPENDIX C
RECORD OF MUNICIPAL ADOPTION

ERRATA TO BE PRESENTED APRIL 22, 2008
Natural Hazard Pre-Disaster Mitigation Plan
Town of Cheshire, Connecticut

Section 1

Page 1-8 First full paragraph, "highest ~~scoring~~ scores ~~is~~ are determined..."
Page 1-8 End of first full paragraph, "with lower ~~scoring~~ scores..."

Section 2

Page 2-13 First paragraph, "At the ~~time~~ location ~~that~~ where the Quinnipiac River..."

Section 10

Page 10-7 First paragraph, "~~over 600~~ and hundreds of people with disabilities..."

Section 12

Page 12-2 Last paragraph, first sentence, "review of the goals..."
Page 12-3 Second paragraph, last sentence, "the ~~six~~ seven neighboring..."
Page 12-3 Add City of Waterbury Office of the Mayor to the bullet list
Page 12-3 Bottom of the bullet list, "Town ~~City~~ of Wallingford"

Appended Table 1

Earthquakes – Change scores to 3, 1, and 2, for a total of 6

Appended Table 2

Second sentence, change "no'easters" to "nor'easters"
Shaking – Change scores to 3, 1, and 2, for a total of 6
Flooding from Poor Drainage – Change scores to 1, 3, and 1, for a total of 5
Inland Flooding – Change scores to 2, 2, and 1, for a total of 5
Falling Trees/Branches – Change scores to 1, 3, and 1, for a total of 5

MINUTES OF THE CHESHIRE TOWN COUNCIL PUBLIC HEARING, HELD AT 7:45 P.M. ON TUESDAY, APRIL 22, 2008, IN COUNCIL CHAMBERS, TOWN HALL, 84 SOUTH MAIN STREET, CHESHIRE CT 06410

Present
Matthew Hall, Chairman; Michael Ecke, Vice-Chairman; Matthew Altieri, Elizabeth Esty, Laura DeCaprio, Thomas Ruocco, James Sima, Timothy Slocum, Timothy White.
Staff: Michael A. Milone, Town Manager; Town Attorney Dwight Johnson

Public Hearing Subject Matter:
CONSIDERATION OF PROPOSED CENTRAL NAUGATUCK VALLEY COUNCIL OF GOVERNMENTS PRE-DISASTER MITIGATION PLAN

CERTIFIED COPY
Date Recorded 4/23/08
Carolyn Z. Soltis
Town Clerk Cheshire, CT
Date 4/24/08

1. ROLL CALL
The clerk called the roll and a quorum was determined to be present.

2. Explanation of Hearing Procedure and Agenda.
Chairman Hall explained the procedures and agenda for a public hearing of the Cheshire Town Council.

3. Reading of legal notice.
The Clerk read the legal notice for the public hearing.

4. Presentation on Hearing Subject
Town Manager Milone informed the Council that if Cheshire is to continue to qualify for FEMA grants, the DEP requires that the Town have a pre-disaster mitigation plan adopted. The Council of Governments (COG) has coordinated this plan amongst all the towns in the region. As part of the plan, a public hearing must be held in order to give the public the opportunity to speak on the issue. Cheshire public safety officials have been involved with the COG staff, Milone and MacBroom staff, and town administrators in developing the plan.

Virginia Mason stated that there is no dollar cost to the Town of Cheshire for this plan. There is a 25% match split between the Town staff spending time on consultations with COG. COG provided the mapping services which met the other portion of the 25% match. Under the plan, Cheshire can apply each year for grants. Whenever there is a disaster in Connecticut, to qualify for FEMA's allowance to DEP for projects, there must be an approved list on file with DEP to be eligible for these funds. COG will work to keep municipalities up to date with available help.

David Murphy, Milone and MacBroom, gave a brief overview of the Pre-Disaster Mitigation Plan. He submitted an errata sheet of corrections to the original plan,

which were mostly typographical errors. Mr. Murphy commented on the history of the Disaster Mitigation Act of 2000 which were amendments to the Stafford Act, which streamlined the process for pre-disaster projects.

Mr. Murphy reviewed the plan through a power-point presentation, and cited the following highlights. The goals are to encourage preparedness, hazardous mitigation measures to reduce loss of life and property, reduce cost of problems.

Local towns must have a pre-disaster plan in place to receive certain funds. For Cheshire, this plan will be in place after the Council approves it.

Some of the long term goals include reduction of losses and cost, education of residents and policy makers, connect planning to other town planning efforts, and preservation of natural resources.

A natural hazard is a natural event that incurs that imposes a risk to people. Hazard mitigation is what can be done before hand to eliminate the risks.

Components of the process were identification of natural hazards that could occur, evaluation of vulnerability for certain people, structures, and locations, access of adequacy of mitigation, evaluation of potential mitigation measures, develop recommendations for the plan.

The project began in 2006; meetings with staff in 2006; the draft report went to FEMA in August 2007; January 2008 received FEMA comments; conditional approval granted in April 2008.

Natural hazards covered in the plan include flooding, hurricanes, tornados, lightening, dam failure, wildfires, winter storms, freezing rain, earthquakes. Specific problem areas were identified and they include the Ten Mile River, Quinnipiac River, unnamed water courses, dams, single streams, and sink holes. There is a detailed discussion on sink holes in the plan.

Mr. Murphy noted that Cheshire is already implementing some of the recommendations which COG suggested, particularly the CodeRED System. COG recommended that Cheshire implement a community warning system (CodeRED), have underground utilities, tree limb maintenance, creation of through streets, fire protection, develop an application checklist that cites regulations related to hazardous mitigation.

5. Questions at the discretion of the Chair.

Frank Papandrea, 1801 Cheshire Street, informed the Council that he was a long time member and chairman of the P&Z Commission and Town Council member. Over the years there were concerns about balanced development. He wanted to make sure that when people purchased homes in a subdivision they would be assured, as much as possible, that value and privacy would be given to them.

One subdivision near the high school has one main street and homes on a circle, giving the residents the ability to walk and ride in safety. On the COG report, he noted that "through streets" were recommended, and Mr. Papandrea said the town should be careful about this because it will reduce safety and value of homes. He said the town must be careful about what it does in the future.

6. Proponents and Opponents Statements Alternately Expressed

7. Rebuttal at the discretion of the Chair.

8. ADJOURNMENT

Chairman Hall closed the public hearing at 8:30 p.m.

Attest:

Marilyn W. Milton

Marilyn W. Milton, Clerk

Received for Record 4-25-08 at 10:20 AM
and recorded by

Carolyn Z. Soltis
Town Clerk

Attorney finds out why this bid in the 45 days had lapsed, because this is clearly what caused and precipitated what happened at this meeting. Mr. Ecke commented on the web site Connecticut Corruption which highlighted many of the documents in the book Councilors received, and called into question some of the motives of Cheshire's volunteers who work on the PBC. And, this is horrible, to have one's reputation questioned in this way. Nothing good happened tonight; it is a low point; and everything in the bid procedures must be tightened up. This cannot happen again.

VOTE In favor 6; Slocum, White, Esty, Ecke, DeCaprio, Altieri
Opposed 2: Ruocco and Sima.

The motion passed 6-2.

6. Consideration of proposed Central Naugatuck Valley Council of Governments pre-disaster mitigation plan.

MOTION by Mrs. Esty; seconded by Mr. Slocum

BE IT RESOLVED, That the Town Council approves Resolution #042208-2

RESOLUTION #042208-2

BE IT RESOLVED, That the Town Council hereby adopts the Council of Governments of the Central Naugatuck Valley (COGCNV) "Town of Cheshire Natural Hazard Pre-Disaster Mitigation Plan" as presented at the public hearing of April 22, 2008

Discussion
David Murphy, Milone and MacBroom advised the Council that his firm and COG coordinated this plan, but it is the plan of the Town of Cheshire.

Mr. Altieri asked if this plan will coordinate with the CodeRED System.

Virginia Mason, Assistant Director of COG informed the Council that 7 or 8 towns in the region have the CodeRED system, with 10% of the cost discounted through COG.

Mr. Altieri noted that the fire chief discussed the CodeRED System with the Council. COG has a good plan, and the two plans go together.

Mr. Sima asked about the presentation during the public hearing, and it talking about the possibility of Cheshire receiving 75% or 25% funding for operations it may undertake in light of this program.

CERTIFIED COPY
Date Recorded 4/25/08
Carolyn E. Soltis
Town Clerk Cheshire, CT
Date 4/29/08

In response, Mr. Murphy said that the grant program comes up every December or January. An application is made to the DEP, which selects from among the applicants, and submits them to FEMA for consideration in the next year. The process is competitive; the town must go through a cost benefit analysis for the proposed project; DEP has a list what projects are preferred; FEMA has a list; there is criteria in the application which must be followed. Every Fall, the town has to revisit the plan, and select different projects for application for grants.

If a project has already started, Mr. Sima asked if the Council could still get funding.

Mr. Murphy said "no" this could not be done.

There are two major gas transmission lines going through Cheshire, and a 345 high voltage line, and Mr. Sima asked if they would be part of the pian.

Mr. Murphy said those were looked at for the plan, and said there have been cases where this program has funded utilities. This is not addressed in the plan, but could be added any time, and the town can apply for a project which is not listed, with less chance of accep6tance.

Mrs. Esty asked how often the plan should be updated to be in compliance with DEP and FEMA.

According to Mr. Murphy the plan must be updated every five years, but it can be updated more often.

Ms. Mason explained that COG writes a letter to the town near the renewal date and it is up to the town to make changes. For the emergency notification system, the State is looking into this, and there could be allocations to towns. But, as of the July 1st fiscal year she does not think the State will have anything in place.

With regard to "through streets", Mr. Murphy said that these are recommendations, and not a mandate.

VOTE The motion passed unanimously by those present.

7. Call for public hearing for supplemental appropriations from projected FY 07-08 fund surplus.

A. Expenditures:
Heart and Hypertension – from $312,000 to $500,000
Debt Service – Principal and Interest – Town – from $7,314,391 to $751,391.