Old Lyme, Connecticut
Natural Hazards
Mitigation Plan Update, 2014

Prepared for
Old Lyme Planning Commission

Adopted by
Town of Old Lyme, Connecticut
August 18, 2014

Prepared by
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The Natural Hazard Mitigation Plan is updated every five years. Input from residents and business owners is important to ensure the plan addresses the needs of those potentially affected. Questions, comments or suggestions concerning the Plan or future updates to it may be sent at any time to any of the following staff of the Town or RiverCOG.

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On the Cover:
Photo 1: **Shoreline Flooding** after 1938 Hurricane
Source: Old Lyme Historical Society

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i. ***Executive Summary***

The primary purpose of a Natural Hazard Mitigation Plan is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community to prevent loss of life and reduce property damages associated with identified hazards. The Disaster Mitigation Act of 2000 requires local communities to have a Federal Emergency Management Agency (FEMA)- approved mitigation plan in order to be eligible to receive Pre-Disaster Mitigation Program grants and Post-Disaster Hazard Mitigation Grant Program funds under the Hazard Mitigation Assistance program. This Plan was prepared by the Lower Connecticut River Valley Council of Governments (RiverCOG) in conjunction with the Town of Old Lyme. It is an update of a NHMP first developed by the Connecticut River Estuary Regional Planning Agency (CRERPA) in 2006.

The town considers critical facilities to be those that serve the town on a day-to-day basis as well as during an emergency situation. The facilities include but are not limited to, The Police Station, Town Hall, Public Works Garage, Fire Stations (Lyme Street, Cross Lane (which also houses the ambulance), and Boughton Road (which also houses the EOC)) Phoebe Griffin Noyes Library, The Lymes' Senior Center, and the schools. The critical facilities are necessary to support emergency response before, during, and after natural hazard events.

Transportation is essential in any major event. The town of Old Lyme has a variety of transportation options. The town is served by Interstate 95, a major limited access highway, as well as major arterials such as U.S. Route 1 and CT Route 156. Smaller town roads act as collectors to bring people to larger roads. The town is also served by several bus routes of the 9 Town Transit District. Amtrak's Northeast Regional which carries both Amtrak and Shore Line East trains travels through town, though there is no train station.

This plan details natural hazards present in the town and steps that the town can take to mitigate long lasting effects from each hazard type. The Comprehensive Mitigation Action Item list is provided in Section III: Mitigation. This table includes the item, project status, the party responsible for carrying out the action item, and other pertinent information. The most prominent hazard in any of the towns within the region is flooding, and significant discussion is devoted to how best to mitigate flooding events. Other hazards discussed include high winds and tornadoes, hurricanes and tropical storms, sea level rise, and drought and wildfire. Each hazard type has a list of mitigation action items that the town could implement, some being a higher priority than others. For each of the hazard types presented in the plan, historic events are presented along with the probability of that event occurring again. The town's specific impacts from each event are also noted.

The overall goal of this Natural Hazard Mitigation Plan is: *Reduction or elimination of injury to or loss of life and property and natural environments and the associated economic impacts from natural hazards.*

I. PLANNING PROCESS

A. **Authority** (ELEMENT C1)

Federal: The Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000, provides the legal basis for State, local, and Indian Tribal governments to undertake a risk-based approach to reducing risks from natural hazards through mitigation planning. The Federal Emergency Management Agency (FEMA) coordinates mitigation planning nationwide and provides funding for State-level natural hazard mitigation planning.

State: FEMA requires State, Indian Tribal, and local governments to develop hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. The requirements and procedures for State, Tribal and Local Mitigation Plans are found in the Code of Federal Regulations (CFR) at Title 44, Chapter 1, Part 201 (44 CFR Part 201). The State of Connecticut Department of Energy & Environmental Protection (DEEP) administers the federal funds by providing grants and technical assistance to the regional planning organizations (RPOs) to write the hazard mitigation plans for each regional planning area and the municipalities within each.

Region: The Connecticut General Statutes (§8-35a.(d)) require the regional planning organization to assist the municipalities within its region in developing and carrying out any plans of regional importance. The Lower Connecticut River Valley Council of Governments (RiverCOG) intends that this plan stand-alone so that the Town may adopt it as a section or supplement to its local Plan of Conservation & Development (POCD) and other planning mechanisms.

Municipal: The Connecticut General Assembly delegates certain powers of the state to its municipal subdivisions (city, town, borough, or special district), specifically that a municipality has the authorities in finance, public safety, and health that are necessary to effectuate the goals of this Plan (CGS §7-148).

B. **Purpose & Benefits**

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards (44 CFR 201.2). Hazard mitigation actions may be implemented prior to, during, or after an event. However, hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

The Old Lyme Natural Hazard Mitigation Plan provides information about the types of natural hazards that may affect the town and its residents and identifies specific mitigation actions.

The Town updates the NHMP for two reasons: first, to keep abreast of changes to the physical environment, social fabric, and demographic composition of its people, as well as changes to ongoing efforts to mitigate the effects of natural hazards; second, to remain eligible for Federal funds for ongoing and future mitigation actions.

The purpose of the town's NHMP is to:

- **identify** natural hazards that could potentially occur and the geographic areas most likely affected by the occurrence of those natural hazards;
- **assess** potential threats from the occurrence of those natural hazards to natural resources, public infrastructure, private property and people;
- **review** existing actions and capabilities of the region and its towns to mitigate threats from natural hazards;
- **recommend** additional actions to improve or expand actions and capabilities that further prevent loss of life and reduce property damages associated with the occurrence of natural hazards; and
- **update** plans to remain eligible at the time a community applies for <u>and</u> when the Federal/State agencies award funds for hazard mitigation actions.

The benefits of an up-to-date hazard mitigation plan include:

Home and business owners have information to help them make better decisions about protecting their properties.

Planners and local officials better understand the risks of natural hazards and may improve local planning actions.

Builders and developers have access to more accurate information for making decisions on where and how to build.

Emergency management can use this information to better prepare for response made by police, fire, public health, and town officials, as well as organize efforts as a part of the cycle of recovery from occurrences of natural hazards.

C. **Plan Development** (ELEMENT A & D)

1. **Funding & Technical Assistance**

FEMA Region 1 provided guidance to the Lower Connecticut River Valley Council of Governments (RiverCOG) in following federal guidelines for natural hazard planning, particularly subsequent to Tropical Storm Irene and Superstorm Sandy in September 2011 and October of 2012, respectively.

The Connecticut Department of Energy & Environmental Protection (DEEP) awarded a Hazard Mitigation Assistance (HMA) grant to RiverCOG to assist member towns to update their Natural Hazard Mitigation Plans. Under this grant, J.H. Torrance Downes, Senior Regional Planner and Jeremy DeCarli, Regional Planner, helped prepare this update to the original 2006 Plan. Dan Bourret provided technical assistance with HAZUS report generation.

The Town of Old Lyme provided significant in-kind contributions from its Land Use Department staff, including Kim Barrows, Land Use Technician; and Ann Brown, Zoning Enforcement Officer.

2. **Preparation** (A.1 & D.2)

The Old Lyme First Selectman, who is responsible for the town's NHMP, established a temporary Natural Hazard Mitigation Plan Committee to guide updating the existing NHMP. Bonnie Reemsnyder, First Selectwoman; Kim Barrows, Land Use Technician; David Roberge, Fire Marshal/EMD; John Flower, Building Official; Edward Adanti, Public Works Superintendent; Harry Plaut, Zoning Board of Appealsmember, Harbor Management Commission member, and Sound View Commission member; and Ellie Czarnowski, Flood & Erosion Commission member.

The committee, with assistance from RiverCOG and Land Use Department staff, interviewed officials of the Town on existing conditions and problem areas during hazard events, particularly areas susceptible to flooding. The Committee reviewed the 2006 Plan and made sure to include changes within the town. Those changes are discussed in Chapter III.

The Committee used many sources of information available including GIS, FEMA Flood Maps, and HAZUS – MH Software. It should be noted that at the time of the writing of this Plan Update, the latest data available for HAZUS – MH Event Reports comes from 2000 census data, and so may not reflect current conditions; however, HAZUS – MH does provide a baseline for preparation.

3. **Agency Comment** (A.2)

The Lower Connecticut River Valley Council of Governments (RiverCOG) has prepared this Natural Hazard Mitigation Plan in sync with federal and state guidelines. It is one of nine stand-alone town plans being updated for towns in the former Connecticut River Estuary Planning Region. The Connecticut River Estuary Regional Planning Agency (CRERPA) created the first Natural Hazard Mitigation Plans for the towns in the region in 2005, the first such plans in the State. The agency recently merged with the Midstate Regional Planning Agency (MRPA) to form the Lower Connecticut River Valley Council of Governments (RiverCOG), a seventeen- town region covering all of Middlesex County, as well as Lyme and Old Lyme in the southwestern part of New London County. This update process is currently being carried out for the nine towns of the former estuary region. A review will be made at the next update of how to best serve all seventeen towns of RiverCOG.

The purpose of a hazard mitigation plan is for communities to identify the natural hazards that affect them, to identify actions and activities to reduce any losses from those hazards, and to establish a coordinated process to implement the plan, taking advantage of a wide range of resources (44 CFR 201.1(a)). In keeping with this broader intent, local governments are required to prepare and adopt a hazard mitigation plan as a condition of receiving project grant funds under FEMA's hazard mitigation assistance programs such as the Hazard Mitigation Grant Program (HMGP) and Pre-Disaster Mitigation (PDM) program (44 CFR §201.6(a)(1)).

FEMA's approval of a mitigation plan does not mean FEMA has approved funding for projects identified in the plan or approved an application for Federal assistance. An application for Federal assistance must be submitted to FEMA to be considered for funding and must meet the application requirements for the assistance program as described in the Catalog of Federal Domestic Assistance (www.cfda.gov).

Once a mitigation plan is approved, it is the community's decision to implement specific mitigation strategies or projects. As plans are updated every five years, the local government is required to document progress in local mitigation efforts; however, lack of resources, changes in priorities, community capacity to implement actions, or other concerns may limit a community's ability to implement actions. As described at 44 CFR 201.6, "The local mitigation plan is the representation of the jurisdiction's commitment to reduce risks from natural hazards, serving as a guide for decision makers as they commit resources to reducing the effects of natural hazards. Local plans will also serve as the basis for the State to provide technical assistance and to prioritize project funding."

Maps contained in this Plan are for planning purposes only.

4. **Public Involvement** (A.2, A.3)

The Draft Natural Hazard Mitigation Plan Update, 2014 was made available on the Old Lyme website, the RiverCOG website and in print at Town Hall. As the Regional Planning Agency, the RiverCOG website is regularly visited by residents and officials from all seventeen member municipalities and surrounding regional planning organizations. This gave the Plan good exposure outside of Old Lyme. All meetings of the NHMP Committee were open to the Public with notice as required. A Public Informational meeting was held on Saturday, March 8 at the Old Lyme Town Hall to present the Plan to the Public and receive any feedback. Two members of the Public were in attendance (See Appendix VI for Minutes). The meeting was recorded and is available for viewing. In addition, Bonnie, Reemsnyder, First Selectman, and Jeremy DeCarli from RiverCOG appeared on an episode of “Conversations,” a weekly program on Public Access, to discuss the status of the Plan and its importance. In addition to discussing the details of the document such as the Towns vulnerability and potential hazards within the Town, the discussion also included information on where to find the draft Plan and where to access the survey. The episode, aired on Comcast Public Access, Comcast Channel 14 on April 7, April 21, and May 12 at 7:00PM in nearby towns including East Haddam, Haddam Neck, Lyme, Old Lyme, and Salem. Finally, a survey was developed and distributed to online through several websites and in print upon request. The survey was designed for both residents and non-residents.

a. **Public Survey Response**

A total of 19 responses were collected. Information was used to update the plan, add mitigation action items and better understand problem areas in town. Of the respondents, 95% were Old Lyme Residents. Overall, responses suggested that the Old Lyme website and TV News were the best places to get hazard mitigation information. With regards to natural hazards, 69% of the respondents have suffered losses in the past due to hurricanes or tropical storms, while 80% are concerned about future sea level rise.

With regard to mitigation actions, 100% of respondents who answered the question said that they would be willing to sell their home for open space along the shoreline in order to minimize losses in the future. Eleven respondents offered their input on mitigation measures the town could include. The majority of responses centered on retro-fitting existing homes along the shoreline, prohibiting new construction along the shoreline, and minimizing risks with mandatory evacuations when needed. Another focus of respondents was the removal of trees in order to

reduce the chance for power outage during storms and burying utilities where feasible. For the full survey and its responses, please see Appendices V and VI.

5. **Incorporation of Existing Resource Materials** (A.4)

The Committee began the Plan update process by reviewing the 2006 Plan to familiarize itself with its implementation status. Additionally, the Committee surveyed and analyzed current data regarding the environment and ecological resources, geography and land uses, demographics and critical facilities, as well as economics and cultural resources. From this information, the Committee incorporated Elements of the original 2006 "Natural Hazard Mitigation Plan, Town of Old Lyme, Individual Town Mitigation," into the 2012 Plan. See Appendix I - **Sources of Information.**

D. **Plan Adoption** (ELEMENT E)

The Board of Selectmen, as the "governing" body of the town [CFR § 201.6(c)(5)] officially adopted the Plan on Monday August 18, 2014.

E. **Plan Implementation** (ELEMENT D)

The Plan prioritizes specific actions that could reduce the long-term likelihood of damage from natural disasters. Municipal improvements include rights-of-way, land, housing, or utilities for public purposes; programs include outreach, stewardship, and services; standards include road specifications, zoning regulations, fire/building code, and the local flood ordinance. Recommendations that require regional or inter-town cooperation are included in Figure 31, Natural Hazards Mitigation Action Items. See Section III **MITIGATION** (ELEMENT C).

Some recommendations require regional or inter-town cooperation and are included in Section III **MITIGATION** (ELEMENT C).

1. **Priorities**

Based on the planning process, this Plan suggests assignments of priority for implementation. Those agencies and officials to whom the Plan assigns responsibility will fine-tune these priorities based on availability of resources.

2. **Responsibilities**

The Plan specifies those agencies and officials responsible for implementing the prescribed actions. The Town will track progress to ensure consistent and on-going implementation, as well as to update the Plan more readily.

3. **Resources** (C.6)

The Town must allocate sufficient resources to implement the actions prescribed by the Plan, as well as to maintain the Plan through regular updates (every 5 years). Officials/agencies identified as having responsibility for specified actions need to establish and maintain operating or capital budgets with which to fund implementation (and continual maintenance).

These budgets are also necessary to leverage opportunities for Federal and State grants, which typically require a “match” in funding commitment (funds and in-kind services). All of the grants described below require an approved Natural Hazards Mitigation Plan at the time of application and must have an approved plan at time of award.

The following sources of external funding are available to the region and its towns on a limited and often competitive basis:

a. **Hazard Mitigation Grant Program (HMGP)**

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. The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. This grant is administered by the Connecticut Department of Emergency Services and Public Protection (DESPP), Division of Emergency Management and Homeland Security (DEMHS).

b. **Flood Mitigation Assistance (FMA)**

The National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) created the FMA program with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP).

FEMA provides FMA funds to assist States and communities in implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the National Flood Insurance Program. This grant is administered by the Connecticut Department of Energy and Environmental Protection (DEEP).

Three types of FMA grants are available to states, regions and towns:

- **Planning Grants** to prepare Flood Mitigation Plans. Only NFIP-participating communities with approved Flood Mitigation Plans can apply for FMA Project grant

- **Project Grants** to implement measures to reduce flood losses, such as elevation, acquisition, or relocation of NFIP-insured structures. States are encouraged to prioritize FMA funds for applications that include repetitive loss properties; these include structures with 2 or more losses each with a claim of at least $1,000 within any ten-year period since 1978.

- **Management Cost Grants** for the State to help administer the FMA program and actions. Up to ten percent (10%) of Project grants may be awarded to States for Management Cost Grants.

c. **Pre-Disaster Mitigation Grant** (PDM)

The PDM program provides funds to states, territories, Indian tribal governments, communities, and universities for hazard mitigation planning and mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are to be awarded on a competitive basis and without reference to state allocations, quotas, or other formula-based allocation of funds. This grant is administered by the Connecticut Department of Energy and Environmental Protection (DEEP) and the Connecticut Department of Emergency Services and Public Protection (DESPP).

F. **Plan Maintenance** (ELEMENT A)

1. **Method** (A.5)

The Planning Commission will monitor and evaluate progress in addressing action items in this Plan and include those accomplishments in its annual report to the Town. The Town will post its Annual Report on the Town website to inform and update the citizenry as a part of required ongoing citizen participation in implementation. In addition, meetings concerning the Natural Hazard Mitigation Plan will be public. Notices and agendas will be posted ahead of time.

In order to evaluate progress made each year, responsible parties (Planning & Zoning and Public Works) will:

Conduct Review of Mitigation Actions

Reviews will occur on an annual basis during the first quarter of each fiscal year (July-September). The purpose of these reviews will be to ensure that action items in the NHMP remain a priority for the town. Reviews will also determine what projects are in progress, remain on schedule, have been completed or have yet to be completed. The review will be carried out by Town officials responsible for their progress. A report will be delivered to both the Planning and Zoning Commissions for their consideration for planning the next years projects.

Action Progress Meeting - Public

Matters to be reviewed on an annual basis will include the goals and objectives of the NHMP, natural hazards or disasters that occurred during the preceding year (for example, the recent damage from Superstorm Sandy along the shoreline), 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 review conducted by town officials during the first quarter will play an active role in determining the following year's projects. The annual meeting should be during the second quarter of each fiscal year. This will enable a list of possible projects to be circulated for Town departments to review, with sufficient time for developing grant applications and inclusions in the town budget process. These meetings will be open to the public and publicized with ample time to allow the public to attend.

Continued Public Involvement

Continued public involvement will be sought regarding the monitoring, evaluating, and updating of the NHMP. Public input will be solicited through appropriate measures such as meeting notices, information on the town website and other methods deemed appropriate at the time. Direct input from the homeowners in flood zone areas is anticipated to continue each year. The First Selectman and Planning and Zoning Commissions will continue to provide the linkage to other municipal departments throughout the plan monitoring and evaluation each year relative to communication and participation.

In addition, anyone may contact any of the contact people listed at the beginning of the Plan at any time to make comments, suggestions, or pose questions.

2. **Maintenance and Update Schedule** (A.6)

At a minimum, the Town will update the Plan every five years or sooner if conditions warrant. The following table shows a timeline for continuing action of the current plan and the beginning of the next update. The update process will again include public meetings to allow the public to participate and offer input. See Figure 1 on the following page for a more detailed schedule. The Planning Commission will have the primary responsibility of maintaining and updating the NHMP; they may choose to designate certain portions of the responsibility to other parties as appropriate.

Progress and Update Schedule	FY 2015				FY 2016				FY 2017				FY 2018				FY 2019			
	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q	1st Q	2nd Q	3rd Q	4th Q
Action Item Review					X				X				X				X			
Report on Action Items Status to Town					X				X				X				X			
Action Progress Meeting - Public		X				X				X				X				X		
Budget Action Items Based on Review							X				X				X				X	
Plan Update Committee Formation													X							
Begin Full Plan Review														X						
Begin 5 Year Update Process																X	X			
Completion of 5 Year Plan update (Submission to DEEP and FEMA and Adoption by Town)																		X	X	

Figure 1: **Schedule** for Plan Update Process

II. **RISK ASSESSMENT** & **HAZARD IDENTIFICATION** (ELEMENTS B & D)

The 2006 Natural Hazard Mitigation Plan (NHMP) identified a number of natural hazards that could potentially impact the town of Old Lyme, including flooding, wind and tornado, drought and wildfire, winter storm, earthquake, hurricane, sea-level rise, and tsunami. This section acknowledges changes in local development since 2006 and its effects on natural hazard mitigation.

A. **The Town & the Vulnerability of its Resources** (ELEMENT B)

Given Old Lyme's topography, location and land use patterns, significant areas of the town are most vulnerable to flooding, hurricane, coastal flooding and high winds.

1. **Geography & Land Use Patterns**

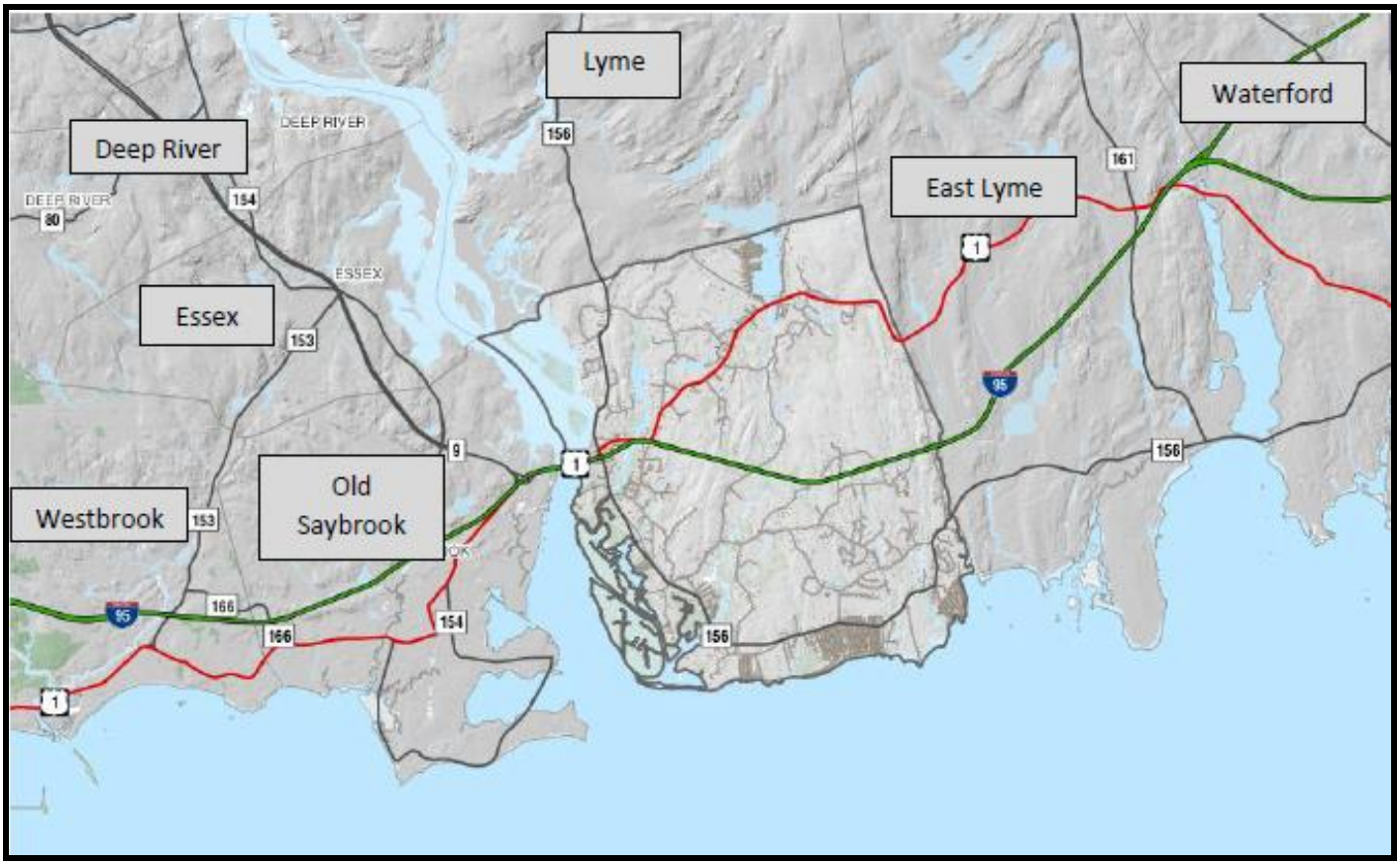
Old Lyme lies within New London County, located in south-central Connecticut, along its shoreline with Long Island Sound. To the west, Old Lyme is bordered by the Connecticut River and the town of Old Saybrook; to the north, by the town of Lyme; and to the east, by the town of East Lyme. Although New York's Long Island serves as a barrier, Old Lyme is susceptible to high winds and coastal storms due to its geographic location.

Old Lyme is primarily residential. By design, its commercial and manufacturing enterprises are few in number and small in size. The primary industrial area is located on the Town's eastern boundary with East Lyme, on either side of Interstate 95 at Exit 71, near the Four Mile River. The primary commercial area is along Halls Road, near the western edge of town surrounding I-95 Exit 70. Other small commercial and industrial areas are located adjacent to Rogers Lake in Laysville, and along Shore Road (Route 156).

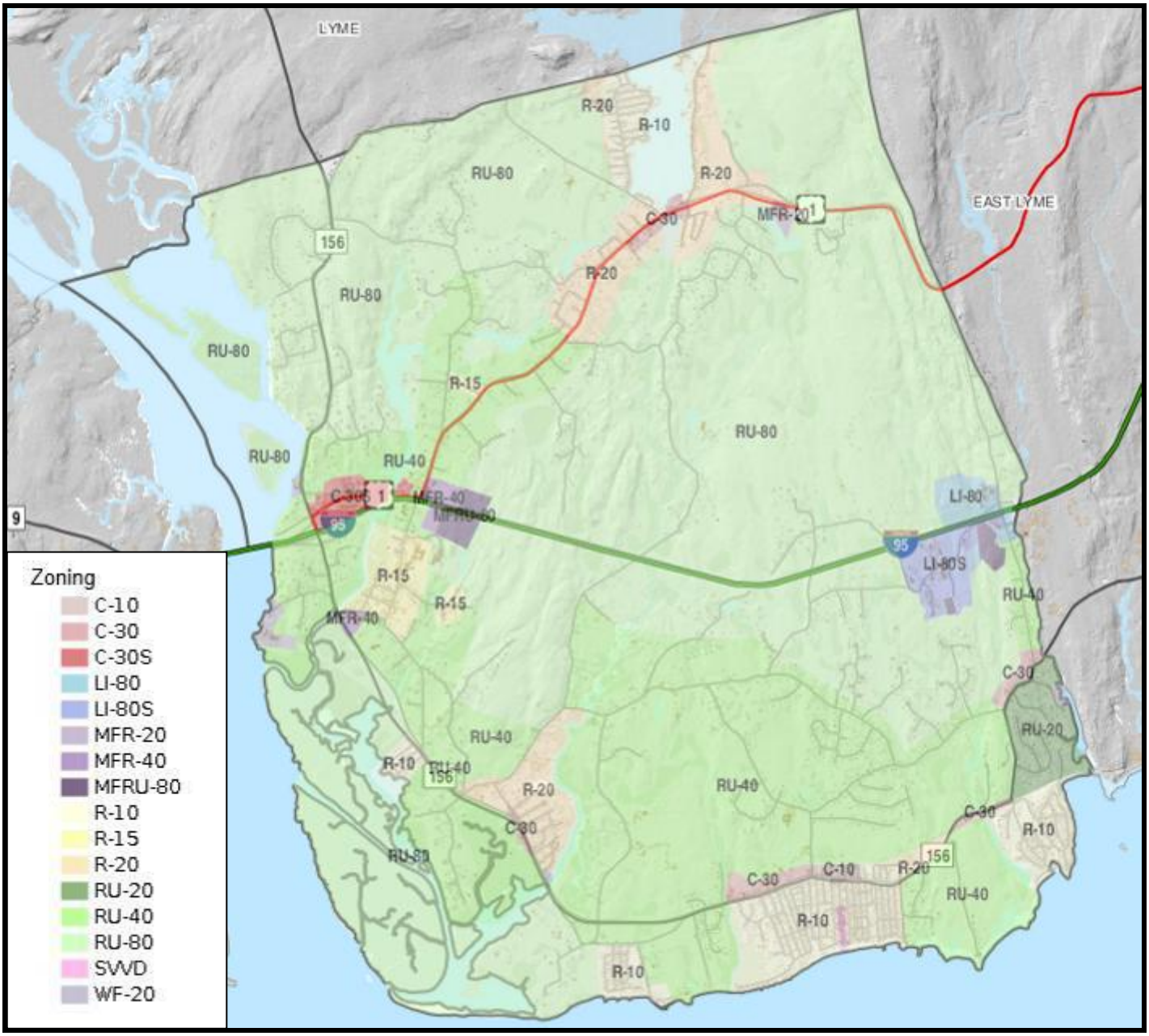
Old Lyme's total area of 23.02 square miles has a relatively low-lying coastal topography, mostly tidal marsh and coastal plain with scattered projections of hills and knolls. Large estuarine islands, protected coves, and rocky headlands form a major portion of Old Lyme's river and shore. Along the approximately 10.5 miles of Long Island Sound and Connecticut River shorefront, beach strands are narrow and interspersed with rocky bluffs, small rivers and streams. Inland from the coastal plain, three linear ridges run north to south delineating the boundaries of the major drainage basins of the Lieutenant, Black Hall, Three Mile, and Four Mile Rivers. Smaller streams are the Duck River, Mile Creek, Swan Brook, Sheffield Brook and Armstrong Brook. An estimated 2,000 acres of inland wetlands are a major component of these drainage systems. On the northern boundary with Lyme, Rogers Lake occupies a total of 260 acres in Lyme and Old Lyme.

About ten percent of Old Lyme is occupied by surface water bodies, including four rivers and the southern portion of Rogers Lake. The town's topography is varied and includes numerous outcrops of bedrock, extensive tidal marshes, and hilly woodlands. Glacial deposits over bedrock are of two types: non-stratified material or till composed of clay, sand and gravel with intermingled boulders, and stratified material composed of sand and gravel. The inland wetlands and tidal marshes have developed from gradual organic deposits over bedrock.

Early development in Old Lyme followed transportation routes which were located to avoid rivers, tidal wetlands and steep interior hills. Development followed the early Boston Post Road (Route 1) and Shore Road (Route 156), concentrating in three areas - the village center along Lyme Street, the Rogers Lake area, and the seasonal communities along Long Island Sound. In the 1920s, small lots were carved out along Rogers Lake for summer cottages, most of which have become year round. At the beginning of the 20th Century, developers recognized the attractiveness of Old Lyme's beaches and began to build seasonal communities on the low lying coastal plain. Several of these communities have been granted charters by the Connecticut General Assembly giving each association the right to levy taxes for road maintenance and other limited services. Within the town as a whole, recent development has been primarily single family homes in subdivisions in previously rural areas. About 32% of Old Lyme's total housing stock has been identified by the Census as seasonal housing, mostly in the beach areas. There has been increasing interest in converting seasonal dwellings to year round use, although strict requirements for conversion include bringing sewage disposal systems and water systems up to health code standards and structures up to Building Code Standards.



Map 1: **Old Lyme** in Lower Connecticut River Valley region



Map 2: **Zoning Districts**

This map depicts the relationships among Old Lyme's Zoning Districts. Visible is the fact that the highest density zoning, R-10 is located along the shoreline where small lots and beach front cottages are abundant.
Source: Old Lyme GIS

2. Demographics & Critical Facilities

The 2010 Census reported a town population of 7,603 people which represents a 2.66% increase from 2000. This is in sharp contrast to the previous decade when the town population increased 13.33%. Stagnation of population growth allows the Town to focus on factors in natural hazard mitigation's effects on population, such as its distribution and make-up.

21.4% of Old Lyme's 2010 population was over age 65 which is about 50% more than the statewide average of 14%. The block-level data indicates that the majority (58.1%) of the over-65 population lives in areas south of I-95, much of which is flood-prone and subject to high winds from hurricanes. Age-related dispositions and disabilities are a specific factor for the Town to take into account in mitigating against natural hazards.

5.6% of Old Lyme's 2010 population was characterized as non-English speaking. The largest percentage, 4.0%, speak Indo-European languages, the languages of Europe to southwest Asia. Next most common was Spanish or Creole spoken by 1.2% of the population. Such a small population with a lack of concentration in one specific language makes it difficult to provide printed educational materials about the potential natural hazards in languages other than English or to be able to anticipate those languages for which the Town might provide translators at public meetings or at evacuation centers during natural disasters.

According to the Old Lyme Office of Emergency Management, 182 residents are classified as having some form of disability. The distribution of these disabilities is:

Classification	Number of Persons
Medically Dependent	17
Transportation Dependent	46
Mobility Restrictions	35
Other Ailments	53
Unclassified Disability	31
Total	**182**

Figure 2: **Population of Persons with Disabilities**

This information was provided by the Old Lyme Office of Emergency Management. Records are as of March, 2014.

The Old Lyme Emergency Management Director defines disabilities as the following:

- **Medically Dependent:** Persons who have medical conditions that would prohibit them from self-evacuating from their residence in the event of an emergency. Persons in this class would require assistance in advanced health care, specialized life supporting medical equipment and transportation along with specialized care in a temporary shelter or respite facility.

- **Transportation dependent:** Persons who in the event of a precautionary relocation or evacuation from their home would require assistance with transportation to and from a shelter or respite center.

- **Mobility Restrictions:** Due to health mobility issues a person would require assistance with transportation in the event of an emergency. Persons in this class would require special transportation needs such as a wheel chair ride or medical support during transport.

- **Other Ailments:** Persons who have various health ailments which could be an impediment in the event of an emergency situation. Ailments such as sight, hearing and speech limitations would limit their ability to effectively communicate with responding agencies.

- **Unclassified Disability:** Persons who have voluntarily registered themselves with the Old Lyme Office of Emergency Management as having health issues that would require assistance.

The 2010 U.S. Census reported a total of 5,021 residential structures. Of these structures, 3,172 are “owner-occupied,” 460 are “renter occupied” and 1,849 are unoccupied. Of these unoccupied structures, 1,612 units are considered seasonal residences, mostly beach cottages. This leaves a total of 237 other units that may or may not have tenants during all or portions of the year. Tenants may be omitted inadvertently from ongoing education about natural hazards or may be difficult to contact through typical Town resources to warn of pending natural events.

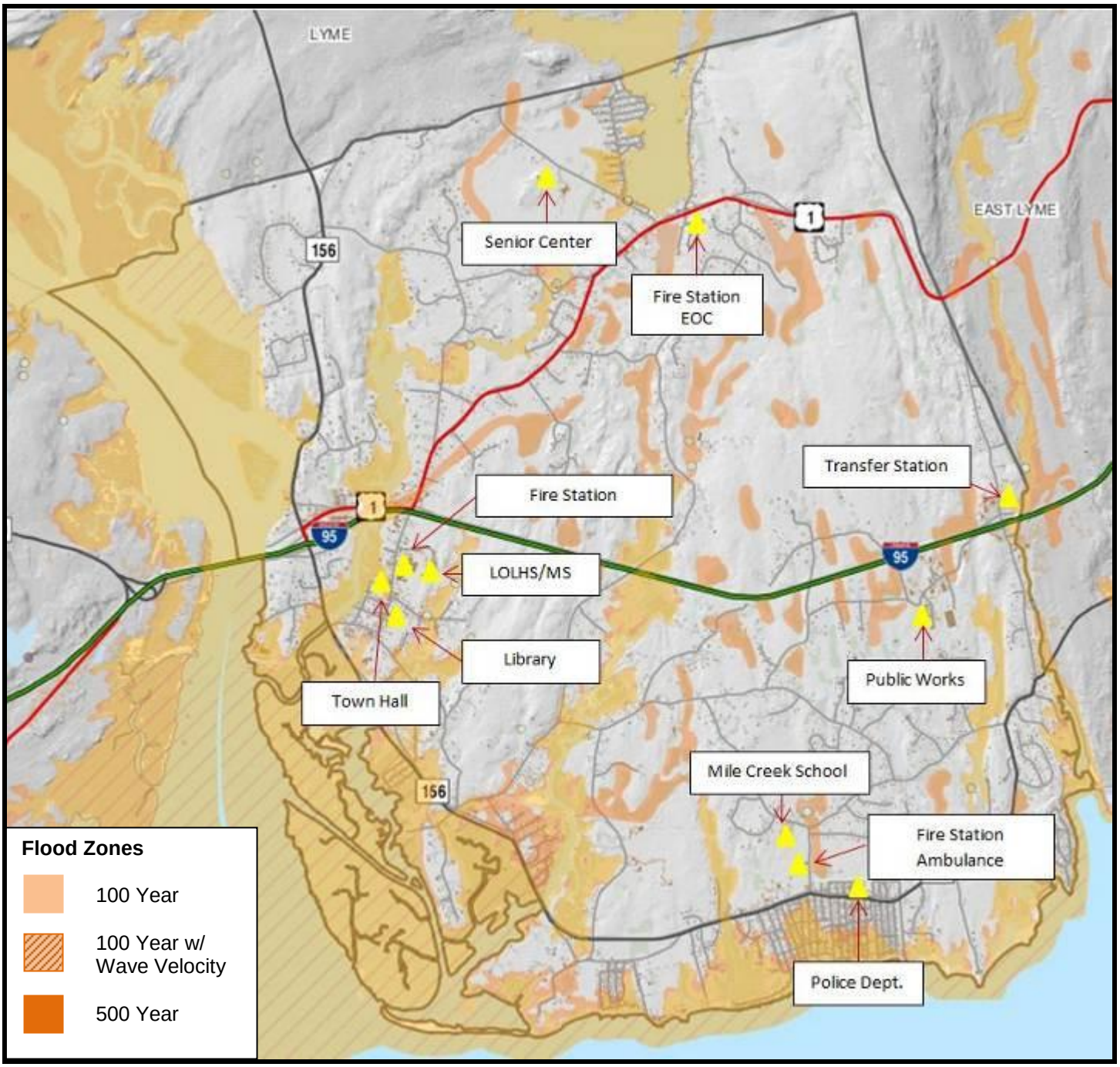
In Old Lyme, structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water-reactive materials exist primarily in the industrial districts near I-95 Exit 71 along Hatchets Hill Rd and Route 1. These areas are mostly outside of the 100-year floodplain.

The Town’s police station, fire stations, public works vehicle and equipment storage facility, Old Lyme Ambulance Association, and Emergency Operations Center (EOC) are located outside the 100-year flood zone. However, the town hall property is partly in the flood hazard zone. In addition, the town hall is in a Category 3 - 4+ Hurricane

Inundation zone. Old Lyme uses many of its public buildings for minor natural hazard events, such as cooling centers during heat waves. The Town's principal overnight shelter is the Multi-Jusidictional Shelter at East Lyme Middle School, 31 Society Rd, East Lyme, CT, which is outside special flood hazard areas. Within Old Lyme, The Lymes' Senior Center, 26 Town Woods Rd is used as well as the Lyme - Old Lyme High School, 69 Lyme St., which can be used as a respite center and a place to shower in the event of an extended loss of power. In addition, the Phoebe Griffin Noyes Library is an unofficial place of respite from heat and cold if needed, located at 2 Library Lane.

Public and private utility facilities, which are vital to maintaining or restoring normal services to areas of town before, during, and after a natural disaster, were not inventoried extensively. All gas stations in Old Lyme are located along Routes 1 and 156, which are accessible to most of the townspeople and businesses that may lose power and may seek gasoline to power emergency generators. Public and private utility facilities are subject to the same loss of power, potable water, communications and accessibility as is the community they serve.

Transportation within Old Lyme consists of roads, highways, and a regional bus service. Major roads throughout Old Lyme include Interstate 95, a limited access highway, as well as State Routes 1 and156, and Four Mile River Road. These roads act as collector roads. Many smaller town-owned roads also traverse the town. Bus service is offered along Routes 156 and 1 to the shopping plazas along Halls Road and to the Lymes' Senior Center on Town Woods Road by the 9 Town Transit Southeast Shuttle Route, between the Old Saybrook Amtrak Station and the New London Amtrak Station. This bus offers connections to other 9 town Transit shuttles which connect to Middletown Area Transit busses, Amtrak and Shoreline East trains. Amtrak's Northeast Corridor runs through town, parallel to I-95, but does not provide a stop in Old Lyme.



Map 3: **Critical Facilities** with Special Flood Hazard Area

Critical Facilities include facilities necessary to support emergency response before, during and after natural hazard events; utility infrastructure to support businesses and people.
Source: Old Lyme GIS

3. Economics & Cultural Resources

The primary business and industry sectors in Old Lyme are as follows:

2005 sector	% of total establishments	% of total employment
services	40.7%	43.9%
trade	17.4%	23.7%
const. and mining	14.6%	9.3%
finance, ins. & real estate	7.6%	6.0%
manufacturing	5.0%	5.2%
government	5.1%	7.6%
transportation & utilities	3.3%	2.1%
agriculture	6.2%	2.2%
	100%	**100%**

Figure 3: **Economic Sectors** in Old Lyme
Source: Connecticut Dept. of Economic and Community Development, 2010

As might be the case with many natural disasters and as was demonstrated during and after Tropical Storm Irene in 2011 and Superstorm Sandy in October 2012, the economic core of Old Lyme is vulnerable to loss of electricity and communication services due to downed utility lines. The potential for services, the largest business sector, to be shut down for an extended period will affect the economic viability of the town and a long lag time for damage assessment and insurance adjustments can hinder rebuilding activities.

After a far-reaching disaster with a prolonged recovery, the Town would be faced with reduced or delayed collection of taxes on land, improvements and personal property, which serves as the Town's revenue base, yet the Town would expend a maximum output of a fixed annual budget to restore infrastructure.

Residential uses collectively provide the majority of tax receipts in Old Lyme, including historic structures in the Old Lyme Historic District along Lyme Street. However, the highest density of residential use lies within the special flood hazard area. Thus, damage from a major coastal storm could result in a reduction in the assessed value of any building so damaged as to be removed; damaged buildings would realize a tax adjustment in the subsequent year and the Town's grand list could decrease in value.

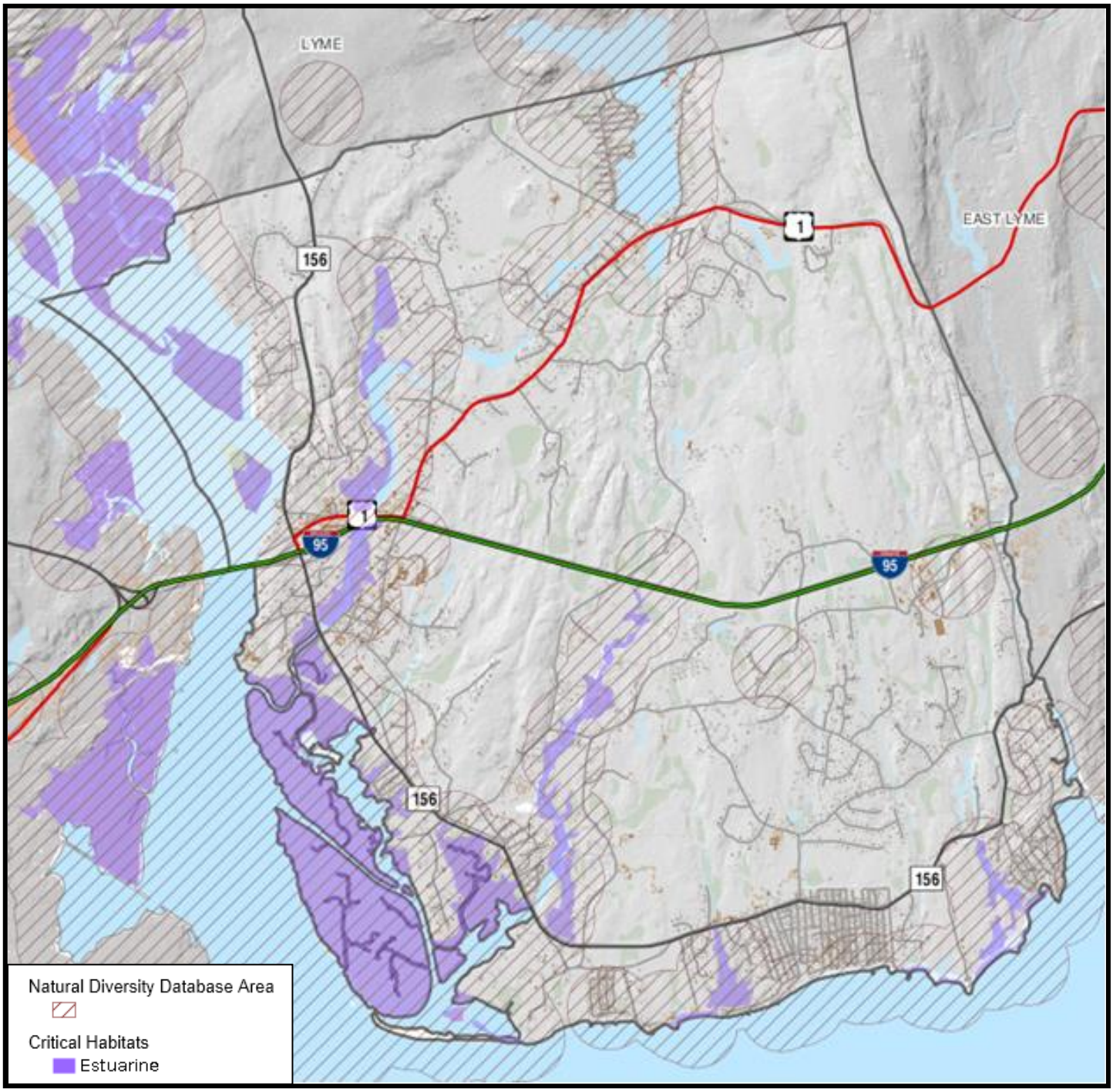
Open space is not a significant generator of tax revenue, but may serve as a buffer to reduce storm effects, thus protecting the value of nearby developed land. Therefore, vacant land may have potential to similarly provide protection of developed properties if set aside as open space.

4. Environment and Ecological Resources

Old Lyme is endowed with many ecological and environmental assets. Beaches, dunes, tidal and inland wetlands, the Connecticut River shoreline and large tracts of uninterrupted forest are examples of some of the Town's valuable natural resources. The CT DEEP has created a statewide map of "Critical Habitats" that highlight ecologically significant areas and areas of species diversity (see Map 4). In Old Lyme, aside from the fens and the Atlantic White Cedar swamps, the remaining critical habitat sites periodically suffer damage from flooding, high winds and waves associated with coastal storms.

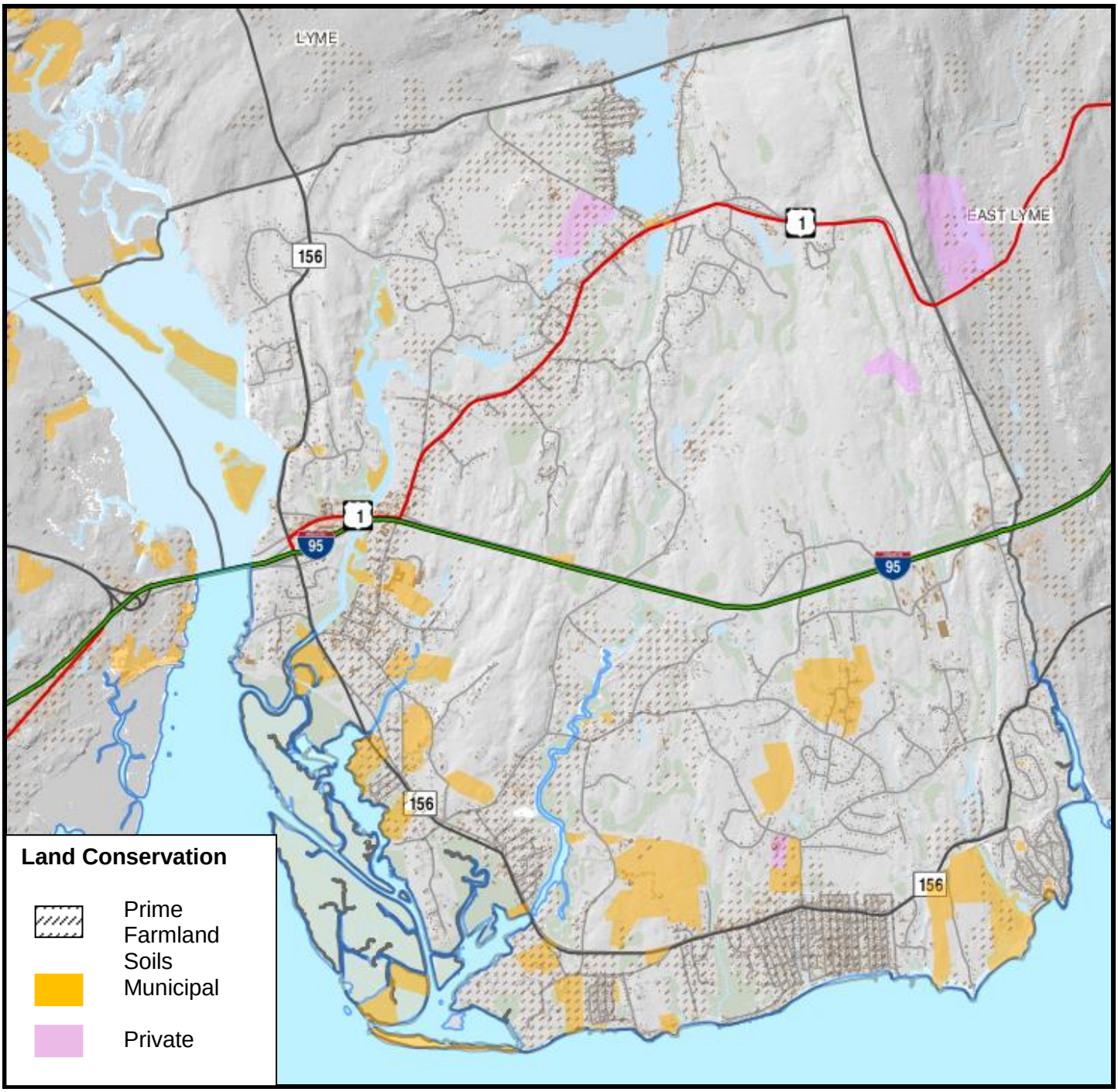
Of great concern is the impact from sea level rise. These critical habitat sites initially will have to deal with increased frequency and magnitude of flooding events but eventually may become permanently flooded – assuming that the rate of sea-level rise exceeds naturally occurring rates of accretion. Of greatest concern in Old Lyme is the potential loss of the extensive intertidal marsh habitats. These marshes provide breeding areas for a wide variety of terrestrial and aquatic organisms and are important visual components that add to the character of the town. The largest intertidal marsh system is located where the Lieutenant River and Black Hall River drain out to the Connecticut River. This area is partly made up of Marvin Island and Great Island, near where the Connecticut River meets the Long Island Sound. These areas are mostly brackish marshes as they are at the point where freshwater comes down from the river and salt water washes up from the Sound. These sites are all located within the 100-year floodplain, are well adapted to diurnal tidal flooding, and can tolerate periodic longer term flooding associated with storm events. Those plant ecologies are not capable of surviving permanent flooding and would "drown" from sea level rise or be forced to migrate upland. However, in places where there are steep slopes, rocky outcrops, or other barriers along the wetland edges, the tidal wetlands may simply die off.

Similarly, the extent of the built environment surrounding Old Lyme's tidal marshes will prevent them from migrating upland in response to sea level rise. This is unfortunate for the built areas, as well, because the buffering effect tidal wetlands provide from storm surges, wave action and flooding will be lost. Engineered responses to natural hazards, such as sea walls, groins, etc., that "harden" the shoreline can have undesirable effects on natural processes and unintended consequences on storm energy by transferring associated damage to other portions of the shore.



Map 4: **Natural Diversity and Critical Habitat**

Critical Habitats represent significant natural community types occurring in CT. These habitats are known to host a number of rare species including highly specialized invertebrates with very specific habitat associations. Critical Habitats also can be used to highlight ecologically significant areas and to target areas of species diversity.
Source: Old Lyme GIS



Map 5: **Dedicated Open Space**

This map depicts dedicated open space throughout Old Lyme. Most preserved land is owned by the Town. Other lands are owned by private entities such as the Old Lyme Land Trust, Regional School District 18 and others.
Source: Old Lyme GIS

B. **Natural Hazards** (ELEMENT B)

Old Lyme is at risk from a variety of natural hazards, each occurring with different frequency, probability, and intensity of impact.

	Natural Hazard Type							
Effects & Impacts	*Hurricane and Tropical Storm*	*Summer Storm*	*Winter Storm*	*High Wind and Tornado*	*Earthquake*	*Wildfire*	*Drought*	*Tsunami*
Coastal Erosion (CE)	X	X	X					X
Building Damage (BD)	X	X	X	X	X	X		X
Downed trees & branches (DT)	X	X	X	X				X
Flooding – Coastal (FC)	X	X	X					X
Flooding – Dam Failure (FD)	X	X	X		X			
Flooding – Inland (FI)	X	X	X					
Flooding – Sea Level Rise (FSLR)	X	X	X					
Flooding – Storm Surge (FSS)	X	X	X					
Fire (F)		X			X	X	X	
High Wind (HW)	X	X	X	X				
Hail (H)		X						
Ice (I)			X					
Lightening (L)	X	X				X		
Power Failure (PF)	X	X	X	X	X	X		X
Infrastructure Damage (ID)	X	X	X	X	X	X		X
Snow (S)			X					
Water Rationing (WR)							X	

Figure 4: **Natural Hazard Effects & Impacts**

The categories of impacts that may be caused by different types of natural hazards.

Natural Hazard Type	**geographic scope** 1 – localized 2 – large area 3 – townwide	**frequency** 0 – extremely rare 1 – infrequent (< ten years) 2 – occasional (< annual) 3 – often (> annual)	**damage magnitude** 1 – low 2 – medium 3 – high
Hurricane and Tropical Storm	3	2	3
Summer Storm	1-3	3	2
Winter Storm	3	3	2
High Wind and Tornado	2	1	2-3
Earthquake	3	0	2-3
Wildfire	1	3	1
Drought	3	0-1	1
Tsunami	2	0	3
Flood	2	2	3

Figure 5: **Natural Hazard Scope, Frequency & Magnitude**

Natural hazard events can affect different parts of Old Lyme, can range in occurrence from rare to often, and can cause varying degrees of damage. Figure 4 summarizes these differences among the types of natural hazards. The potential for each hazard event to occur in Old Lyme is identified as being either not likely, likely, or very likely in. These labels are based on the Frequency defined in Figure 5 and relate as follows: *not likely*, 0, 1; *likely*, 2; and *very likely*, 3.

Natural Hazards affecting the Lower Connecticut River Valley Region including Lyme		
DATE	**NAME / TYPE**	**IMPACTS** (codes from Fig. 4)
March 1936	**Flood of 1936**	FI
September 1938	**Great New England Hurricane** (Cat. 1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
September 1944	**Great Atlantic Hurricane** (Cat. 1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
August 30, 1954	**Hurricane Carol** (Cat. 2)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
August 13, 1955	**Tropical Storm Connie**	CE, BD, DT, FC, FI, FSS,HW, PF, ID
August 18, 1955	**Tropical Storm Diane**	CE, BD, DT, FC, FI, FSS,HW, PF, ID
September 1960	**Hurricane Donna** (Cat. 1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
March 2-5, 1960	snowstorm	S
February 2-5, 1961	snowstorm	S
January 1978	winter rainstorm	FI
February 1978	**Blizzard of '78**	BD, DT, HW, PF, ID
June 1982	rainstorm	FI
September 1985	**Hurricane Gloria** (Cat. 1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
August 1991	**Hurricane Bob** (Cat. 1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
October 1991	**Hurricane Grace** "The Perfect Storm"	CE, BD, DT, FC, FI, FSS,HW, PF, ID
December 1992	nor'easter	S, HW, FC, FSS
March 12-14, 1993	snowstorm	S
January 6-8, 1996	snowstorm	S
July 1996	remnants of **Hurricane Bertha** (tropical storm)	CE, BD, DT, FC, FI, FS,HW, PF, ID
February 15-18, 2003	snowstorm	S
October 2005	remnants of **Hurricane Tammy**	CE, BD, DT, FC, FI, FSS,HW, PF, ID
April 2007	nor'easter	HW, FC, FI
March 2010	rainstorm	FI
February 2011	**Winter Storm Ella** "Groundhog Day Blizzard"	S, HW
February 7, 2011	winter rainstorm	HW, FC, FI
August 2011	**Tropical Storm Irene**	CE, BD, DT, FC, FI, FS,HW, PF, ID
October 2011	**Snowstorm Alfred**	DT, PF, ID, S
October 2012	**Superstorm Sandy** (Cat.1)	CE, BD, DT, FC, FI, FSS,HW, PF, ID
February 2013	**Blizzard**	S, HW, PF, DT

Figure 6: **Natural Hazards Affecting the Lower Connecticut River Valley Region**
A chronological summary of various types of natural hazards that have caused significant damages in Old Lyme and the surrounding region. The IMPACTS column summarizes the categories of damages (see Figure 4) from each storm.

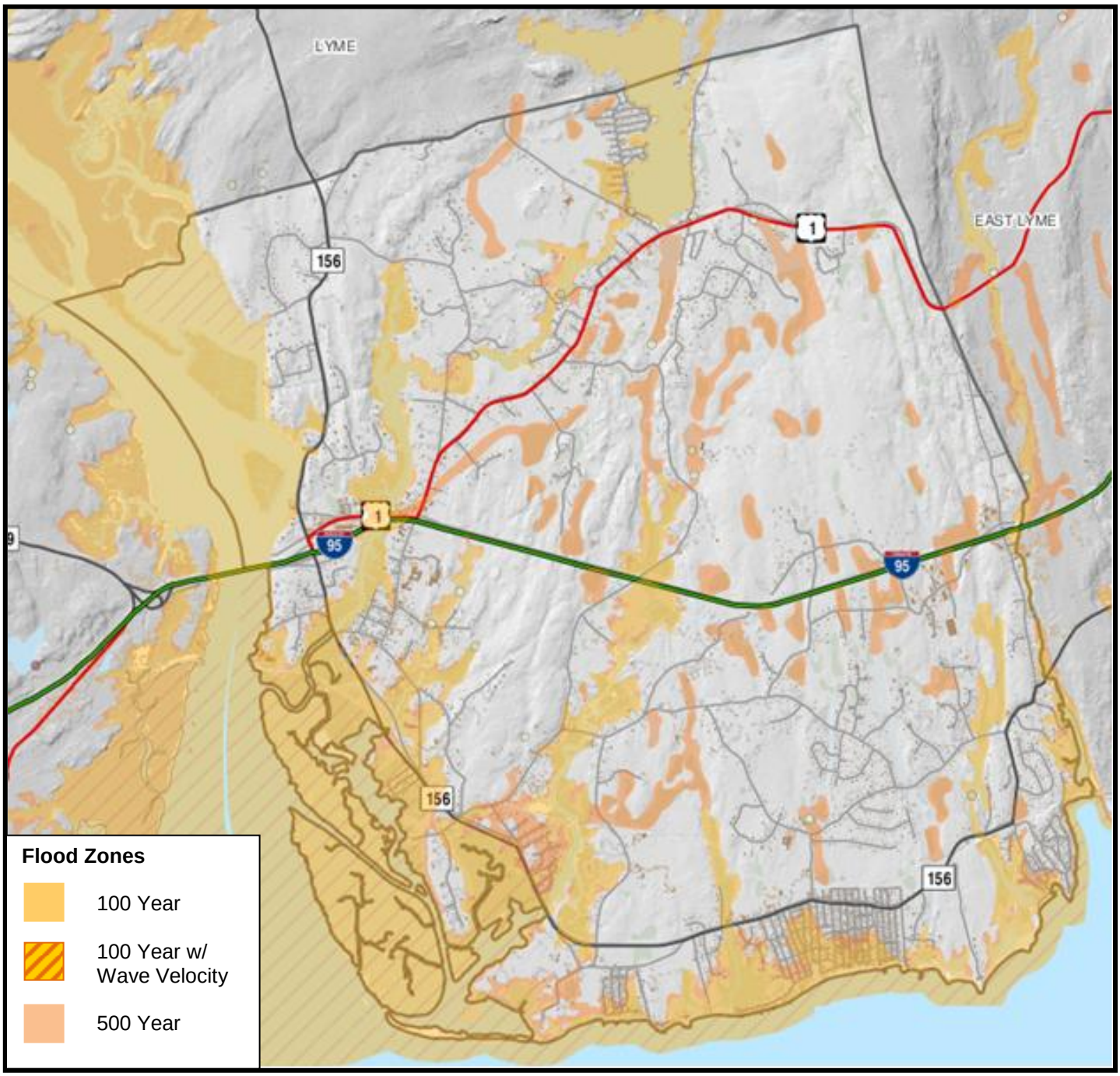
1. **Flooding**

A flood, as defined by the National Flood Insurance Program, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; or mudflow. A flood can also be a collapse or subsidence of land along the shore of a lake or similar body of water because of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

In Old Lyme flooding is the most significant recurring natural hazard. It can be broken into three general categories: 1) inland flooding along streams and low lying areas; 2) coastal flooding of areas along Long Island Sound and the Connecticut River; and 3) nuisance flooding primarily in coastal areas at low elevation. Inland flooding can be caused by any weather event with significant amounts of rain over a short time span. Coastal flooding typically occurs with hurricanes, tropical storms and nor'easters where low pressure and strong winds create storm surges that when coupled with rising tides can push sea water far inland. Nuisance flooding in low lying coastal areas is caused by extreme astronomical high tides, which can flood yards, basements, septic systems, storm water drainage systems and roads.

a. **Geographic Extent** (B.1)

FEMA provides Flood Insurance Rate Maps (FIRMs) that delineate areas in Old Lyme vulnerable to 100-year and 500-year flood events. 100-year floods have a 1% chance of occurring in any given year; 500-year floods a 0.2% chance of occurring in any given year. Map 5 shows the FEMA special flood hazard area that officially was adopted by the Town in August, 2013. The majority of the 100-year flood zone lies to the south of Interstate 95 with a small area along the Connecticut and Lieutenant Rivers north of I-95. The 100-year flood zone is most susceptible to coastal flooding.



Map 6: **Special Flood Hazard Area**

This map displays areas in Old Lyme that have been mapped by FEMA as within the 100-year flood zone which includes special flood hazard areas designated A, AE, AO and VE. These areas have a 1% chance of flooding in any given year.
Source: Old Lyme GIS

b. **Occurrences** (B.2)

For a list of notable occurrences of this natural hazard, see Figure 6 – Natural Hazards affecting the Lower Connecticut River Valley region.

Month	Year	Event
March	1936	Heavy Rain and melting snow caused major flooding throughout the Northeast and Middle Atlantic states
September	1938	Widespread 10 inch rainfall caused by a hurricane resulted in major flooding throughout the Connecticut River valley
August	1955	Hurricanes Connie and Diane came a week apart to batter most of New England with the most significant flooding recorded at many locations
March	1968	Heavy rain combined with snowmelt caused small river flooding in southeast New England
June	1972	Up to 16 inches of rainfall resulted in major flooding throughout Connecticut
June	1982	Heavy rains combined with snowmelt resulted in major flooding throughout New England
March	1987	Heavy rains combined with snowmelt resulted in major flooding throughout New England
March	2010	Heavy Rains caused moderate to severe flooding causing damage to the Woods Pond Dam.

Figure 7: **Record Breaking Floods in CT since 1936**.
Source: NOAA

Photo 2**: Mile Creek Road** flooding near the railroad underpass during a rain event in March 2010.
Photo: J. Loper

c. **Probability of Occurring Again** (B.2)

Floods are a *very likely* hazard in Old Lyme. High-intensity localized storms can cause flooding of the relatively short coastal and upland watercourses; regional natural hazard rainfall events can cause flooding of the larger watershed of the Connecticut River; and tropical storms, hurricanes and nor'easters can cause significant coastal flooding.

d. **Potential Impacts** (B.3)

The impacts from flooding can range from localized nuisance flooding to much more widespread coastal flooding affecting entire neighborhoods or sections of the town.

Similar to nearby communities along Long Island Sound, the densest residential development in Old Lyme is located in the beach communities directly adjacent to the sound. This area is mostly zoned R-10. Much of this development occurred in the early 20th century at a time when there were no standards for construction within areas subject to flood hazards. Some of the densest and most flood prone areas are located in the Hawks Nest, Old Lyme Shores, White Sands Beach, and Point 'O Woods communities. Hawks Nest, in particular, is prone to damage as a result of a significant number of cottages being located directly on the beach with no seawall or protective dunes. In addition, structures along West End Drive sit on a dune protecting a large salt marsh directly to the north and are prone to significant flooding.

In some cases, flooding events can be so severe that dams become compromised, leading to a larger flooding problem. Dam breeches release a large amount of water at one time downstream. Dams are classified and required to be inspected periodically (See Dam Failure, Page 41) .

	1-10		**11-20**		**21-30**		**31-40**		**41-50**		**Substantially**	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	47	12.81	53	14.44	41	11.17	209	56.95	17	4.63
Total	**0**		**47**		**53**		**41**		**209**		**17**	

Figure 8: **Expected Building Damage by Occupancy**
Source: HAZUS - MH

A HAZUS – MH Flood Event Report was run, using a 100 year flood scenario. This report generates an estimate of building and infrastructure loss in real numbers as well as monetary values based on the specified event. For the full report, see Appendix V: HAZUS – MH Flood Event Report.

e. **Authorities, Policies, Programs and Resources** (B.4, C.1 & C.2)

The Town of Old Lyme participates in the National Flood Insurance Program (NFIP). FEMA develops NFIP FIRMs through an engineering report called the Flood Insurance Study (FIS). FIRMs depict the limits of the floodwaters as special flood hazard areas within which "zones" establish the base flood elevation and, therefore, risk for flooding and flood-related damages. Old Lyme is committed to continuing NFIP compliance and standards, as has been demonstrated through zoning regulations.

Within the Old Lyme Zoning and Subdivision Regulations, there are standards and criteria which govern the location of structures and the placement or removal of fill within designated flood zones. The regulations/ordinances within which these standards and criteria are found dictate parameters such as structure setbacks and structural configurations in flood-prone areas. State Building Code also includes parameters for construction in such hazard zones as well. State policies regarding minimizing potential impacts within flood zones are also found within the Connecticut Coastal Management Act (C.G.S. Sec. 22a-90 through 22a-112, et. seq.).

When the federal flood program was initiated, an ordinance model was used based upon the forms of governments most likely to adopt such standards. In Connecticut, the primary jurisdiction as established in state statute is located at the municipal level where Planning & Zoning Commissions oversee municipal land use. Although many Connecticut municipalities first adopted the national ordinance format, many adopted zoning regulations as well, acknowledging the primary Planning & Zoning jurisdiction. Where ordinances were adopted, the State administrator of the federal flood program, the CT DEEP, subsequently urged Towns to rescind such ordinances so as to simplify the regulation of property in areas prone to flooding.

The current Old Lyme Zoning Regulations include a Flood Plain Zone, which is identified as the "Special Flood Hazard Areas"(SFHA) by the Federal Emergency Management Agency (FEMA) in its Flood Insurance Study (FIS) for New London County, Connecticut, dated July 18, 2011, and accompanying Flood Insurance Rate Map (FIRM), dated July 18, 2011, and other supporting data applicable to the Town of Old Lyme, and any subsequent revisions thereto, are adopted by reference and declared

to be a part of this regulation. (Flood Plain Zone, Section 4.4.8) According to this section of the Town of Old Lyme Zoning Regulations, the Zoning Enforcement Officer is responsible for the enforcement of the Flood Plain Zone regulations.

The NFIP collects data on repetitive losses in special flood hazard areas. Repetitive loss properties (RLP) are those with insurance claims for multiple events. Since the beginning of the NFIP in 1979, thirty-seven (37) properties have been listed as RLPs and three (3) being listed as Severe Repetitive Loss properties. All 37 properties are located within the coastal zone along Long Island Sound. All but one property listed is residential. Four properties contain multi-family dwellings, while the rest are categorized as single family. As of June 30, 2013 (the latest information available) only one of these properties has been mitigated.

The Town of Old Lyme is committed to enforcing the Connecticut State Building Code and all land use regulations.

f. **Mitigation Specific to this Hazard** (C.3, C.4)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Land Acquisition – Advance an assertive land acquisition plan to reserve vacant land subject to flooding. The Town's Land Acquisition Committee should regularly evaluate opportunities to acquire lands for municipal purposes, including floodplain protection and relocation of critical facilities.

Open Space Criteria – Consider adding sea level rise to the Town's considerations for preserving as open space those areas that flood waters will inundate.

Stormwater Infrastructure Inventory – Complete mapping and monitoring of catch basins, stormwater outfalls and related infrastructure. DPW should consider completing an initial inventory of catch basins and outfalls.

Stormwater Infrastructure Maintenance – Provide for annual maintenance of stormwater infrastructure, including catch basins, detention basins and outfalls. DPW annually cleans catch basins.

Stormwater Management – Continue land use permitting that encourages stormwater retention within new and redeveloping areas (rain gardens, curb-less roads, etc.). Town updated its Regulations for Public Improvements for roads to encourage pervious surfaces and sheet flow into stormwater swales.

Best Management Practices – Continue to use best management practices (BMPs) as described in the Connecticut DEEP Stormwater Management Guidelines on a site-by-site basis as advised by a professional engineer.

Road Elevation – Evaluate roads to develop plans for improvement or elevation for emergency access and evacuation.

Repetitive Loss Elevation Funding – Encourage RL property owners to obtain assistance from DEEP and FEMA to acquire hazard mitigation funds to elevate structures where appropriate. Town continues to educate RL and SL property owners in conjunction with regular one-on-one guidance in permitting. Town maintains a Floodplain Management heading under Town Initiatives on its website.

2. **Dam Failure**

A dam is a barrier that impounds water or underground streams. Dams generally serve the primary purpose of retaining water. Many dams built within Old Lyme were built to power mills during the early years of industrial revolution. There are several different types of dams including earthen, cement, and stone.

a. **Geographic Extent** (B.1)

The DEEP requires registration of all dams over six feet in height. There are fifteen such dams in Old Lyme. Some have been built within the last 50 years or so, but a number of them were constructed for agricultural and manufacturing purposes during the time shortly after the town was settled, in the early 1700's and the 1800's during the industrial revolution. As a result of their ages and private ownership, the dams are in varying conditions of repair. Within Old Lyme, 1 Dam is Class BB, Moderate Hazard, and 4 Dams are Class B, Significant Hazard. See Map 7 on Page 45 for the location of all dams in Old Lyme. Areas immediately downstream from dams are most susceptible to a dam break, but effects can be felt anywhere along the watercourse below the dam.

DEEP assigns dams to one of five hazard classes according to their hazard potential:

Class **AA**: negligible hazard potential dam which, if it were to fail, would result in no measurable damage to roadways, land, or structures and negligible economic loss.

Class **A**: low hazard potential dam which, if it were to fail, would result in damage to agricultural land, damage to unimproved roadways, or minimal economic loss.

Class **BB**: moderate hazard potential dam which, if it were to fail, would result in damage to normally unoccupied storage structures, damage to low-volume roadways, or moderate economic loss.

Class **B**: significant hazard potential dam which, if it were to fail, would result in possible loss of life; minor damage to habitable structures, residences, hospitals, convalescent homes, schools, etc.; damage to or interruption of the use or service of utilities; damage to primary roadways and railroads; or significant economic loss.

Class **C**: high hazard potential dam which, if it were to fail, would result in the probable loss of life; major damage to habitable structures, residences, hospitals, convalescent homes, schools, etc.; damage to main highways; or great economic loss.

The classification of a dam can change due to changes in downstream development. Of dams in Connecticut, 83% fall within the negligible to moderate hazardous categories while only 17% fall within the significant and high hazard categories. Map 9 depicts which Hazard Class each dam in Old Lyme is.

Dam	Water Body	Hazard Class	Owner
Lower Millpond	Mill Brook	B	Town of Old Lyme
Mile Creek Pond	Three Mile River	B	Private
Upper Mill Pond	Mill Brook	B	Private
Rogers Lake	Mill Brook	B	Town of Old Lyme

Figure 9: **Significant and High Hazard Dams in Old Lyme**

b. **Occurrences** (B.2)

During the June 1982 flooding that took place throughout the region, several dams in Old Lyme were damaged and one failed. The Lower Mill Pond Dam failed, causing water to rush downstream. In addition, the Mill Creek Dam and the Upper Millpond Dam were both damaged. Resulting floods caused Major Damage to 6 Homes (between $5,000 and $20,000) and caused between $50,000 and $250,000 worth of losses to commercial and industrial structures.

During the Spring Flooding in 2010 the Woods Pond Dam failed, requiring extensive repair. This resulted in damage to AMTRAK property and roadway damage nearby.

c. **Probability of Occurring Again** (B.2)

Although only one dam has failed in Old Lyme, the risk is still present for others to fail. Old dams, some dating to the 1700's can become over-burdened during flooding events and heavy rain storms. The dams, if not maintained properly, could collapse under the stress of more water than normal. Overall, Dam failure is *not likely* in Old Lyme.

d. **Potential Impacts** (B.3)

A dam break could cause significant flooding downstream of the dam and potentially cause other dams to break in succession. A dam break would release a significant amount of water at high velocity with significant pressure. This wall of water could cause other dams to break.

A dam break could cause flooding outside of normal flood hazard areas, meaning residents and businesses might be especially unprepared for dam breaks.

According to the National Performance of Dams Program (NPDP), since 1877 there have been a total of 7 dam failures in New London County resulting in $44,397,208 worth of property damage. A large enough flood could cause similar damage throughout the State. There are no critical Town facilities in the path of either of the four Hazard Class B Dams in Town; however, the area downstream of Rogers Lake is most susceptible to a dam break upstream. Rogers Lake is home to more dense residential development and there are two more Class B dams downstream of Rogers Lake.. A rough estimate based on assessed property values within the area shows that a severe enough dam failure upstream could cause well over $1,000,000 in damage to surrounding properties. Overall, based on HAZUS-MH Flood Event Report, a 100 year storm could result in as much as a $73.22 Million economic loss in Town. A dam break would likely be far less than this as much of the flood prone area is along the immediate Long Island Sound shoreline.

Figure 10 below taken from the Connecticut State NHMP, shows the relative risk of dam failure to be Medium-High for all New London County towns. This risk is based upon population density, population projections to 2025, building permits and other factors.

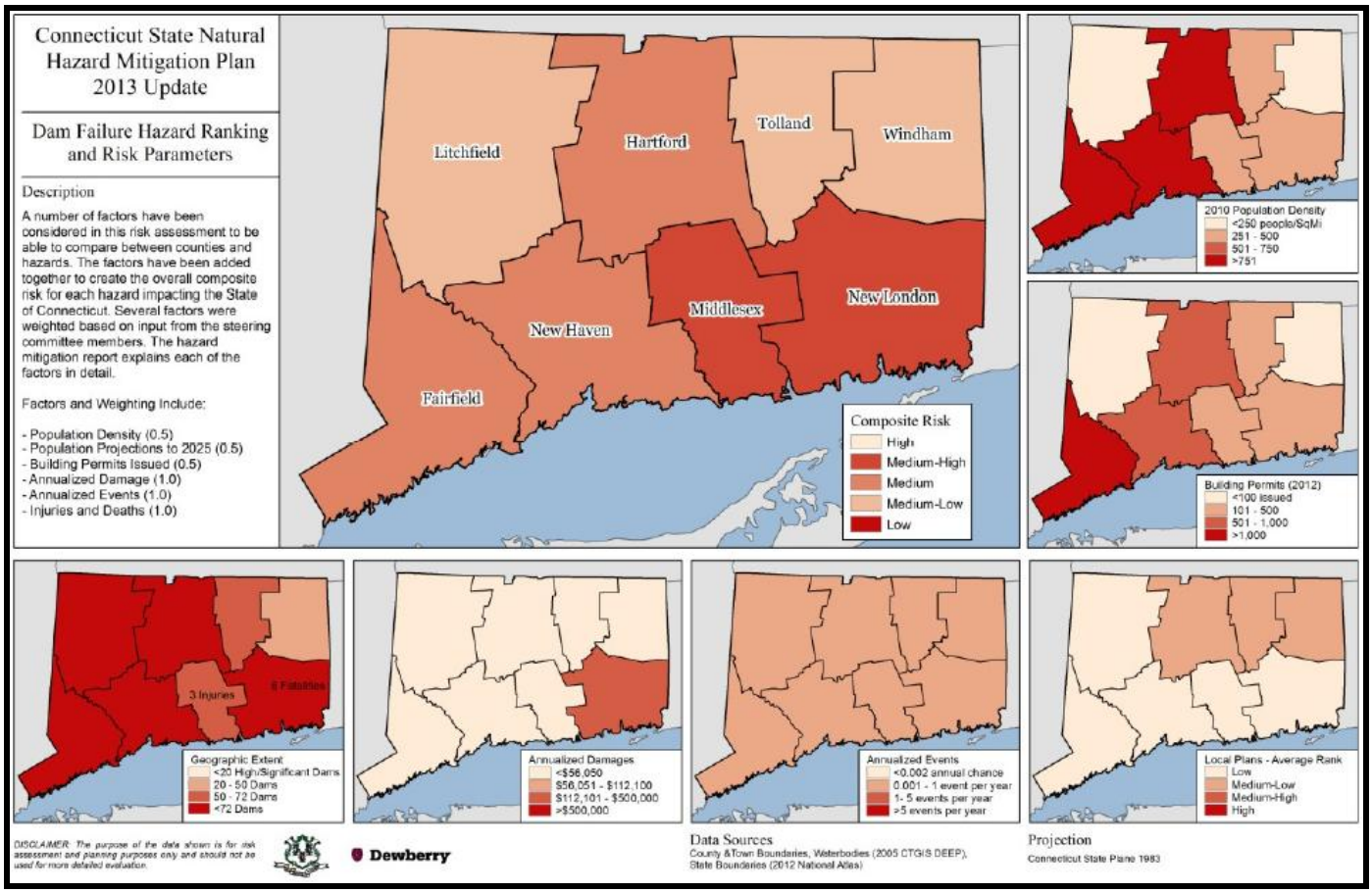


Figure 10: **Dam Failure Hazard Ranking and Risk Parameters**
Source: CT State NHMP 2013 Update

e. **Authorities, Policies, Programs, and Resources** (C.1)

The State Department of Energy and Environmental Protection requires the registration of all dams over the height of six feet. The Dam Safety Section of the Inland Water Resources Division of the Connecticut Department of Energy and Environmental Protection (DEEP) is responsible for administering and enforcing Connecticut's dam safety laws. The existing statutes require that permits be obtained to construct, repair, or alter dams, dikes, and similar structures and that existing dams, dikes, and similar structures be registered and periodically inspected to assure that their continued operation and use does not constitute a hazard to life, health, or property.

The DEEP records which dams have emergency plans, but not all emergency plans are up to date and not all dam owners will want those plans shared publically. Only significant and high-hazard dams would typically have an emergency plan with inundation areas specified, but not all do as it is not yet mandated by state statute or regulation.

f. **Mitigation** (C.3, C.4)

See Section III Mitigation (Figure 31) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

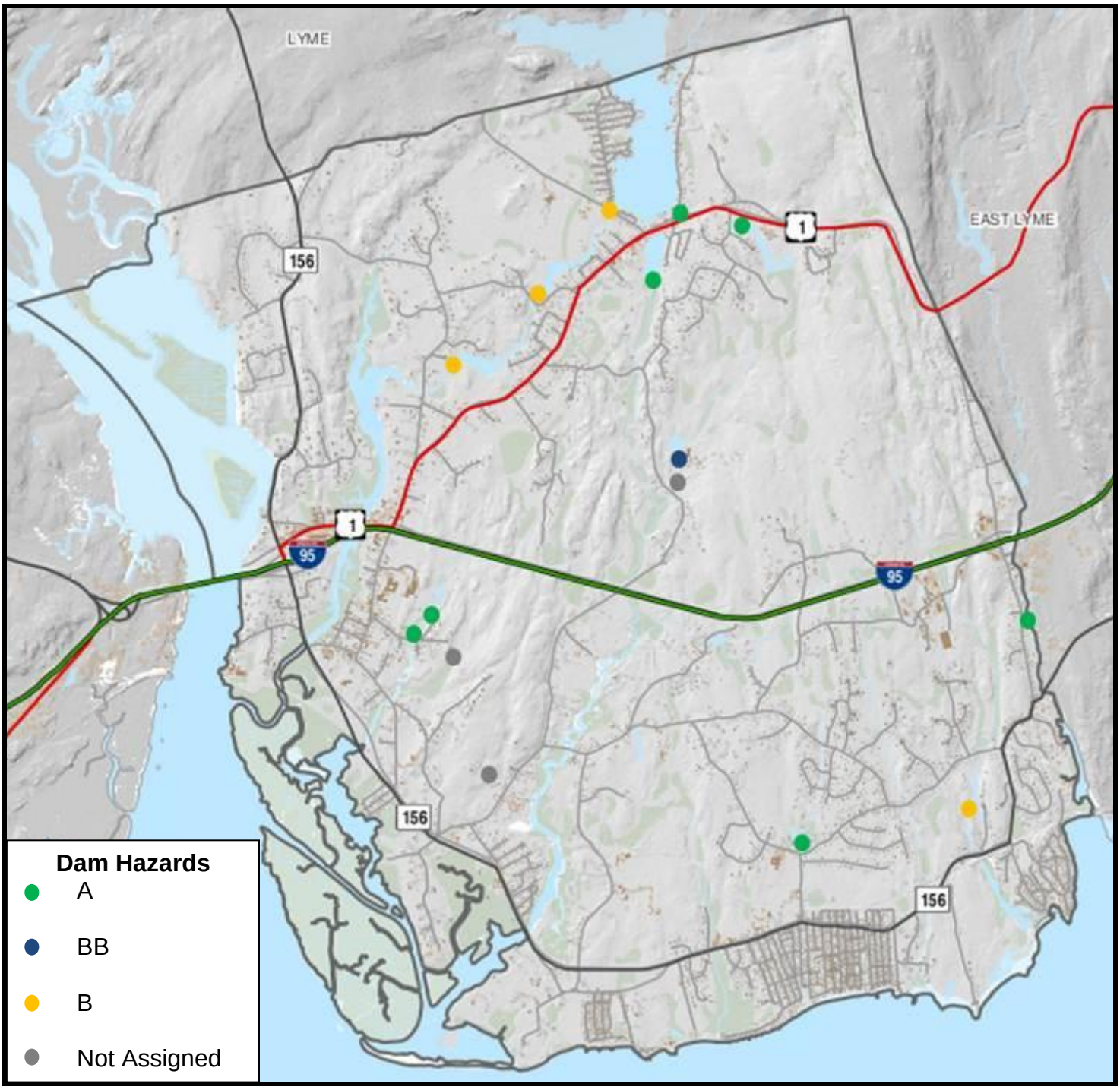
Mitigation includes prioritizing dams using the DEEP classification systems and inspection. The high hazard dams should be repaired by utilizing grant funding, low interest loans to the property owners, or other types of incentives. Lower priority dams should be evaluated for repair as funding is available. The Town should work together with DEEP to ensure that dam owners are properly maintaining their dams and understand the risks of dam failure.

Mitigation for dams within Old Lyme includes monitoring, inspection, and structural repairs or modifications where necessary.

Dam Inventory - Update inventory of dams and assess downstream risks due to a catastrophic failure.

Town Dam Evaluation - Evaluate town-owned dams; work with DPW and CT DEEP for repairs as needed. The State Department of Energy and Environmental Protection requires the registration of all dams over the height of six feet. Twelve of Old Lyme's fifteen dams are privately owned. (See Map 6) Interviews with DEEP officials who are inventorying dams note that private property owners are very reluctant to repair dams on their property due to the high costs. Where a hazard exists, the dam owner should be notified and if possible, be assisted in either repairing or

removing a dam in questionable condition.



Map 7: **Dam Hazards**

This map depicts the locations of dams in Old Lyme and indicates their hazard potential classification. (See Dam Hazard Class Definitions on Pages 42&43)
Source: Old Lyme GIS

3. **High Wind & Tornado**

Straight-line winds, responsible for most thunderstorm wind damage, can exceed 100 mph. One type of straight-line wind, the downburst, is a small area of rapidly descending air beneath a thunderstorm. A downburst can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation. A "dry microburst" is a downburst that occurs with little or no rain.

A tornado is a violently rotating column of air, pendant from a cumuliform cloud or underneath a cumuliform cloud, and often visible as a funnel cloud. High winds are typically 1-minute average surface winds of 40 mph or greater lasting for 1 hour or longer, or winds gusting to 58 mph or greater regardless of duration that are either expected or observed over land.

a. **Geographic Extent** (B.1)

Other than hurricane- and storm-associated winds, high winds in Connecticut tend to be localized microbursts. In comparison to the tornados that occur in the Midwest's "tornado alley", New England tornados tend to have much shorter and narrower paths due to the hillier terrain. Tornados are unlikely to occur in New London County. Historically there have been tornados and microburst wind events in other parts of the state. Thus, these events should not be dismissed entirely. Severe thunderstorms have been known to occur and spawn small tornados. Damage from sheer downburst winds has been suspected as another source of damage in the state. Old Lyme-area historical tornado action is near the Connecticut state average, which is 25% smaller than the overall U.S. average (Source: City Data). Overall, residents throughout Old Lyme are equally susceptible to the chance of a tornado occurrence.

b. **Occurrences** (B.2)

One Tornado has occurred in Old Lyme. An EF-1 Tornado was recorded in town on Jun 30, 1998. As recently as February 27, 2012, high winds plagued Connecticut. "More than 300 United Illuminating customers were without power in Fairfield Saturday afternoon. As of 5 p.m., there were 1,298 CL&P customers without power" (Connecticut Post, February 27, 2012).

Deadly and destructive tornados do occur in New England, including Connecticut. There have been 8 recorded tornadoes in the RiverCOG region since 1950, the most recent having been in 1998. Although no tornadoes have been recorded since that time, evidence lead locals to believe tornadoes may have occurred in Chester and Old Lyme on July 31, 2009 when tornadoes were recorded in other parts of the state.

Enhanced Fujita Scale	Date	Injuries	Fatalities	Town
EF 2	July 12, 1950	0	0	Portland
EF 3	August 21, 1951	8	0	East Hampton
EF 1	July 19, 1963	0	0	Middletown
EF 1	July 21, 1972	0	0	Middletown
EF 1	June 27 1974	0	0	Essex
EF 0	June 30, 1998	0	0	Killingworth
EF 1	June 30,1998	0	0	Chester
EF 1	June 30, 1998	0	0	Old Lyme

Figure 11: **Recorded Tornadoes** in RiverCOG Region, 1950-2013.
Source: Tornado History Project

While Connecticut, ranked 42 out of 50, is an unlikely area for dangerous tornadoes, there have been instances where tornadoes have developed in conjunction with high wind events and storms. Tornadoes are produced inside powerful thunderstorms, which, in turn, are created near the junction between warm, moist air and cold, dry air. The conditions that produce a "tornadic thunderstorm" exist when warm, moist air gets trapped beneath a stable layer of cold, dry air. A primary future difficulty with tornadoes in Connecticut is the relative density of population and structures to the potential for damage. According to the National Climactic Data Center (NCDC) New London County experiences .006 Annualized Tornado events with $0 in annualized damages.

c. **Probability of Occurring Again** (B.2)

Tornados are *not likely* to occur in Old Lyme. According to *Significant Tornadoes 1680–1991* by Thomas Grazulis from 1953 to 1991, Connecticut recorded an average of about 1.3 tornadoes per year, ranked 43rd in the United States. As shown in the chart above, one of those occurred in town.

d. **Potential Impacts** (B.3)

Tornados and high winds destroy vegetation and structures within the storm's path. For example, "October 3, 1979: The Windsor Locks, Connecticut tornado, an extremely destructive F4 tornado, one of the worst in Connecticut history, killed 3 persons and injured 500 more in northern Hartford County. The tornado struck without warning, tearing through Bradley International Airport destroying more than a dozen airplanes, and narrowly missing a Boeing 727, which was attempting to land. About 100 homes were completely leveled. Most of the $200+ million in damage was done in Windsor Locks and Suffield. This was the sixth-most damaging tornado in US history." [Wikipedia, 2012]

EF-Scale Number	Intensity	Wind Speed (mph)	Impact
EF-0	Gale Tornado	65-85	Some damage to chimneys; branches broken off trees; shallow-rooted trees knocked over; damage to sign boards.
EF-1	Moderate Tornado	86-110	Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF-2	Significant Tornado	111-135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF-3	Severe Tornado	136-165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF-4	Devastating Tornado	166-200	Well-constructed houses leveled; structures with weak foundations blown off for some distance; cars thrown and large missiles generated.
EF-5	Incredible Tornado	201-240	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-reinforced concrete structures badly damaged.

Figure 12: **Enhanced Fujita Scale and potential impacts.**

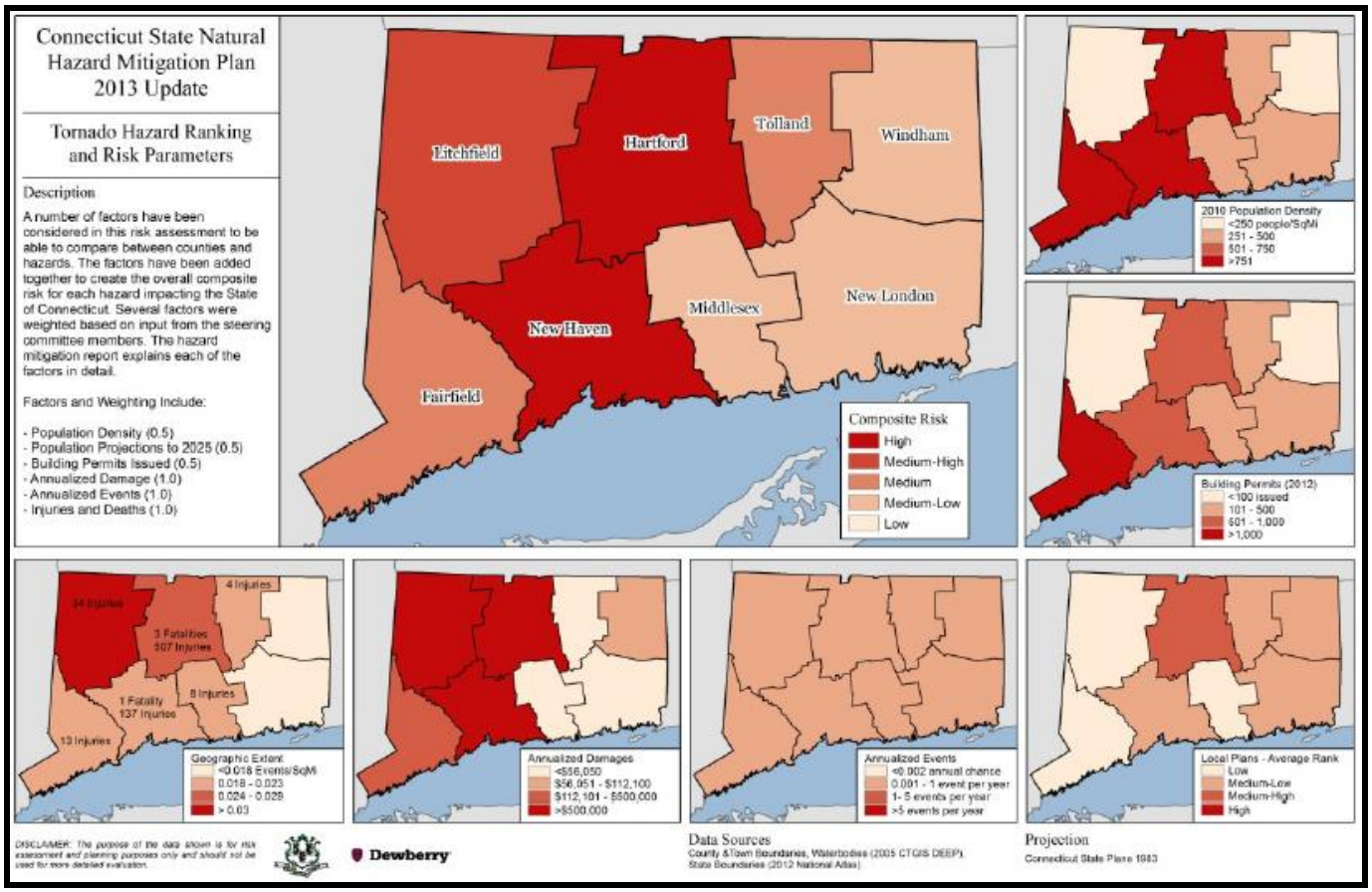


Figure 13: **Tornado Hazard Ranking and Risk Parameters**
Source: CT NHMP, 2013

Figure 13 above taken from the Connecticut State NHMP, shows the relative risk of tornado to be Medium-Low for all New London County towns. This risk is based upon population density, population projections to 2025, building permits and other factors.

Damage estimates are difficult to predict as tornadoes and high wind events can happen anywhere within the Town. A tornado would cause much more property damage south of I-95 where the land is more densely developed and more structures could potentially be damaged. Needless to say, a strong tornado could cause significant damage to any structure in its path.

Figure 12 on the previous page includes a description for possible damage due to the various categories of Tornadoes. Also included is a definition of intensity and wind speed as it relates to the Enhanced Fujita Scale Number.

All areas of Old Lyme are equally susceptible to damages form High Wind and Tornadoes; however a high wind event in more densely populated areas such as around Rogers Lake and immediate shoreline would result in more property damage than in other areas of town.

e. **Authorities, Policies, Programs, and Resources** (C.1)

Old Lyme enforces the Connecticut State Building Code which requires that all new structures be built to withstand a 110 mph wind load. However, structures in the area within one mile of the Long Island shore must be constructed with wind resistant glass able to withstand 120 mph winds.

f. **Mitigation** (C.3, C.4)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Mandatory Wind Code Compliance. Enforce the policy that all building permit applicants must construct their projects to meet 110 mile per hour wind resistance standard, whenever possible.

Underground Utilities. Require underground utilities for new development; require retrofitting during redevelopment of existing sites to bury utilities where appropriate to mitigate NHs.

Outreach. Promote owner participation in mitigation efforts to protect their property, such as to elevate, flood- and wind-proof structures to meet and exceed requirements through its various regulations.

4. Drought & Wildfire

A drought is defined as a long period of extremely dry weather when there is not enough rain for the successful growing of crops or the replenishment of water supplies. A wildfire is any uncontrolled fire in combustible vegetation that occurs in the countryside or a wilderness area. A wildfire differs from other fires by its extensive size, the speed at which it can spread out from its original source, its potential to change direction unexpectedly, and its ability to jump gaps such as roads, rivers and fire breaks. Wildfires are characterized in terms of the cause of ignition, their physical properties such as speed of propagation, the combustible material present, and the effect of weather on the fire. There are three different classes of wildfires. A "surface fire" is the most common type and burns along the floor of a forest, moving slowly and killing or damaging trees. A "ground fire" is usually started by lightning and burns on or below the forest floor in the humus layer down to the mineral soil. "Crown fires" spread rapidly by wind and move quickly by jumping along the tops of trees.

Photo 3: **Fire Crews Investigate** a reported brushfire in Old Lyme off Mile Creek Road in 2010.
Source: WFSB

a. **Geographic Extent** (B.1)

As with all towns in the region, Old Lyme is small enough that a drought would most likely be town-wide. Under extreme drought conditions, areas of concern for wildfire include the deciduous forest located throughout the town or areas of Phragmites in coastal tidal marshes. Drought also can exacerbate potential for small wildfires and hinder the ability of the town to control outbreaks. Large expanses of deciduous forest are located throughout the town and areas of phragmites in coastal areas are prime areas of concern. At times of severe drought, communities face growing rural -urban interface problems.

The severity of a fire depends on several factors including, fuel type, weather, and topography. There are four types of fuels of concern for wild fires which will affect how a fire behaves:

- Ground Fuels – organic soils, forest floor duff, stumps, dead roots, and buried fuels;
- Surface Fuels – litter layer, downed woody materials, dead and live plants to two meters in height;
- Ladder Fuels – vine and draped foliage fuels; and
- Canopy Fuels – tree crowns.

The weather can also play an important role in the spread of fire. Three important weather factors are:

- Wind – most important factor since it dries out fuel and drives a fire;
- Relative humidity – affects fuel moisture; and
- Precipitation.

A fire is much more likely to spread and cause significant damage when there is high wind, little humidity and a period of little no rainfall.

Different areas throughout town are susceptible to different types of fires. Inland areas where thick forest cover is abundant is more susceptible to fires feeding on ground fuels ladder fuels. Areas closer to the shoreline where development is more dense and more roads are present are more susceptible to fires feeding on surface fuels. Overall Connecticut does not have a history of fire feeding on the canopy of trees. Most fires remain on the ground.

b. **Occurrences** (B.2)

Below is a table of historic data for drought that includes coastal Connecticut. [Northeast Regional Climate Center (**NRCC**) in the Department of Earth and Atmospheric Sciences at Cornell University]

Coastal Climate Division --		
Drought Periods	**Duration**	**Lowest PDSI**
1/1901 - 2/1901	2 months	-3.79 in 2/1901
8/1910 - 7/1911	12 months	-4.30 in 7/1911
7/1913 - 9/1913	3 months	-3.68 in 8/1913
12/1924 - 6/1925	7 months	-3.64 in 6/1925
4/1930 - 3/1931	12 months	-4.26 in 9/1930
11/1949 - 1/1950	3 months	-3.13 in 12/1949
9/1964 - 1/1965	5 months	-4.16 in 11/1964
3/1965 - 2/1967	24 months	-5.19 in 12/1965
3/1985 - 4/1985	2 months	-3.84 in 4/1985
8/1995 - 9/1995	2 months	-3.61 in 8/1995
7/1999 - 8/1999	2 months	-3.50 in 7/1999
1/2002 - 4/2002	4 months	-3.67 in 2/2002

Figure 14: **Historic Periods of Drought in the Region.** Based on the monthly Palmer Drought Severity Index (PDSI) as computed by the National Climatic Data Center. Period of record: January 1895 through June 2002
Source: NOAA

In the spring of 2012 headlines on the local network television stations such as, “Mar 28, 2012 – Brush fires have been reported in East Haddam, East Windsor and Fairfield,” were common. “The largest of the fires consumed more than 50 acres in Devil's Hopyard State Park in East Haddam and fire officials made the decision to let the fire burn.” (NBC Connecticut website, March 28, 2012) “Brush fires are not uncommon[,] since 2009 there has been 130 brush fires in Connecticut, fortunately none have been terribly large other than that 60 + acre fire in remote Salisbury that fire fighters had a tough time getting to last year.” [WXedge.com, Connecticut Brush Fire 101**,** Brandon Gervais (a 22 year old Environmental Science senior at the University of New Haven) on March 19, 2012]

The town of Old Lyme experiences brush fires annually, sometimes as many as 4-6 fires per year. Typically these are small fires that affect less than one acre of land and can be controlled within a short amount of time.

c. **Probability of Occurring Again** (B.2)

Drought and wildfire (particularly brush fires) are both *likely* to occur in Old Lyme.

With a significant amount of Urban Forest Boundary throughout town, fires are *likely* with the amount of human interaction with the forest.

d. **Potential Impacts** (B.3)

Because they are not often severe, response to droughts in the region most often have begun with voluntary water conservation. Under severe drought conditions water use restrictions may be mandatory.
A significant portion of the population in Old Lyme relies on ground water for domestic water supply. Under extreme and prolonged drought conditions, these water sources could be affected.

With an intricate network of wetlands and watercourses in Old Lyme there are more natural breaks that would contain fire than in other parts of the country. That being said, a brushfire can still threaten houses and other structures.

Drought can be problematic to homeowners with shallow wells, particularly in the Rogers Lake area, where wells may go dry during long periods of drought.

Figure 15 as shown in the Connecticut State NHMP 2013 Updated shows that the overall risk of wildfires in Middlesex County is Medium. This is based up population density, population projections to 2025, building permits, forest cover and other factors.

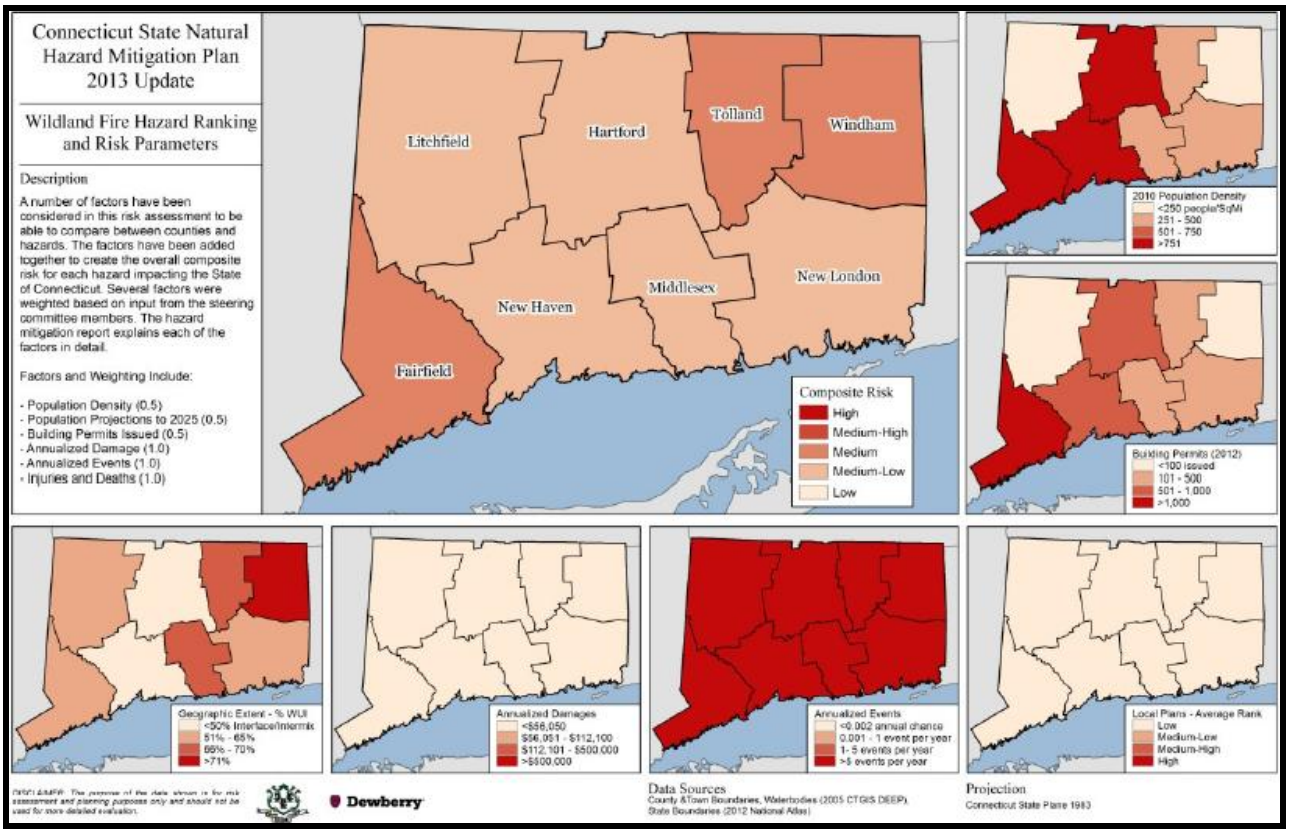


Figure 15: **Wild Fire Hazard Ranking and Risk Parameters**.
Source: CT State NHMP 2013 Update

In Old Lyme, the area north of the Amtrak tracks is the more heavily forested part of town and therefore more susceptible to wild fires. Homes and other structures in that area are more at threat as they lie within the wild land-urban interface (WUI) in an intermix pattern, meaning that homes are tucked into the larger forest cover. Although unlikely, a large enough wildfire north of the Amtrak line could spread, causing the loss of many homes and potentially several million dollars of property damage.

e. **Authorities, Policies, Programs and Resources** (C.1)

The DEEP Division of Forestry issues Forest Fire Danger Ratings for Connecticut (See Figure 16). A National Fire Danger Rating system that utilizes two indexes is used in Connecticut. The "spread" of a fire is predicted with the Spread Index, which is a numeric rating that corresponds with how fast a fire travels in 'Chains per Hour' (a chain is 66'). For example, if a prediction is made that the Spread Index will be 19, it means the fire is predicted to spread 1254 feet (19 x 66') in an hour. Connecticut also uses a Build Up Index (BUI) that measures drought. The BUI is a relative measure of the cumulative effect of daily drying factors and precipitation on fuels with a ten-day time-lag.

Rating or Class Days	Spread Index	Build Up Index
LOW	0-10	0-22
MODERATE	11-15	23-44
HIGH	16-29	45-59
VERY HIGH	30-39	60-74
EXTREME	> 40	> 75

Figure 16: **Five Forest Fire Danger Ratings**
Source: CT DEEP

The CT DEEP monitors weather conditions and issues warnings when fire danger is at its highest. DEEP also has the authority to block fire burning permits and restrict campfires within State Parks. The Fire Danger Warning is easily accessible on the DEEP web page. These measures are largely successful at reducing the risk from large wildfires.

The current Subdivision Regulations allow for the Planning Commission to require the construction of a fire well or fire pond within any new subdivision to be funded by the developer. Location of said well or pond must be approved by the commission. The fire company maintains a list of fire wells and dry hydrants and there is an effort to keep those areas on the list clear and accessible. Subdivision regulations require that streets with only one means of egress be limited in length to limit the number of houses on the street. Emergency access roads must be constructed when a road reaches a length of greater than 1200 feet without a second point

of egress. Subdivision regulations require that the Fire Marshal review each subdivision plan to assure that there is an adequate source of water for firefighting. If no natural source is present, the development may be required to construct a fire pond that is accessible to fire trucks or to install an underground storage tank with a dry hydrant. Zoning regulations require that the Fire Marshal review site plans for commercial and industrial uses to assure that there is adequate access for firefighting.

Currently the Town of Old Lyme has mutual aid agreements in place with surrounding towns to provide fire coverage should the need arise. DEEP monitors weather conditions and issues warnings when fire danger is at its highest. DEEP also has the authority to block fire burning permits and restrict campfires within State Parks.

f. **Mitigation** (C.3, C.4)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:

Access to Woodlands. During periods of drought, forestry practices should be established that increase the ability of firefighters to access forest fires.

Land-Use Planning. Require storm water retention to recharge groundwater within existing, new, and redeveloping areas.

Wildfire Management Plan. Work on a regional level and with neighboring towns to develop a wildfire management plan and protocol to ensure that outside fire-fighting resources, such as the DEEP Forestry Unit, are available.

Fire Warnings. During vulnerable periods, a system of warnings about campfires and open fires should be posted in public locations.

Firefighter Training and Education. Training and education of firefighters should include brush and forest fires, with consideration for large areas of phragmites.

Water Conservation. Encourage homeowners to conserve water during times of drought.

5. Winter Storms

A winter storm is an event in which the dominant varieties of precipitation are forms that only occur at low temperatures, such as snow or sleet, or a rainstorm where ground temperatures are low enough to allow ice to form (i.e. freezing rain). In temperate continental climates, these storms are not necessarily restricted to the winter season, but may occur in the late autumn and early spring as well. Winter storms also can be accompanied by strong winds (e.g. nor'easters) that can cause coastal flooding and damage.

a. Geographic Extent (B.1)

Winter storms typically will impact the entire town; however, effects can vary locally depending on weather conditions (e.g. snowfall in upland areas with rain along the shore) or coastal flooding from nor'easters.

Figure 17 below identifies various weather advisories that are issued throughout the winter and the extent to which the storms may impact the residents of Old Lyme. These alerts are typically issued by NOAA in advance of a winter storm in order to allow people to take precautions ahead of the storm and to encourage people to limit travel on roads.

Winter Weather	Extent of Weather Event
Winter Weather Advisory	This alert may be issued for a variety of severe conditions. Weather advisories may be freezing drizzle, freezing rain, or a combination of weather events. Announced for snow, blowing or drifting snow, freezing drizzle, freezing rain, or a combination of weather events.
Winter Storm Watch	Severe winter weather conditions may affect your area (freezing rain, sleet, or heavy snow may occur separately or in combination).
Winter Storm Warning	Severe winter weather conditions are imminent.
Freezing Rain or Freezing Drizzle	Rain or drizzle is likely to freeze upon impact, resulting in a coating of ice glaze on roads and all other exposed objects.
Sleet	Small particles of ice usually mixed with rain. If enough sleet accumulates on the ground, it makes travel hazardous.
Blizzard Warning	Sustained wind speeds of at least 35mph are accompanied by considerable falling or blowing snow. This alert is the most perilous winter storm with visibility dangerously restricted.
Frost/Freeze Warning	Below freezing temperatures are expected and may cause significant damage to plants, crops, and fruit trees.
Wind Chill	A strong wind combined with a temperature slightly below freezing can have the same chilling effect as a temperature nearly 50 degrees lower in a calm atmosphere. The combined cooling power of the wind an temperature on exposed flesh is called the wind-chill factor.

Figure 17: **Winter Weather Alerts** and the Extent of Winter Storms.
Source: NOAA

b. **Occurrences** (B.2)

There is a history of powerful winter storms that have affected Old Lyme and the region. See Figure 6 for a summary. Some of the more notable storms are listed below.

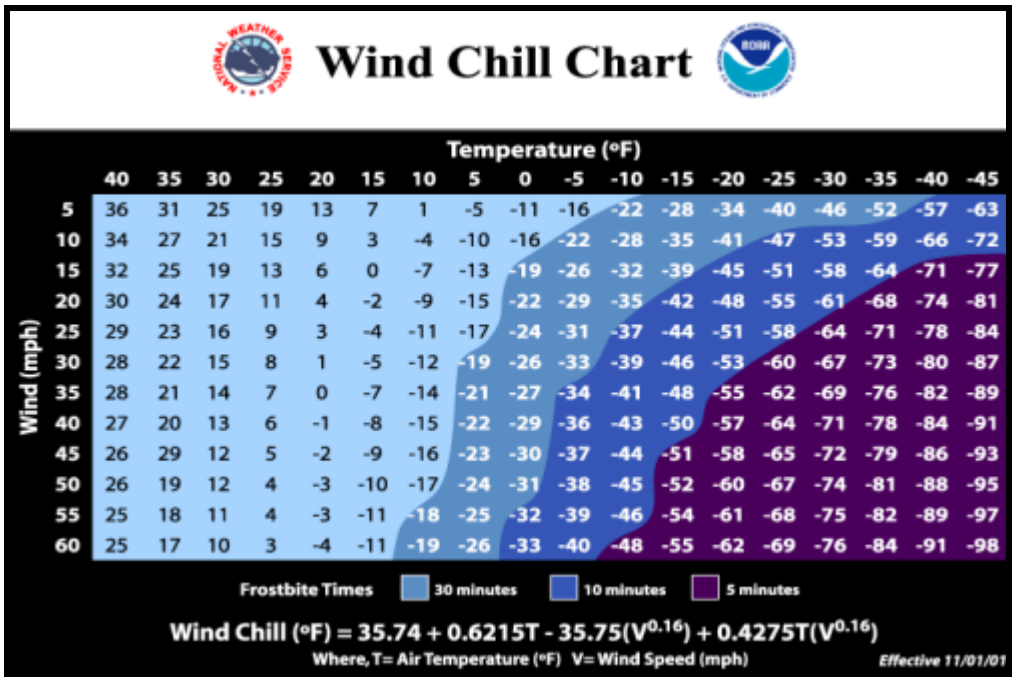
1888 – Blizzard
1978 – Blizzard
1993 – "Storm of the Century"
1996 – Blizzard
2013 - February Blizzard

According to the NCDC, New London County experiences 4.15 annualized events and $0 in annualized damages.

c. **Probability of Occurring Again** (B.2)

Winter storms are *very likely* to occur in Old Lyme. They have caused significant damage and are second only to hurricanes in terms of the potential damage they can cause in Old Lyme.

d. **Potential Impacts** (B.3)



Wind Chill Chart

Wind (mph)	Temperature (°F) 40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	29	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Effective 11/01/01

Figure 18: **Wind Chill Chart**
This chart displays wind speed and ambient temperature as they relate to frostbite on skin.
Source: NOAA, NWS

Depending upon the severity and duration of the storm, impacts can be varied. Those of which require attention for hazard mitigation can cripple transportation, communications and threaten provision of basic needs for health, safety and the general welfare. Significant snowfall rates or ice accumulation can exceed the ability of crews to keep roads open for travel and can bring down electric, telephone and cable wires. With the advent of cellular systems, reliance upon landline communications is less; however, severe storms can affect cellular communication towers. Most homes are dependent upon electricity to either provide heat or to ignite other fuel sources. Depending on outside temperatures, a prolonged electrical outage in the winter can result in freezing of pipes and can be life threatening. If travel becomes impossible, the provision of food, medicines and other necessary goods can be delayed or halted and economic losses can occur as people are unable to get to and from work.

Winter storms also can cause significant coastal flooding, the impacts of which are discussed in Section II.B.1 (Flooding).

NOAA's National Climatic Data Center is now producing the Regional Snowfall Index (RSI) for significant snowstorms that impact the eastern two thirds of the U.S. The RSI ranks snowstorm impacts on a scale from 1 to 5, similar to the Fujita scale for tornadoes or the Saffir-Simpson scale for hurricanes. The RSI differs from these other indices because it includes population. RSI is based on the spatial extent of the storm, the amount of snowfall, and the juxtaposition of these elements with population. Including population information ties the index to societal impacts. Currently, the index uses population based on the 2000 Census(Source: NOAA).

CATEGORY	RSI VALUE	DESCRIPTION
1	1–3	Notable
2	3–6	Significant
3	6–10	Major
4	10–18	Crippling
5	18.0+	Extreme

Figure 19: **Regional Snowfall Index**
Source: NOAA

Typically property losses only occur during unprecedented storms or during winters when snow events come one after the other creating a deep snow pack, overloading roof structures causing collapse. During the unusually snowy winter of 2010-2011, at least 46 buildings and more than 130 barns collapsed under the intense weight of the snow causing an unknown amount of damage across Connecticut. There is no way to reliably estimate damage figures from snowfall. Damage will depend on the ability to remove snow from roofs in a timely manner, temperature, and other factors.

e. **Authorities, Policies, Programs and Resources** (C.1)

In anticipation of severe winter storms, the Town has the authority to order parking bans and can order evacuations in extreme situations if there is a significant threat of localized flooding.

The Department of Public Works maintains a fleet of trucks and other snow removal equipment and monitors weather forecasts during the winter months to mobilize in advance of storms. The Department of Public Works only has a difficult time keeping the roads open in extreme conditions, such as the February 2013 Blizzard.

f. **Mitigation Specific to this Hazard** (C.3, C.4)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:

Landscaping. Promote landscaping practices that encourage the planting of species that are less susceptible to damage from ice storms to reduce the probability of damage to structures.

Underground Utilities. Consider requiring that all new subdivisions and commercial development bury utilities to prevent power and telecommunications lines from damage from ice, snow and falling tree limbs.

Public Information. Provide information on the town's website about pending storms and links to town, regional, state and federal sites for information on reducing damage from natural hazards.

6. Earthquake

An earthquake is the sudden, rapid shaking of the earth, caused by the breaking and shifting of subterranean rock as it releases strain that has accumulated over a long time.

a. **Geographic Extent** (B.1)

An earthquake would likely affect the entire town. Damages to homes and businesses would depend on the age and quality of the structure. Figure 21 describes what impacts earthquakes may have on the community.

b. **Occurrences** (B.2 & B.4)

While there is no record of damages in Old Lyme from an earthquake, they have occurred in the region and have been felt locally.

Date	Distance (miles)	Magnitude	Depth (miles)
6/3/2011	29.67	1.7	5
6/17/1982	10.74	3	2
10/21/1981	17.24	3.8	5
10/25/1980	25.44	3	0
10/24/1980	24.54	3.1	0

Figure 20: **Earthquakes** within 50 miles of Old Lyme
Source: USGS

The most severe earthquake in Connecticut's history occurred at East Haddam on May 16, 1791.

Describing that earthquake an observer said: "It began at 8 o'clock p.m., with two very heavy shocks in quick succession. The first was the most powerful; the earth appeared to undergo very violent convulsions. The stone walls were thrown down, chimneys were untopped, doors which were latched were thrown open, and a fissure in the ground of several rods in extent was afterwards discovered. Thirty lighter ones followed in a short time, and upwards of one hundred were counted in the course of the night." A moderate tremor occurred at Hartford in April 1837. It jarred loose articles, set lamps swinging, and rang bells.
In August 1840, an earthquake of similar intensity was centered a few miles southwest of the 1837 tremor. On June 30, 1858, New Haven was shaken by a moderate tremor at 10:45 in the evening. Residents reported rattling of glasses and a noise "like carriages crossing a bridge." The strong tremor hit near Hartford on November 14, 1925.

An intensity V earthquake in southern Connecticut occurred on November 3, 1968. It cracked plaster at Madison, furniture shifted at Chester, and small items fell and broke.

A few damaging shocks centering in neighboring States, and several Canadian tremors, have been noted by Connecticut citizens the past three hundred years. A devastating earthquake near Tros-Rivieres (Three Rivers), Quebec, on February 5, 1663, caused moderate effects in some areas of Connecticut.

An earthquake near Massena, New York, in September 1944 was felt over a wide region. Mild effects were noticed by residents of Hartford, Marion (Southington), New Haven and Meriden, Connecticut. At its epicenter, the shock destroyed nearly all chimneys, crippled several buildings, and caused $2 million property damage in that region. [Source: USGS website, 2012]

As recently as March 23, 2011 the village of Moodus in East Haddam, just north of Old Lyme experienced a tremor which measured 1.3 on the Richter scale.

c. **Probability of Occurring Again** (B.2)

The occurrence of an Earthquake in Old Lyme is *not likely*. The USGS database shows that there is a 1.186% chance of a major earthquake within 50 kilometers of Old Lyme, Connecticut within the next 50 years. [Source: USGS website, 2012] Old Lyme-area historical earthquake action is slightly below the Connecticut state average and is 91% lower than the overall U.S. average (Source: City Data).

d. **Potential Impacts** (B.1, B.3)

In Old Lyme and the surrounding region, recorded impacts have been limited to shaking to the extent that things were knocked off shelves and people were alarmed. Structural damage has been limited to building components such as chimneys and buildings in poor repair; but failing structures have caused property damage in nearby towns.

A HAZUS MH: Earthquake Event Report was run with a 100-Year Probabilistic 5.0 Richter scale earthquake scenario. This report inventories building structures and infrastructure and estimates damage and losses from event scenario. The report estimates that no buildings or infrastructure would be damaged, no lives lost, and no financial impact during this event. For the complete report, see Appendix IV HAZUS-MH: Earthquake – Old Lyme.

Figure 21 on the following page defines the potential impacts from each category earthquake as measured on the Richter Scale.

Magnitude	Description	Mercalli Intensity	Average Earthquake Impacts
< 2.0	Micro	I	Micro-earthquakes, not felt, or felt rarely by sensitive people. Recorded by seismographs.
2.0–2.9	Minor	I to II	Felt slightly by some people. No damage to buildings.
3.0–3.9		II to IV	Often felt by people, but very rarely causes damage. Shaking of indoor objects can be noticeable.
4.0–4.9	Light	IV to VI	Noticeable shaking of indoor objects and rattling noises. Felt by most people in the affected area. Slightly felt outside. Generally causes none to minimal damage. Moderate to significant damage very unlikely. Some objects may fall off shelves or be knocked over.
5.0–5.9	Moderate	VI to VIII	Can cause damage of varying severity to poorly constructed buildings. At most, none to slight damage to all other buildings. Felt by everyone. Casualties range from none to a few.
6.0–6.9	Strong	VII to X	Damage to a moderate number of well-built structures in populated areas. Earthquake-resistant structures survive with slight to moderate damage. Poorly-designed structures receive moderate to severe damage. Felt in wider areas; up to hundreds of miles/kilometers from the epicenter. Strong to violent around epicenter. Death toll ranges from none to 25,000.
7.0–7.9	Major	VIII or Greater	Causes damage to most buildings, some to partially or completely collapse or receive severe damage. Well-designed structures are likely to receive damage. Felt across great distances with major damage mostly limited to 250 km from epicenter. Death toll ranges from none to 250,000.
8.0–8.9	Great		Major damage to buildings, structures likely to be destroyed. Will cause moderate to heavy damage to sturdy or earthquake-resistant buildings. Damaging in large areas. Felt in extremely large regions. Death toll ranges from 1,000 to 1 million.
9.0 >			Near or at total destruction - severe damage or collapse to all buildings. Heavy damage and shaking extends to distant locations. Permanent changes in ground topography. Death toll usually over 50,000.

Figure 21: **Earthquake Magnitude and Impacts.**

e. **Authorities, Policies, Programs and Resources** (C.1)

The Town enforces the State building code construction standards.

f. **Mitigation Specific to this Hazard** (C.2)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:
Insurance. Educate residents about the possibility of earthquakes and the option to purchase a low cost earthquake rider for homes and businesses. This would protect property owners from damage to chimneys, windows or foundations.

Public Information. Provide information on the town's website about earthquakes and links to town, regional, state and federal sites for information on reducing earthquake property damage.

Building Code. Insure that all new residential and commercial construction meets state building codes.

7. Hurricane & Tropical Storm

A hurricane is an intense tropical cyclone often with torrential rain and strong thunderstorms and with a well-defined surface circulation and maximum sustained winds of 74 MPH (64 knots) or higher. A tropical storm is similar but with winds from 39 to 73 MPH (34-63 knots).

Photo 4: **Hawks Nest Beach** is devastated after Superstorm Sandy in October 2012.
Source: The Lymes Patch.

a. Geographic Extent (B.1)

Hurricanes and tropical storms will affect the entire town; however affects will vary depending on proximity to the shore. Strong winds and rain will affect the entire town while storm surges and coastal flooding will affect coastal areas. See Section II.B.1 (Flooding) for a discussion of coastal flooding and FEMA's flood insurance rate maps that depict the 100-year flood zone and Section II.B.2 (High Wind & Tornado) for a discussion of high winds.

Map 9 and 10 below, Hurricane Surge Inundation with Storm Categories, depicts the extent of worst-case coastal flooding that could occur in Old Lyme from category 1 through category 4 hurricanes. The extent of damages that may occur as a result of each category of hurricane is shown in Figure 24.

b. Occurrences (B.2 & B.4)

See Figure 17 on the next page for a summary of hurricanes that have

affected Old Lyme since records have been kept. Reliable record keeping of Hurricanes and Tropical Storms in the Atlantic Ocean began in 1851.

Date	Name	Category (in CT)	Landfall	Wind Speed (mph)
September 16, 1858	Storm # 3	1	Groton, CT	80
September 8, 1869	Storm # 6	1	Westerly, RI	115
August 24, 1893	Storm # 4	1	Queens, NY	85
October 10, 1894	Storm # 5	1	Clinton, CT	85
September 21, 1938	Great New England Hurricane	3	New Haven, CT	115
September 15, 1944	Great Atlantic Hurricane	1	Matunuck, RI	85
August 30, 1954	Carol	2	Groton, CT	115
September 12, 1960	Donna	1	Old Saybrook, CT	100
September 27, 1985	Gloria	1	Milford, CT	85
August 19, 1991	Bob	1	New Shoreham, RI	105
August 24, 2011	Irene	TS	Brooklyn, NY	65
October 29, 2012	Sandy	1	Brigantine, NJ	80

Figure 22: **Major Hurricanes** and Tropical Storms (TS) in New England since 1858.
Source: Ryan Hanrahan, WVIT NBC 30

Most recently, Superstorm Sandy hit Old Lyme on October 29, 2012 and Tropical Storm Irene on September 2, 2011 both of which caused significant coastal flooding, property damage, damage to homes and downed power lines resulting in week-long power outages in many cases.

c. **Probability of Occurring Again** (B.2)

As a coastal community, Old Lyme is *very likely* to experience hurricanes and tropical storms.

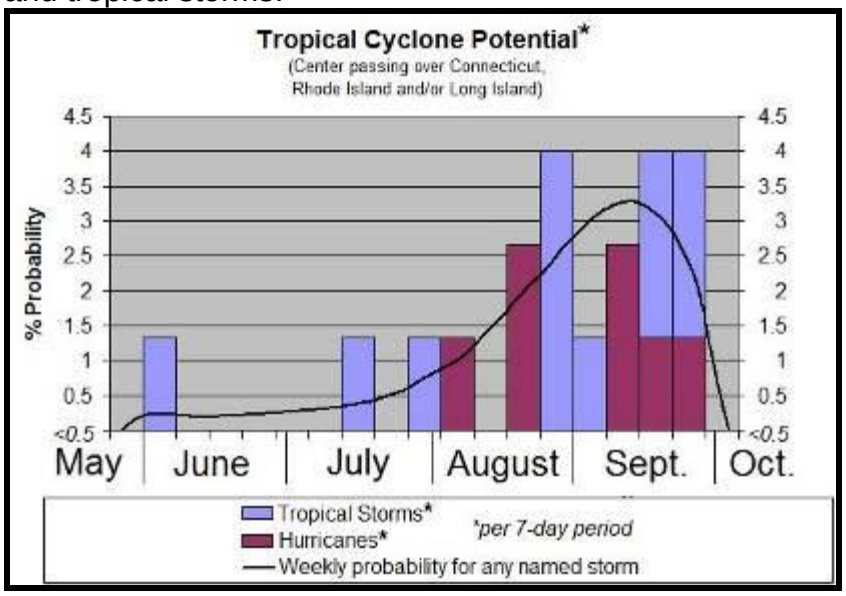


Figure 23: **Potential for Tropical Storm/Hurricane** in Connecticut
Source: WXEdge.com

d. **Potential Impacts** (B.1, B.3)

In the event of a hurricane or tropical storm, the primary risks in Old Lyme are from high wind, storm surges and coastal flooding and inland flooding on small streams and rivers from heavy rain. See Sections II.B.1 and 2 for a discussion of potential impacts.

Because of the frequency of hurricanes and their potential severity, they are the natural disaster likely to cause the greatest damage. Flooding from hurricanes can cause smaller rivers and streams to drain much more slowly causing significant flooding inland. (See Map 6, Flood Zones.)

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	**Very dangerous winds will produce some damage:** Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	**Extremely dangerous winds will cause extensive damage:** Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 kt 178-208 km/h	**Devastating damage will occur:** Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	**Catastrophic damage will occur:** Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	**Catastrophic damage will occur:** A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Figure 24: **Saffir-Simpson Scale of Hurricane Winds and Impacts**

Figure 24 provides the definition and impact of each category of Hurricane. Damage estimates are based on wind speed. A Hurricane affecting Long Island Sound would also cause considerable flooding which would cause additional damage to structures lying within the Flood Zone. A HAZUS-MH: Hurricane Event Report was created based on a 100-Year Probabilistic scenario. This report inventories all buildings and infrastructure in Old Lyme and estimates the number of losses and

damages throughout the town in this scenario. These estimates can be found in Figure 25. For the full report, see Appendix III.

Occupancy	No Damage	Minor Damage	Moderate Damage	Severe Damage	Destruction
Agriculture	20	3	1	0	0
Commercial	221	29	7	1	0
Education	8	1	0	0	0
Government	6	1	0	0	0
Industrial	74	9	2	0	0
Religion	16	2	0	0	0
Residential	3,924	800	105	6	5
Total	**4,270**	**845**	**116**	**7**	**5**

Figure 25: **Damage Due to 100 Year Hurricane**

This report also estimates the amount of debris that would be generated after such an event. It is estimated that 14,992 tons of debris would be generated by this event, 69% of which would be tree debris. According to the report, Old Lyme could expect a $17.6 Million economic loss as a result of such a storm. For the full report, see Appendix V, HAZUS-MH: Hurricane – Old Lyme.

e. **Authorities, Policies, Programs and Resources** (C.1)

Section II.B.1(Flooding) discusses policies regarding Flood Zone regulations. Section II.B.2 (High Wind & Tornado) discusses policies regarding Wind Speed Compliance per the state building code.

The Emergency Management budget includes funding each year for unforeseen emergency events which can be utilized to cover some funds. The amount is small and will not help in the recovery of most large storms.

f. **Mitigation Specific to this Hazard** (C.3)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:

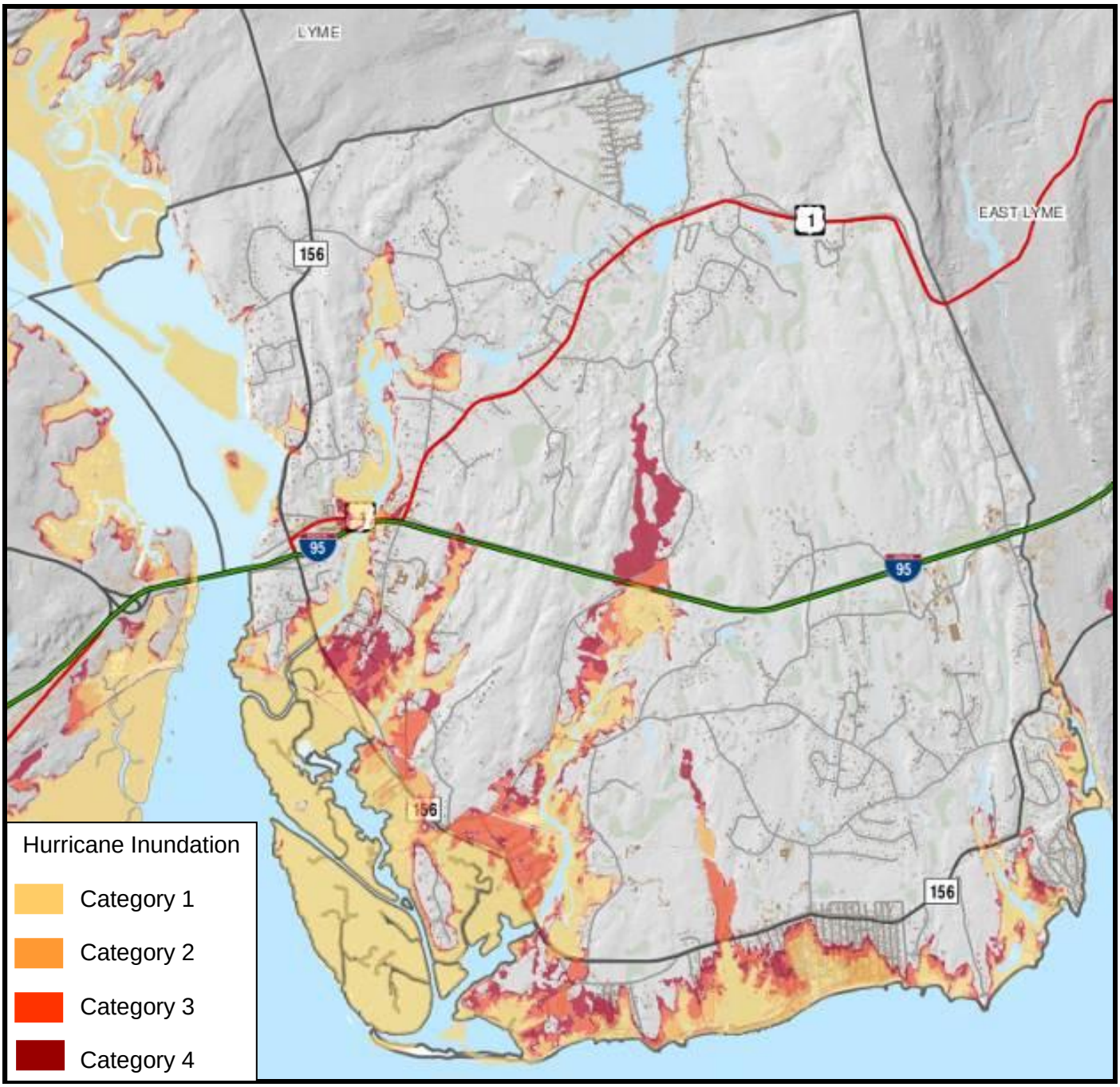
Public Information. Provide information on the town's website about hurricane preparedness and links to town, regional, state and federal sites for information on reducing hurricane damage.

Building Code. Insure that all new residential and commercial construction meets state building codes for high wind zones.

Boats. Identify places where people could store their boats during flooding and hurricane events that would reduce the damage to them and

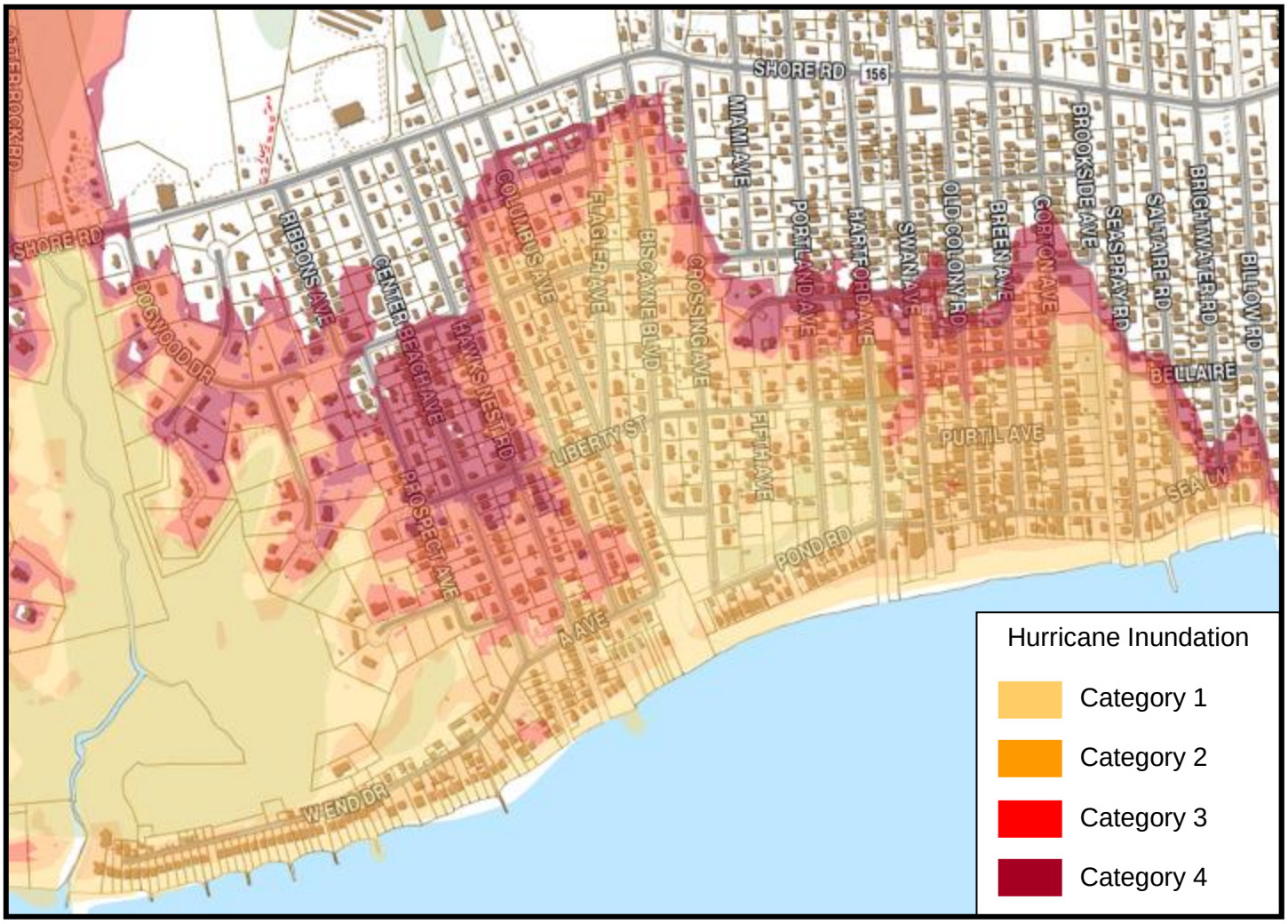
that they cause to the waterfront infrastructure when they break from moorings.

Photo 5: **The Hurricane of 1938** had severe consequences in the Old Lyme beach communities.
Source: City-Data.com



Map 8: **Hurricane Surge Inundation** with Storm Categories
Source: Old Lyme GIS

This map depicts areas that may be flooded under worst case conditions from category 1 - 4 hurricanes. Hurricane surge values were developed by the National Hurricane Center using the SLOSH (Sea Lake and Overland Surge from Hurricanes) Model.



Map 9: **Hurricane Surge Inundation** with Storm Categories
Source: Old Lyme GIS

This map depicts beach neighborhoods that may be flooded under worst case conditions from category 1 - 4 hurricanes. Toward the bottom left is the Hawks Nest community and the Old Lyme Shores community is on the right side of the map. Hurricane surge values were developed by the National Hurricane Center using the SLOSH (Sea Lake and Overland Surge from Hurricanes) Model.

8. Sea Level Rise

Sea level rise is a mean rise in sea level, which may cause a general shoreline retreat and an increased risk for flooding.

a. **Geographic Extent** (B.1)

In A Movable Shore: The Fate of the Connecticut Coast (1992), the Connecticut Department of Energy & Environmental Protection (DEEP) documents sea level rise as occurring along the New England coast. In Old Lyme, low lying coastal areas adjacent to Long Island Sound and the Connecticut River will be affected.

b. **Occurrences** (B.2 & B.4)

Unlike the event-driven natural hazards discussed previously, sea level rise is a relatively slow-moving process – a slow-motion natural disaster.

Global sea level has been rising for more than ten thousand years, leading to the establishment and expansion of coastal salt marshes (e.g., Redfield and Rubin, 1962; Redfield, 1967, 1972; Lambeck, 1990). For most of the last 1000 years the rate of relative sea-level rise (RSLR) was between 1.3 and 1.8 [millimeters per year] mm/yr, but over the last 300-400 years it increased to 2.9-3.3 mm/yr, and has been faster than the accretion rate, especially in the middle marsh. [Source: A sea-level rise curve Koren R. Nydick, Alison B. from Guilford, Connecticut, USA Bidwell, Ellen Thomas I, Johan C. Varekamp Department of Earth and Environmental Sciences, Wesleyan University, Middletown, CT 06459, USA Received 13 April 1994; revision accepted 21 September 1994]

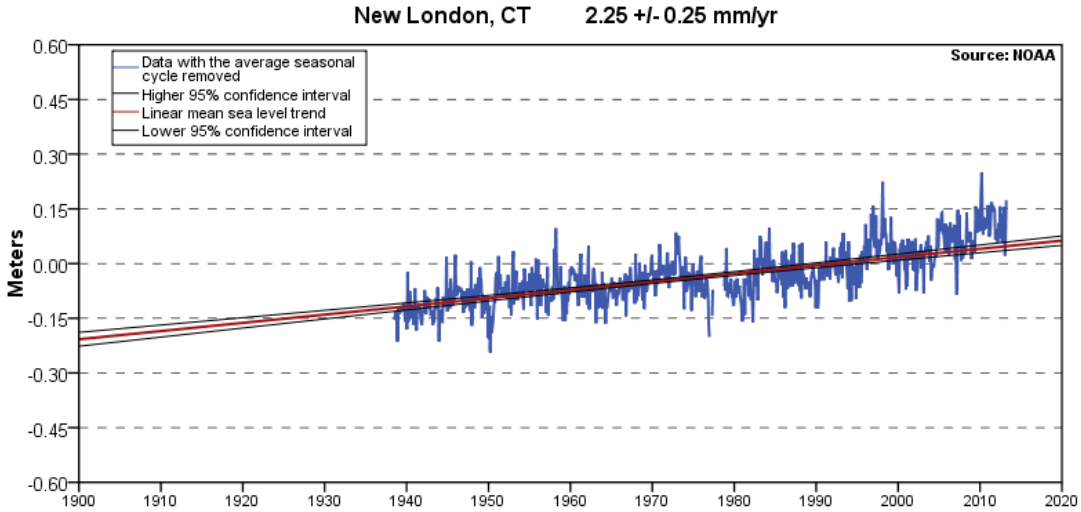


Figure 26: **Mean Sea Level Trend** at New London
Source: NOAA

c. **Probability of Occurring Again** (B.2)

Sea level rise must be considered a natural hazard that has a likelihood of impacting Old Lyme in the future. It is the rate of rise that is in question. Sea level rise has been recorded in New England long enough so that it is not in question. Impacts from Sea Level Rise are *likely* over time.

d. **Potential Impacts** (B.3)

Regardless of the projections used, sea level rise is becoming an increasingly important issue that towns need to deal with now to be prepared for the eventual impacts to occur within the next fifty (50) to seventy (70) years.

At this time, estimates of economic loss are impossible to create; however, HAZUS estimates that a 100-year flood event with current sea level is capable of producing an economic loss of $73.22 Million. It can be expected that that number will only rise as sea levels rise.

e. **Authorities, Policies, Programs and Resources** (C.1)

At the present time the Town does not have a comprehensive understanding of the specific medium- and long-term impact of sea level rise and the tools available to deal with it. (See mitigation action item to establish a Sea Level Rise Study Committee to address these issues.)

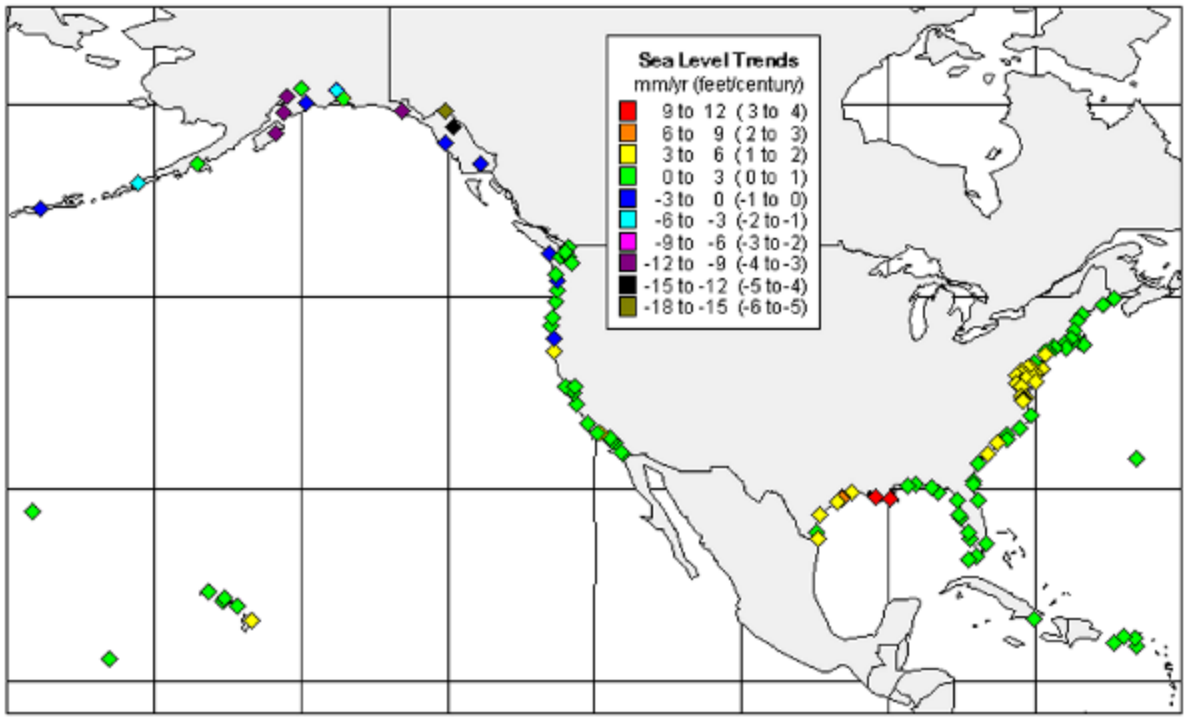
f. **Mitigation Specific to this Hazard** (C.2)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:

Possible Open Space Criteria. The Conservation Commission should consider making possible inundation by future sea level rises to its considerations for preserving open space.

Local Sea Level Rise Study Committee. The BOS should establish an ad-hoc committee to research medium and long-range impacts to coastal areas from SLR, to investigate possible mitigation actions and to assess legal, financial and policy implications.

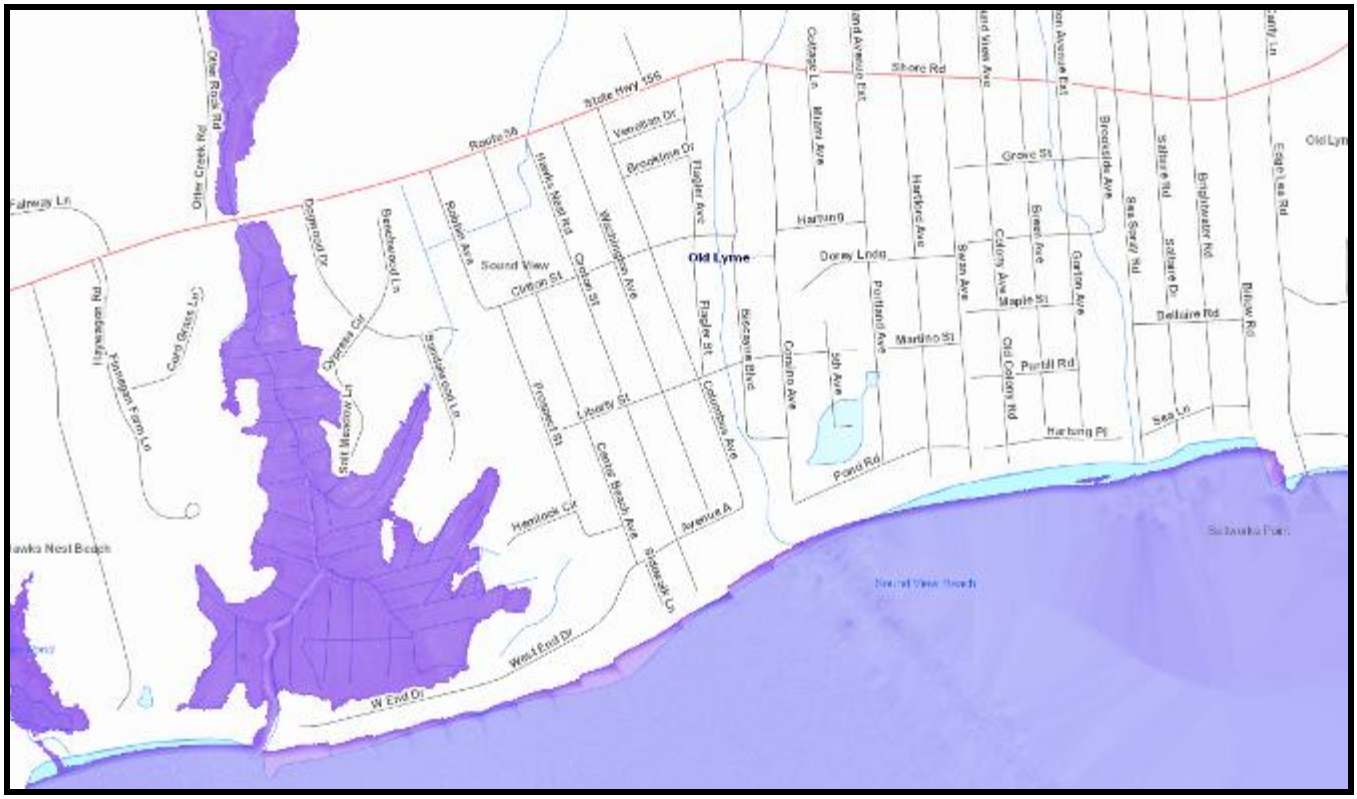
Research Sea Level Rise Impacts. Seek grants funds to collaborate with an academic institution to research and study the social, economic, environmental and policy-related impacts from SLR.



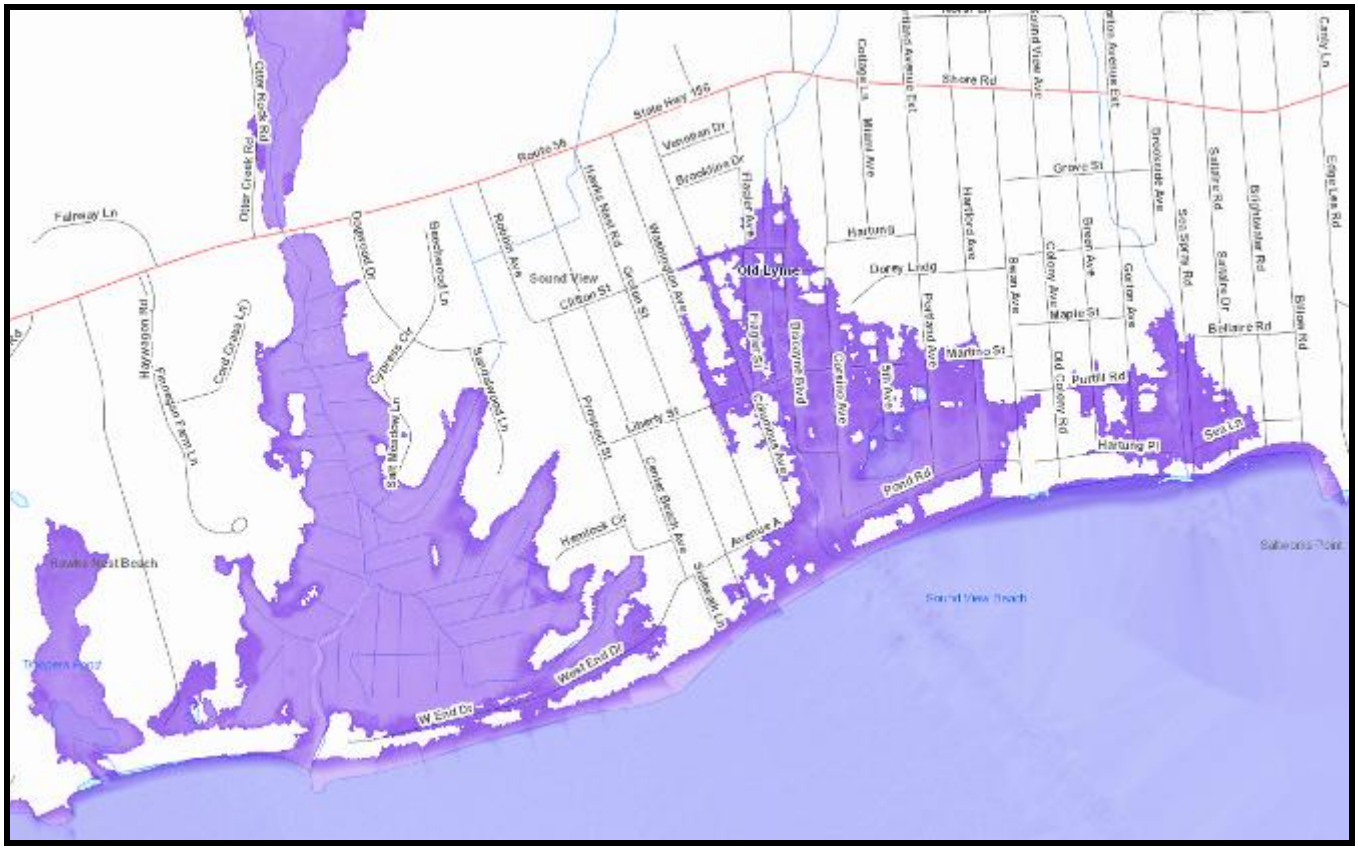
Map 10: **Sea Level Trends** (Source: NOAA)
Source: NOAA

This map depicts expected Sea Level Rise along the US shores.

Map 11: **Current Mean High Water Inundation**



Map 12: **2 Foot Sea Level Rise** Mean High Water Inundation



Map 13: **5 Foot Sea Level Rise** Mean High Water inundation
Source: CT ECO

Maps 11 through 13 depict Sea Level Rise Visualization. These maps show the Hawks Nest Beach and Old Lyme Shore Beach area of town with three Sea Level Rise scenarios. Many homes are threatened by Sea Level Rise in this area. It is important to note that the marshland surrounding the mouth of the Mile Creek (left side of maps) becomes increasingly inundated, threatening homes and cottages near it, particularly those along West End Drive.

9. Tsunami

A tsunami, also known as a seismic sea wave (mistakenly called “tidal wave”), is a series of enormous waves created by a disturbance such as an earthquake, landslide, volcanic eruption, meteorite, or in rare cases, a strong storm. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves of 100 feet or more.

a. **Geographic Extent** (B.1)

In theory, a tsunami could inundate large areas of coastal Old Lyme. There is not enough information available to understand what the exact extent of a tsunami would be in Old Lyme.

b. **Occurrence** (B.2 & B.4)

There is no record of a tsunami having occurred in Old Lyme. However, according to NOAA, a small tsunami did affect the Narragansett Bay in Rhode Island on June 13, 2013. The water level rose and fell over a period of 20 minutes as a result of a straight line of thunderstorms out at sea that caused the pressure over the ocean to suddenly drop.

c. **Probability of Occurring Again** (B.2)

The occurrence of a tsunami is *not likely* in Connecticut.

d. **Potential Impacts** (B.3)

Long Island is a barrier to smaller events in the Atlantic. Smaller events in the Sound could impact Old Lyme but they would most likely resemble a flood event originating from other sources. A tsunami would cause water levels similar to a storm surge for a category 3 or 4 hurricane, which could cause significant damage to shoreline areas (see Maps 9 &10).

HAZUS-MH estimates a 100 year hurricane could cost the town $17.6 Million in economic damage. A tsunami would likely cause similar damage.

e. **Authorities, Policies, Programs and Resources** (C.1)

Warning systems from off shore buoys would be the most logical form of mitigation. Currently the town utilizes a reverse 911 system for warnings, along with a Public Announcements system throughout town which could aid in evacuations if time allows. The Town can form a committee to begin discussion on how best to prepare for a tsunami.

e. **Mitigation Specific to this Hazard** (C.2)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:
An event in the Atlantic Ocean large enough that Long Island Sound is overrun will most likely be beyond the capability of Old Lyme to plan or respond upon its own. Prevention measures for flood damage in the flood zones adjacent to the Connecticut River are likely to provide the required mitigation for the unlikely possibility of a tsunami reaching the east coast of the United States. A benefit cost analysis would show that the *very unlikely* probability of its occurrence would not merit extensive mitigation.

Incident Notification System – Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.

Recovery & Reconstruction Plan – Develop a post-disaster recovery and reconstruction plan to re-establish infrastructure and public services, etc. damaged or destroyed by any NH event, including establishment of a "rainy day" fund in case Federal assistance is insufficient or delayed.

10. Extreme Heat / Heat Waves

A heat wave is a prolonged period of excessively hot weather, which may be accompanied by high humidity. While definitions vary, a heat wave is measured relative to the usual weather in the area and relative to normal temperatures for the season. In Connecticut, a three-day period in which the daytime high reaches 90º or above is considered a heat wave. Severe heat waves have caused catastrophic crop failures, thousands of deaths from hyperthermia, and widespread power outages due to increased use of air conditioning.

a. **Geographic Extent** (B.1)

Old Lyme falls in the humid continental climate zone, the same as much of interior Connecticut. Summer is hot and humid throughout the state, with average highs in New London of 81 °F (27 °C) and 87 °F (31 °C) in Windsor Locks. July and August tend to be the hottest months of the year with average temperatures in Hartford being 84ºF and 82ºF, respectively. The elevated summer temperatures bring the risk of extreme heat. With its dense forest coverage and abundant water features, Old Lyme is slightly more protected from extreme heat than some of its neighbors as it lies along the shoreline, but heat waves do occur. Generally, the entire town is susceptible to the same hazards from extreme heat and heat waves.

b. **Occurrences** (B.2 & B.4)

Heat waves are a regular summer season event in Connecticut, including Old Lyme. Summer 2012 was a particularly hot period, with many days in which temperatures in Hartford reached 100ºF and humidity levels were much higher than average. The entire northeast and much of the United States was under the intense heat for much of July. In June alone, 164 all-time high temperature records were broken across the country. In many areas, severe thunderstorms associated with the heat caused lengthy power outages, forcing people to cope with the heat as they lost the ability to have air conditioning.

c. **Probability of Occurring Again** (B.2)

Extreme heat and heat waves are *very likely* during the summer months in Old Lyme. As global temperatures continue to climb, heat waves will likely occur more frequently in the future.

Figure 27 below, shows the projected increase in the number of days per year with a maximum temperature greater than 90°F averaged between 2041 and 2070, compared to 1971-2000, assuming continued increases in global emissions (A2) and substantial reductions in future emissions (B1).

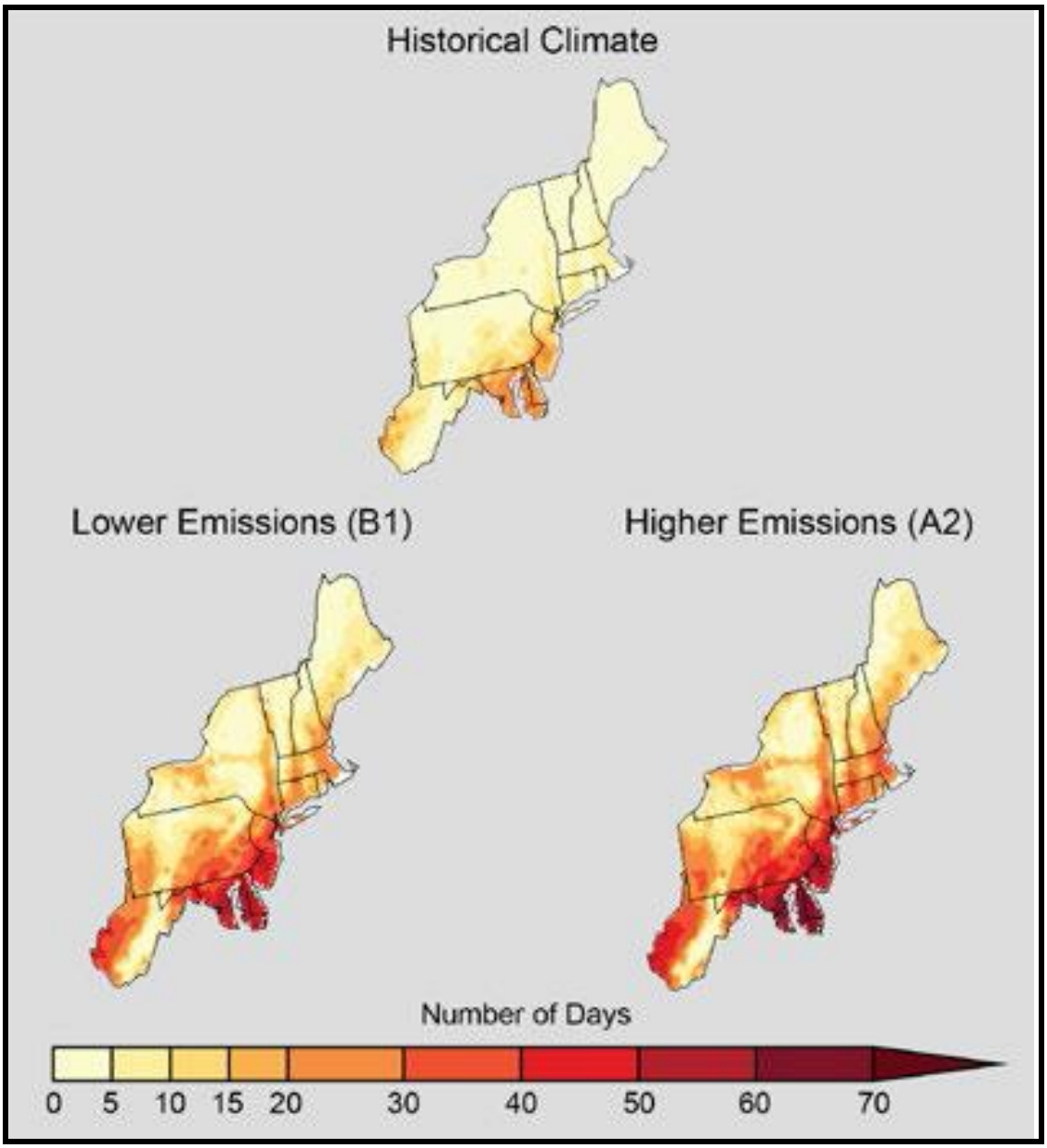


Figure 27: **Projected Increases** in the Number of Days over 90°F
Source: NOAA NCDC / CICS-NC.

d. **Potential Impacts** (B.3 & B.4)

Elderly and very young populations, especially those living in homes with no air conditioning, are most likely to be adversely impacted by extreme heat. Dehydration, heat stroke, and other negative health effects are likely during heat waves.

Physical infrastructure can also be affected negatively by extreme heat. Heat always brings with it the potential for strong thunderstorms, which could knock out power by downing trees. Asphalt, especially in places where there is not a substantial base, can buckle or crack significantly

under heat. Extended periods of very high temperatures can also exacerbate droughts.

There is no record of heat related economic losses to base future projections upon. However, if heat becomes an increasing problem, physical infrastructure may be tested and need replacement or extensive repairs in the future.

Heat Index (Apparent Temperature) Chart

The **Heat Index** (HI) is the temperature the body feels when heat and humidity are combined. The chart below shows the HI that corresponds to the actual air temperature and relative humidity. (NOTE: This chart is based upon shady, light wind conditions. **Exposure to direct sunlight can increase the HI by up to 15°F.**) (Due to the nature of the heat index calculation, the values in the tables below have an error of +/- 1.3F.)

Heat Index	*General Effect of Heat Index on People in Higher Risk Groups*
80 to 89° - Caution	Fatigue possible with prolonged exposure and/or physical activity.
90 to 104° - Extreme Caution	Sunstroke, heat cramps and heat exhaustion possible with prolonged exposure and/or physical activity.
105 to 129° - Danger	Sunstroke, heat cramps or heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity.
130° or higher - Extreme Danger	Heat sunstroke highly likely with continued exposure.

Relative Humidity (in percent)

Air Temp (in F)	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
140	125																				
135	120	128																			
130	117	122	131																		
125	111	116	123	131	141																
120	107	111	116	123	130	139	148														
115	103	107	111	115	120	127	135	143	151												
110	99	102	105	108	112	117	123	130	137	143	150										
105	95	97	100	102	105	109	113	118	123	129	135	142	149								
100	91	93	95	97	99	101	104	107	110	115	120	126	132	138	144						
95	87	88	90	91	93	94	96	98	101	104	107	110	114	119	124	130	136				
90	83	84	85	86	87	88	90	91	93	95	96	98	100	102	106	109	113	117	122		
85	78	79	80	81	82	83	84	85	86	87	88	89	90	91	93	95	97	99	102	105	108
80	73	74	75	76	77	77	78	79	79	80	81	81	82	83	85	86	86	87	88	89	91
75	69	69	70	71	72	72	73	73	74	74	75	75	76	76	77	77	78	78	79	79	80
70	64	64	65	65	66	66	67	67	68	68	69	69	70	70	70	70	71	71	71	71	72

Figure 28: **Heat Index** and impacts on people.
Source: NOAA

e. **Authorities, Policies, Programs and Resources** (C.1)

The Old Lyme Emergency Management Director has the authority to designate cooling centers in public buildings during heat waves. The designated cooling center when needed is The Lymes' Senior Center, located on Town Woods Road. The Phoebe Griffin Noyes Library can act a secondary point of refuge for residents when needed.

f. **Mitigation Specific to this Hazard** (C.2)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items.

The best mitigation when it comes to the public is information. Senior citizens should be made aware when an extreme heat wave is coming. Reminders about drinking water and staying indoors can help. In the past, The Lyme's Senior Center has been used as a cooling center for those without air conditioning at home, and the Estuary Transit District has waived advance reservation requirements for its dial-a-ride service during heat waves. Maintaining a designated location for a cooling center is important for people living without air conditioning to take refuge during heat events. A cooling center can also provide water to those people, especially the elderly.

11. Marine Debris

Marine debris is human-created waste and naturally occurring debris that has deliberately or accidentally been released in a lake, sea, ocean or waterway. Floating debris tends to accumulate on the coastline, frequently washing aground, when it is known as beach litter or tide-wrack. Human created waste can be anything from small trash to large tanks and containers. Naturally occurring debris is usually in the form of driftwood. With the increasing use of plastic, human influence has become an issue as many types of plastics do not biodegrade. Waterborne plastic poses a serious threat to fish, seabirds, marine reptiles, and marine mammals, as well as to boats and coasts. Dumping, container spillages, litter washed into storm drains and waterways and wind-blown landfill waste all contribute to this problem.

a. **Geographic Extent** (B.1)

As a coastal community and a community at the mouth of the Connecticut River, Old Lyme is particularly susceptible to debris coming from both northern New England and the Long Island Sound.

The Connecticut River stretches more than 400 miles from the Canadian border in New Hampshire to the Long Island Sound with its mouth between Old Lyme and Old Saybrook. As a result, debris from as far north as Canada can reach the Old Lyme shoreline.

The Long Island Sound, which drains to the Atlantic Ocean can also be a source of marine debris. Debris can come from any of the other rivers which drain to the Sound or from the Atlantic Ocean, finding its way to the Old Lyme shoreline.

Areas most susceptible to damages form marine debris are those directly fronting along the Connecticut River and Long Island Sound.

b. **Occurrences** (B.2 & B.4)

After storms and during the Spring thaw each year, Old Lyme sees extensive amounts of marine debris, mainly in the form of driftwood. Man-made items such as plastic bottles and other trash items also find their way downriver after being trapped by ice through the winter months. The Spring thaw typically releases large amounts of both natural and man-made marine debris.

c. **Probability of Occurring Again** (B.2)

Marine debris is *likely* every spring and throughout the year as trash and other items wash up on shore from other places. Large storms in other parts of the Atlantic Ocean and Long Island Sound can cause debris to

come on shore from those sources, and flooding events in northern New England can cause debris to move down river to Old Lyme.

d. **Potential Impacts** (B.3 & B.4)

Both large and small debris can have damaging impacts along the Old Lyme coastline. Large items can cause significant damage to beachfront homes during flooding events. Both large and small debris can clog outlets of smaller streams and rivers, causing a back-up of water and flooding conditions upstream. Man-made debris also poses a threat to the natural environment, contaminating water and threatening wildlife species that can be confused and eat toxic items.

Damage within Old Lyme would depend on several factors including intensity of the storm causing flooding, snow pack in northern New England sending debris down river, and speed of the snow melt across the region. Damage estimates are nearly impossible to create; however, debris blocking culverts and other drainage infrastructure would cause the Town to expend funds to clear blockages and maintain the infrastructure. Homeowners along the immediate coast could expect to expend funds after damage causing debris.

e. **Authorities, Policies, Programs and Resources** (C.1)

Currently, the Town of Old Lyme has very few resources for mitigating Marine Debris. Public Works cleans catch basins annually, which can reduce by a small fraction the amount of debris making its way into the water.

f. **Mitigation Specific to this** Hazard (C.2)

See Section III MITIGATION (Figure 31) for Comprehensive Mitigation Action Items. The following are representative mitigation activities specific to this hazard:
Enforce Local Litter Laws. Littering is illegal in Connecticut and can exacerbate marine debris problems. Most littered items make their way to waterways through storm drains and runoff channels. Enforcing litter laws can prevent litter from making its way into waterways.

Litter Removal. A crew of dedicated volunteers or paid employees can help to remove debris from locations where it is most known to collect. This may include islands, bridge piers and outlets of other streams and small rivers.

Research. The Town can establish a committee to study and research the best methods for mitigating the damaging effects caused by Marine Debris.

III. **MITIGATION** (ELEMENTS C & D)

A. **Evaluation of Prior Plan** (ELEMENT D)

1. **Changes in Development**

Very little in the way of development has taken place in Old Lyme since the last iteration of the Natural Hazard Mitigation Plan. As stated in a previous section of this Plan, the population of Old Lyme has only increased by 2.66% in the last decade. Much of the land within Old Lyme remains undeveloped. Several new homes have been constructed since the 2006 plan, but little commercial or industrial development has taken place. Between 2010 and 2011 only 8 permits were issued by the Building Official for new residential construction. Regional School District 18, the district covering both Lyme and Old Lyme, has recently completed upgrading and expanding the Lyme Old Lyme High School Facility on High School Rd, near the I-95 Exit 70 interchange in the western portion of town. Overall developmental changes in Town have not impacted the vulnerability of the Town as a whole.

New Construction Permits		
Year	**Residential**	**Commercial**
2006	7	1
2007	7	0
2008	9	1
2009	3	0
2010	4	0
2011	3	0
2012	2	0
2013	6	2

Figure 29: **New Construction Permits** since 2006

2. **Progress in Local Mitigation Efforts**

Mitigating for natural hazards is a multidisciplinary affair. Therefore, RiverCOG and its towns use the Plan in order to make consistent efforts to organize the necessary regulatory, structural, organizational, and educational efforts to achieve mitigation for each type of natural hazard. Examples of actions proposed by each Plan include: updates to regulations of local land use (both conservation and development), a list of structural projects for the capital improvement plan, suggestions for outreach materials for its citizenry and businesses to educate and protect themselves.

The Town has made progress in implementing the action items prescribed

by the Plan. Figure 31, entitled “Comprehensive Mitigation Action Items”, notes the status of each.

3. **Changes in Priorities** (C.5)

In 2006, the Town set a priority for implementation of each action item in the Plan using the STAPLEE criteria described in FEMA’s “How-to Guide #3: Developing the Mitigation Plan” (FEMA 386-3). The Town reviewed its progress in updating the Plan, and continues to maintain the same priority but with qualitative rating labels (**1, Very Low; 2-3, Low; 4-5, Medium; 6-7, High**). The Town assigned the same rating system for **new** action items, many of which reflect an increased concern for the long-term effects of sea level rise.

Priorities in Town have changed since as a result of Tropical Storms Irene and Sandy. The Town is more aware of the types of damage possible by even Tropical Storms. The biggest problem for the Town during those storms was flooding, which is forcing the Town to evaluate drainage infrastructure as well as upstream infrastructure which may cause shoreline flooding to flow upstream through culverts, causing flooding in unexpected areas. The Town is considering daylighting one stream which has been in a culvert for several decades in order to ease flooding conditions upstream of the culvert. In addition, more attention is being paid to trees near power lines. After both storms, power outages persisted more than a week for some residents as a result of downed trees and tree limbs.

B. **Goals to Reduce or Avoid Long-term Vulnerability** (C.3)

The goal of the Plan can be summarized as: *the most efficient use of public funds and resources to reduce the loss of life and property and the associated economic impacts from natural hazards.*

C. **Integration into Other Planning Mechanisms** (C.6)

Although many action items listed in the 2006 NHMP were integrated into other Town plans, the NHMP itself was not incorporated into any other planning mechanism. Many items listed were implemented; the status of each is listed in Figure 31.

The Town intends to integrate the action items of the Plan into several mechanisms. Being that the State of Connecticut requires an update of the POCD every ten years, when the town next updates the Plan, it should consider adding mitigation items from this NHMP into the POCD. As the town follows their procedure to update the POCD, the NHMP should be thoroughly reviewed for items for inclusion. Action Items from this update, as a Stand-Alone Plan, can be integrated by the Town into several mechanisms, including the following:

5-year Capital Improvement Plan (CIP) addresses *municipal improvements* including: rights-of-way, land, housing, or utilities for public purposes. Mitigation actions from this NHMP should be included in the CIP. Larger items such as bridge and culvert replacements and elevation of roads should be included in the next 5-year CIP. The CIP should be reviewed often so that it can include new mitigation action items each time the NHMP is updated. This is a good way for the town to prioritize mitigation items.

Plan of Conservation & Development references the Plan as an appendix guiding other boards / commissions in promoting *programs* including: outreach, stewardship, and services. The POCD update, currently in process, should take into consideration items from this NHMP. The POCD could encourage prioritization of purchasing land in flood hazard zones in order to allow for more open space in these areas, and prioritizing road construction projects in order to lower the risk of flooding by raising roads and replacing inadequate bridges and culverts.

Administrative Departments take on the implementation of the need for new or updated *standards* including: road specifications, zoning regulations, fire/building code, and the local flood ordinance. As these departments update and change their standards, the NHMP should be thoroughly reviewed to insure that the departmental standards are in line with the NHMP mitigation action items.

Regulation or Plan Status Relative to Hazard Mitigation	Changes to Potentially Be Made	Responsible Party
Zoning Regulations	Incorporate suggested changes from NHMP into ZR.	Zoning Commission
Subdivision Regulations	Incorporate suggested changes from NHMP into SR.	Zoning Commission
Inland Wetland Regulations	Incorporate suggested changes into IWR including prevention of runoff near waterways.	Inland Wetlands Commission
Plan of Conservation and Development	Consider adding NHMP as an appendix.	Planning & Zoning Commissions
Capital Improvement Plan	Consider new projects listed in Figure 31 of this NHMP.	BOS, BOF

Figure 30: **Plans and Regulations to be Potentially Updated**

D. **Discussion of Benefit-Cost Review** (C.5)

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

Although it is beyond the scope of this plan to develop precise BCRs for each recommendation, a cost estimate and possible funding source for each mitigation action item is included in Figure 31. When pursuing grants for selected projects, this information can be used to help select the projects that have the greatest chance of successfully navigating through the application review process. In many cases, benefit to the community may outweigh financial costs, and therefore priority may be increased.

E. **Comprehensive Mitigation Action Items** (C.4, C.5, D.2, D.3)

Figure 31 below, describes and details the entire Mitigation Action Item List for the Town of Old Lyme. A schedule is listed for each action item determining when the Town plans to carry out the project. Items that are shaded grey are items carried over from the 2006 Plan; other items are new to this 2013 Plan. Each Mitigation Action Item status is noted.

A column has been dedicated to a Benefit Cost Review, which considers the cost to the municipality and the Public. Costs are rated as Minimal, Up to $100,000, and Over $100,000.

In addition, each item has a Responsible Party listed. It should be noted that for each item which has more than one Party noted, the first party is the primary responsible party.

The columns marked “Status” includes the current status of each Mitigation Action Item. Action items that were included in the 2006 Plan are shaded grey, while all other items are new to this 2014 Plan Update. Items that are new are marked as such, other items that may be partially implemented or are otherwise in process describe their status.

A time line for completion or occurrence of each mitigation action item is included and is specified as Daily, Monthly, Annually, 2014-2016, 2017 - 2019. It should be noted that items with a schedule of Daily are those that are items used on a day-to-day basis, such as Best Management Practices. These are items that the

Town currently implements, and the status for each of these items reflects that. If resources become available, the schedule for these future projects could change.

The individual town review was important for the development of goals and objectives within Old Lyme. After the supporting tasks were compiled, town personnel evaluated each task using the STAPLEE criteria described in FEMA's "How-to Guide #3: Developing the Mitigation Plan" (FEMA 386-3. The evaluation yielded priority ratings based on the following: High (if the task met 6-7 of the STAPLEE criteria), Medium (if the task met 4-5 of the STAPLEE criteria, Low (if the task met 2-3 of the STAPLEE criteria), and Very Low (if the task met 1 of the STAPLEE criteria). The STAPLEE method was used for the 2006 Plan as well; however, each item has been reviewed again, and a new STAPLEE total has been given to all items (including those from the 2006 Plan) for this Plan update. With a significant change in the Town budget after the 2008 financial crisis, it was decided that all projects need to be reprioritized to better reflect 2014 conditions.

	Figure 31: **Comprehensive Mitigation Action Items**[4]	Natural Hazards										Responsible Party *[1,2]	Schedule A. Daily B. Monthly C. Annually D. 2014-2016 E. 2017 - 2019	Status	Cost[3]	Possible Funding Source**[1]	Weighted STAPLEE Criteria Costs (0)/ Benefits (1)							
		Flooding	High Wind and Tornado	Drought and Wildfire	Winter Storm	Earthquake	Hurricane	Sea Level Rise	Tsunami	High Heat/ Heat Wave	Marine Debris						Social	Technical	Administrative	Political	Legal	Economic	Environmental	**STAPLEE Total**
	Local Plans and Regulations																							
	Amend Flood Ordinance. Consider adding a "freeboard" – an additional height above the flood level – to add a greater margin of safety. In the case of nonresidential structures, the insurance rates do not go down until a structure is flood proofed at least one (1) foot above the BFE.	X			X		X		X		X	ZC	**D**	New	**$**	CIP, OP	1	1	1	0	1	1	1	**6**
	Benefit-Cost Analysis. Evaluate opportunities for public funding of mitigation projects on private property where public benefits exceed the cost for Repetitive Loss (RL) properties or for properties otherwise eligible for buy-out.	X	X	X	X	X	X	X	X			BOF, BOS, F&EC	**C**	New	**$$**	CIP, OP	1	0	0	1	1	1	1	**5**
	Best Management Practices. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	X	X	X	X	X	X	X	X		X	BOS, PW, LUO, BO	**A**	New	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
	Business Recovery Plan. Develop business recovery plan cooperatively with other region towns and distribute to town businesses.	X	X	X	X	X	X	X	X			BOS	**D**	Not yet implemented	**$$**	CIP, OP	1	0	0	1	1	1	1	**5**
	Capital Improvement Program. Use Capital Improvement Program (CIP) to set aside funds for infrastructure improvements to reduce loss of life and property during natural hazard (NH) events.	X	X	X	X	X	X	X	X			BOF, BOS, PW	**C**	New	**$$**	CIP	0	1	1	0	1	1	1	**5**
	Conservation Planning. Educate the public about how the Town uses planning, regulations, and ordinances to mitigate NHs via LID, aquifer recharge, riparian buffer, rain gardens, open burning ordinances, house numbering, etc.	X		X	X		X	X	X		X	CC	**D**	New	**$$**	CIP, OP	0	1	1	1	1	1	1	**6**
M	**Cooperative Agreements for Shelters.** Develop supporting documentation and encourage the Board of Selectmen to establish agreements for shelters that can provide specialized services, throughout the region. Shelters with the capacity to provide for companion pets and medical equipment needs for individuals with disabilities are two examples of such specializations. Support changes in the laws that require every town to provide facilities capable of serving the most severe of handicapped individuals such that towns could pool their resources to better serve these individuals and their families by giving them the option to go to a regional shelter better equipped to handle theirs, and their family's needs.	X	X	X	X	X	X		X			EMD, PC, BOS	**D**	Partially implemented	**$$**	CIP, OP, HMGP	1	1	1	1	1	1	1	**7**

	Design Standards. Continue to implement State Building/Fire Code and local Flood Code for construction that minimizes loss of life and property damage due to NHs. Develop guidelines for HDC and to retrofit existing structures in a manner that is respectful to significant or contributing structures and to overall neighborhood preservation.	X	X	X	X	X	X		X			BO, FM, HDC	**D**	New	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
	[Immobile] Evacuees. Review annually the program to evacuate persons without means of transport, including registration and house numbering.	X	X	X	X	X	X		X			EMD	**C**	Existing with updates needed.	**$$**	CIP, OP	1	0	1	1	1	1	1	**6**
M	**Flood Zone Study.** Update flood zone study for the town to incorporate changed conditions upland and within the floodplain, and an expected sea level rise over the next twenty years.	X						X	X			LUO, ZC	**D**	Partially implemented.	**$**	HMPG,PDM	1	1	0	1	1	1	1	**6**
	Forest Management Plan. Hire a consulting forester to establish a forest management plan to enable ability of firefighters to access forest fires during periods of drought.			X								PC, CC, TC, Tree Warden	**D**	New	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
	Grants. Identify and apply for grants to fund infrastructure improvements and other mitigation tasks identified in this plan.	X	X	X	X	X	X	X	X			BOF, BOS, LUO, EMD	**C**	Partially implemented	**$$**	CIP	1	1	0	1	1	1	1	**6**
	Land Use Regulation. Maintain, and strengthen as appropriate, subdivision and zoning regulations to make safer new roads and lots within flood zones.	X	X	X	X	X	X	X	X			LUO, ZC, PC	**A**	New	**$**	OP	1	1	1	1	1	1	1	**7**
	Landlord/ Land Owner Incentives. Research what kind of incentives would motivate land owners to make the additional investment that would reduce potential damages to their properties and loss of life of their tenants, both residential and commercial.	X	X	X	X	X	X	X	X			BOS, LUO, FM, BO, HD	**D**	New	**$$**	OP	1	0	0	1	1	1	1	**5**
M	**Local Sea Level Rise Study Committee.** BOS should establish an ad-hoc committee to research medium and long-range impacts to coastal areas from SLR, to investigate possible mitigation actions and to assess legal, financial and policy implications.	X			X		X	X	X			BOS, LUO, ZC	**E**	New	**$**	HMGP, PDM, CIP, OP	1	1	1	1	1	1	1	**7**
	Local Social Resources. Identify local resources to assist with disadvantaged populations (i.e. elderly, disabled, non-English speakers, who may frequent, reside, or work) in Old Lyme. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Old Lyme will be affected by natural hazards.	X	X	X	X	X	X	X	X			BOS, EMD	**D**	New	**$$**	HMGP. PDM, CIP, OP	1	1	0	1	1	1	1	**6**
	No net runoff from development. Require all new development to be built using techniques to eliminate run-off.	X		X	X		X					ZC, IWC, PC, LUO	**A**	Not yet implemented	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
	Owner Participation. Promote owner participation in mitigation efforts to protect their own properties.	X	X	X	X	X	X	X	X			LUO, BOS, F&EC, BO, EMD	**C**	Not yet implemented	**$**	HMGP, CIP, OP	1	1	1	1	1	1	1	**7**
	Possible Open Space Criteria. The Conservation Commission should consider making possible inundation by future sea level rises to its considerations for preserving open space .	X			X		X	X	X			ZC, PC, LUO, CC, OS	**D**	New	**$**	HMPG, PDM, CIP	0	1	1	0	1	1	1	**5**

	Post Disaster School Arrangements. Establish reciprocal arrangements with other school districts for getting students back into classes during extended recovery periods.	X	X	X	X	X	X		X			BOE, EMD, CC, OS	**D**	New	**$$**	HMGP, CIP, OP	1	1	0	1	1	1	1	**6**
	Potential Financial Impact of Recent Storm. Provide a reference point; ask the Tax Assessor if he can provide a figure for the lost property value resulting from Tropical Storm Irene and Superstorm Sandy and the potential lost tax revenue if the structures are not restored before the next taxing period.	X	X	X	X	X	X		X			Assessor, LUO, BOS, BOF	**D**	New	**$$**	CIP, OP	1	0	0	1	1	1	1	**5**
	Potential Financial Impact of Probable Events. Estimate the municipal tax revenue that could potentially be lost in various events to provide the Board of Selectmen and Board of Finance with an idea of how large a "rainy day" fund might be necessary to cover that post disaster period when there would be minimal income and maximum output of public funds at all levels of government.	X	X	X	X	X	X	X	X			Assessor, LUO, BOS, BOF, Tax Collector	**D**	New	**$$**	CIP, OP	1	0	0	1	1	1	1	**5**
M	**Private Property Funds**. Evaluate opportunities for public funding for projects on private property where the benefits exceed the costs.	X	X	X	X	X	X	X	X			BOS, BOF, LUO, EMD	**C**	Not yet implemented	**$$$**	HMPG, FMA, RFC,SRL	1	1	1	1	1	1	1	**7**
	Public Transit Funding. Support regional transportation system (RTD) to facilitate movement of people without means of transportation prior to NH events.	X	X	X	X	X	X	X	X			BOF, BOS, EMD	**C**	Partially implemented	**$$**	CIP	1	1	1	0	1	0	1	**5**
M	**Recovery & Reconstruction Plan.** Develop a post-disaster recovery and reconstruction plan to re-establish infrastructure and public services, etc. damaged or destroyed by any NH event, including establishment of a "rainy day" fund in case Federal assistance is insufficient or delayed.	X	X	X	X	X	X	X	X			LUO, PC, EMD, HD, FM, BO, BOS, BOF	**D**	New	**$$**	CIP, HMPG	1	0	0	1	1	1	1	**5**
M	**Sea Level Rise Study.** Work with The Nature Conservancy (TNC), DEEP, educational institutions, and state and federal agencies to study impacts of sea level rise on (SLR) coastal flooding in Old Lyme.							X			X	LUO	**E**	New	**$$**	PDM, CIP, OP	0	1	1	0	1	1	1	**5**
	Regulations. Strengthen existing subdivision regulations to either optimally prevent road or house construction within the floodplain, or alternatively raise structures above BFE.	X	X	X	X	X	X	X	X			IWC, PC, ZC, LUO, BO, FM	**D**	Not yet implemented	**$**	CIP	1	1	1	1	1	1	1	**7**
	Zoning Map Audit. The Town should conduct a comprehensive audit of the zoning map to consider what changes might be advisable so that the free market investing is not misguided back towards areas that are at high risk from natural disasters.	X	X	X	X	X	X	X	X			ZC, LUO, EDC	**C**	New	**$$**	CIP	1	1	0	1	1	1	1	**6**
	Structure and Infrastructure Projects																							
M	**Caches.** Consider creating stores of emergency supplies in areas of town that will be cut off during major flooding events.	X			X		X	X	X			EMD, BOS	**C**	New	**$$**	CIP,HMPG	0	1	1	0	1	1	1	**5**
M	**Construction Standards.** Ensure that flood proof construction standards for roads and structures within the flood plain are strictly enforced.	X			X		X		X			BO, FM	**D**	Not yet implemented	**$$**	PDM, HMGP, CIP, OP	1	1	1	1	1	1	1	**7**
M	**Critical Facilities.** Upgrade as necessary all facility mechanicals, such as generators, in municipal and other critical facilities.	X	X	X	X	X	X	X	X			PW, BOS, BOF, EMD	**C**	New	**$$$**	PDM,HMPG, CIP	1	1	1	1	1	1	1	**7**

	Data for Plans. Use GIS database to develop better mitigation plans.	X	X	X	X	X	X	X	X			BOF, LUO	**D**	New	**$$$**	CIP, HMGP	1	0	1	1	1	0	1	**5**
M	**Drinking Water Cache.** Develop and implement sources of alternate distribution for potable water and other commodities. Install drinking water tanks with a supply of bleach for private well water purification. (Batteries?)	X	X	X	X	X	X	X	X	X		EMD, BOS	**C**	New	**$$**	PDM,HMPG, CIP	1	1	1	1	1	1	1	**7**
M	**Dry Hydrants.** Continue to require dry hydrants or alternate water sources in new developments where water supply is inadequate.			X						X		LUO, BO, FM, PC, Fire Dept.	**A**	New hydrant has recently been installed at Rogers Lake.	**$**	CIP	1	1	1	1	1	1	1	**7**
	Electronic Records Preservation. Design databases for records keeping. Create a back-up of existing electronic records, including geographic information system (GIS) data.	X	X			X	X		X			BOS, BOF, IT	**D**	Not yet fully implemented.	**$$**	CIP, HMPG	1	0	0	1	1	1	1	**5**
	Engineering Reports. Implement strategic enforcement actions to include engineering reports for structural expansion or alterations on properties within the 1% annual chance flood zone.	X			X		X		X			BO, LUO	**D**	New	**$$**	CIP	1	0	0	1	1	1	1	**5**
M	**Firefighting Infrastructure Analysis.** Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.			X						X		FM, Fire Dept.	**D**	New	**$$$**	HMGP, CIP, OP	1	1	1	1	1	1	1	**7**
	Geographic Information System. Annually review and update as necessary existing town GIS data.	X	X	X	X	X	X		X			LUO, IT	**D**	New	**$$**	HMPG, CIP	1	0	0	1	1	0	1	**4**
	GIS Database. Establish a comprehensive GIS database to better identify and assess areas, structures and populations potentially affected by natural disasters. These data will provide the town with information necessary to assess natural hazard risks and develop plans to mitigate risks to people and property.	X	X	X	X	X	X	X	X			BOS, BOF, LUO, EMD, IT	**D**	Not yet implemented.	**$$**	CIP	1	1	0	1	1	0	1	**5**
M	**Municipal Buildings Capable of being Shelters.** Future investment in municipal structures should include funding for new construction or renovation that will assure the structure is compliant with the standards for use as a shelter, to the extent possible.	X	X	X	X	X	X		X			BOS, BOF, BO, EMD, BOE	**E**	New	**$$$**	HMPG,PDM, CIP	1	1	1	1	1	0	1	**6**
	Oblique Imagery. Over the next five (5) years obtain oblique imagery in order to allow for assessment of such factors as extent of fire damage, compliance with building standards, identification of shoreline hardening and shoreline erosion and accretion.	X	X	X	X	X	X	X	X			LUO	**D**	New	**$$**	CIP	1	0	0	1	1	0	1	**4**
M	**Off-street parking.** Construct public parking lots to deter on-street parking that hinders emergency access and evacuation in high-density neighborhoods or high-intensity areas.	X	X	X	X	X	X		X			PW, BOF, BOS	**E**	New	**$$$**	CIP, HMGP, OP	1	1	1	1	1	1	1	**7**
	Paper Records Preservation. Convert all paper records maintained by the municipality to an electronic format, consistent with any State recommendations, to ensure their survival. Establish protocols for practices going-forward.	X	X			X	X		X			BOS, BOF, EMD, Town Clerk	**D**	Not yet fully implemented	**$$**	CIP, OP	1	1	0	1	1	1	1	**6**
M	**Public Flood Preparation.** Cooperate with Parks and Recreation and Regional School District 18 as well as neighboring towns to provide and encourage swim instructions to residents for enhanced capability during flooding events.	X			X		X	X	X			BOF, BOS, P&R, BOE	**E**	New	**$$$**	HMPG, CIP	1	1	1	0	1	0	1	**5**

	Promote Self Inspection. Develop a list of techniques for homeowner self-inspection especially for those located in coastal areas.	X	X	X	X	X	X	X	X			BOS, LUO, BO, EMD	**A**	New	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
M	**Transfer Station Generator.** Purchase and install a generator for back-up power.		X		X		X		X			PW, BOF, BOS	**D**	New	**$$**	HMPG, CIP	1	1	1	0	1	0	1	**5**
M	**Risk Reduction.** Develop a strategy and funding program to elevate or relocate structures of flood-prone properties or acquire RL properties that request a "buy-out".	X	X	X	X	X	X	X	X			LUO	**E**	New	**$$**	HMGP, PDM, SRL, FMA	0	0	0	0	1	1	1	**3**
M	**RL and SRL Properties.** Encourage owners of repetitive loss and severe repetitive loss properties (residential and commercial) to obtain assistance for hazard mitigation funding from DEEP/FEMA for elevation of structures and repairs where applicable.	X	X	X	X	X	X	X	X		X	LUO, BO, FM, EMD	**D**	Not yet implemented	**$$**	HMGP, FMA, PDM, SRL	0	0	0	0	1	1	1	**3**
M	**Road Evaluation**. Evaluate to develop plans, and improve for emergency access and evacuation.	X			X	X	X	X	X			PW, EMD	**E**	New	**$$$**	HMGP, FMA, CIP, STIP, RTP	1	1	1	1	1	0	1	**6**
M	**Road Reconstruction.** Develop a priority list for road reconstruction and elevation for routes which experience frequent flooding or are integral to evacuation.	X			X	X	X	X	X			PW	**E**	Not yet implemented	**$$$**	HMPG, FMA, CIP, STIP, RTP	1	1	1	1	1	1	1	**7**
M	**Safer Location of Town Buildings.** Future municipal structures should be located outside of known hazardous locations such as floodplains, to the extent possible.	X			X		X	X	X		X	BOF, BOS, PC, EMD	**E**	New	**$$$**	PDM, CIP	0	0	1	0	1	0	1	**3**
M	**Schools.** Visit schools and educate children about the risks of floods, hurricanes, and other natural hazards and how to prepare for them.	X	X	X	X	X	X	X	X	X	X	BOS, EMD, BOE, LYSB	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Storm Preparation.** In preparation for a storm, the town should move portable generators on to trailers in order for them to be transported to town facilities in the event of power outage. In addition, contract with local vendors to supply rental generators for critical facilities during power outages.	X	X	X	X	X	X	X	X	X		PW, BOS, EMD	**A**	Occurs before each storm event.	**$**	CIP	1	1	1	1	1	1	1	**7**
M	**Storm water Infrastructure Inventory**. Implement mapping and monitoring of catch basins, storm water outfalls and related infrastructure.	X			X		X		X		X	PW	**D**	Not yet implemented	**$$**	HMPG, FMA, CIP	1	1	1	1	1	1	1	**7**
M	**Storm water Infrastructure Maintenance.** Provide for annual maintenance of storm water infrastructure, including detention basins.	X			X		X		X		X	PW	**C**	Not yet implemented	**$**	CIP	1	1	1	1	1	1	1	**7**
	Structural Reports. Continue to require structural engineering reports for expansion or alteration of buildings within the V zone. Evaluate benefits of requiring structural engineering reports for expansion or alteration of buildings within other zones.	X	X		X		X	X	X			BO	**A**	New	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
M	**Telecommunication Tower Generators (Private).** Evaluate whether generators are needed for back-up power at telecommunications facilities.		X		X		X					Private	**D**	Several towers in Town are equipped with generators.	**$$**	HMGP, PDM, CIP, OP	0	0	0	0	1	1	1	**3**
M	**Underground Utilities**. Require underground utilities for new development; require retrofitting during redevelopment of existing sites to bury utilities where appropriate to mitigate NHs.		X	X	X	X	X					BOS, BOF, LUO	**E**	New	**$$$**	HMPG,PDM, CIP	1	1	1	1	1	0	1	**6**

M	**Upgrade Fire Fighting Infrastructure.** Upgrade existing fire ponds to ensure adequate water supply is available. Construct new fire ponds and fire wells where water is not currently available.			X		X				X		EMD, FD, BOS, FM	**D**	New	**$$$**	CIP, OP	1	0	1	1	1	0	1	**5**
M	**Upgrade Dry Hydrants.** Upgrade where appropriate and maintain dry hydrants and water sources to ensure adequate fire- fighting capability.			X		X				X		FM, EMD, Fire Dept.	**D**	New	**$$**	HMGP, PDM, CIP, OP	1	1	1	1	1	0	1	**6**
M	**Wind Code Compliance.** Consider establishing a policy that all building permit applicants be encouraged to construct their projects to meet 110 mile per hour wind resistance standard, whenever possible.		X									BO, FM	**A**	New	**$**	CIP, OP	1	1	1	1	1	1	1	**7**
	Natural Systems Protection																							
	Assist Property Owners with Buyouts. Develop strategy and program for flood prone property owners who request a buyout.	X					X	X	X		X	BOS, BOF, LUO, OS	**E**	New	**$$**		0	1	0	1	1	1	1	**5**
M	**Below Base Flood Elevation Funding.** Encourage property owners whose homes are below BFE to obtain assistance from DEEP and FEMA to acquire hazard mitigation funds to elevate structures where appropriate.	X			X		X		X			BOS, LUO, F&EC	**D**	Not yet implemented	**$**	HMPG, PDM, RFC, SRL	1	1	0	1	1	0	1	**5**
M	**Boats.** Identify places where people could store their boats during flooding and hurricane events that would reduce the damage to them and that they cause to the waterfront infrastructure when they break from moorings. Contact boat marinas to ascertain how many boats might need to be removed from docks and moorings.	X			X		X		X		X	EMD, Harbor Master	**D**	New	**$$**		1	1	0	1	1	1	1	**6**
M	**Dam Inventory.** Update inventory of dams and assess downstream risks due to catastrophic failure. Include State, Town, and Privately owned dams.	X			X		X					LUO, BOS, EMD	**D**	Not yet implemented	**$$**	HMPG	1	1	1	1	1	1	1	**7**
M	**Dune Restoration.** Implement dune restoration and marshland protection techniques for flood storage and surge protection.	X			X		X		X		X	LUO, PW, BOF, BOS, F&EC	**E**	New	**$$$**	FMA,HMPG	1	1	1	1	1	0	1	**6**
	Drought Study. Conduct town-wide study of ground- and surface water capacity as it relates to planning for droughts.			X								LUO	**D**	New	**$$**	HMPG	1	0	1	1	1	0	1	**5**
M	**FIRMs.** Work with Federal Emergency Management Agency (FEMA) to incorporate updated Flood Insurance Rate Maps (FIRMs) into town's planning, outreach and mitigation actions.	X			X		X		X		X	LUO, PC	**D**	New	**$**		1	1	1	1	1	1	1	**7**
	Flood Enforcement. Enforce through existing zoning, building and flood permitting processes, construction standards to minimize flood risks.	X			X		X		X		X	IWC, PC, ZC, LUO	**A**	New	**$**		1	1	1	1	1	1	1	**7**
M	**Land Acquisition.** Advance an assertive land acquisition plan to reserve vacant land subject to NHs.	X		X	X		X	X	X			BOS, BOF, CC, OS	**D**	New	**$$$**	FMA, RFC, SRL	0	1	1	0	1	0	1	**4**
M	**Park Maintainer.** Contract with a dedicated Park Maintainer to act as steward of public open spaces, including parks, forests, trails, drainage basins, conservation easements, coastal access points, and forests, and to mitigate NHs at Town-owned properties.	X	X	X	X	X	X		X		X	BOF, BOS, OS	**D**	New	**$$**		1	1	1	1	1	0	1	**6**

	Risk Assessment. Use GIS to conduct NH risk assessments that identify potentially affected areas and depicts evacuation routes.	X	X	X	X	X	X		X		X	LUO, EMD, IT	**D**	GIS was used as part of this NHMP.	**$$**		1	0	0	1	1	1	1	**5**
	Storm water Management. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	X			X		X		X		X	PW	**D**	New	**$**		1	1	1	1	1	1	1	**7**
M	**Street Tree Program.** Implement a tree hazard management program to encourage appropriate planting practices to minimize future storm damage to buildings, utilities and streets.		X		X		X					PW, TC, Tree Warden, PC	**E**	New	**$$**		1	1	0	1	1	1	1	**6**
	Education and Awareness Programs																							
M	**Assist Beach Associations.** Review mitigations goals and objectives with beach associations at the beginning of each season. Encourage the association's help to educate homeowners and renters.	X	X	X	X	X	X	X	X	X	X	BOS, LUO, EMD, Fed. Of Beaches	**C**	New	**$$**		1	1	1	1	1	1	1	**7**
	Bulletin Boards. Post bulletin boards during storm events and recovery periods with the latest information available to inform the public , particularly during a power outage, or natural hazard event.	X	X	X	X	X	X	X	X	X	X	EMD, PW, BOS	**A**	Bulletin boards are placed within walking distance of most residents in case of extended power outage or blocked roads.	**$**	CIP	1	1	1	1	1	1	1	**7**
M	**Circulate Existing Literature.** Access existing literature prepared by regional groups, the Chamber of Commerce and FEMA and display for public distribution in the Town Hall and Library.	X	X	X	X	X	X	X	X	X	X	BOS, LUO, EMD	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Drought Education.** Coordinate with Connecticut Water Company on public education and public service announcements during droughts.			X						X	X	BOF, BOS	**C**	New	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Educate About Risk Where People Live.** Educate residents at high risk due to demographic or social attributes about the risk(s) relative to the areas that they populate.	X	X	X	X	X	X	X	X	X	X	LUO	**C**	New	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Hotline.** Publicize emergency "hotline" phone number or website for public information and volunteer support.	X	X	X	X	X	X	X	X	X	X	BOS, EMD	**D**	Currently using facebook.	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Incident Notification System.** Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.	X	X	X	X	X	X		X	X	X	BOS, EMD	**D**	New	**$$**	CIP, OP	1	1	1	1	1	1	1	**7**
M	**Interpretation in Shelters.** Request information regarding the need for providing non-English language speakers during natural disasters from the Old Lyme School administration; and coordinate a shared service for non-emergency and emergency operations.	X	X	X	X	X	X		X	X	X	EMD	**D**	New	**$$**	CIP, OP	1	0	0	1	1	1	1	**5**
M	**Natural Hazard Training.** Continue to train and educate emergency responders about mitigating NHs.	X	X	X	X	X	X	X	X	X	X	EMD	**C**	New	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Outreach.** Promote owner participation in mitigation efforts to protect their property.	X	X	X	X	X	X	X	X	X	X	EMD, LUO	**C**	New	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**

M	**Pet Sheltering.** Distribute hurricane preparedness information including pet sheltering plans.	X	X	X	X	X	X		X	X	X	ACO, EMD,	**C**	New	**$$**	HMPG, PDM	1	0	0	1	1	1	1	**5**
M	**Preparedness Webpage.** Keep up-to-date Town website with NH preparedness information, including hazard areas, evacuation routes deemed appropriate per NH event and locations of shelters.	X	X	X	X	X	X	X	X	X	X	BOS, IT, EMD	**D**	Partially implemented	**$$**	HMGP, PDM, FMA, CIP, OP	1	1	0	1	1	1	1	**6**
M	**Proactive Pamphlets**. Provide pamphlets and refer to web-based information for property owners for hazards listed in this document to show options for obtaining additional insurance, structural alterations to protect against various hazard damage, and emergency procedures for families during a hazard. Include information for contractors and homeowners on the risks of building in hazard prone areas.	X	X	X	X	X	X	X	X	X	X	EMD, LUO, BO	**C**	New	**$$**	HMPG, PDM	1	1	1	1	1	1	1	**7**
M	**Recovery Webpage.** Post on Town website information about recovery assistance following NH events.	X	X	X	X	X	X		X	X	X	BOS, EMD	**C**	New	**$$**	HMPG, PDM	1	1	0	1	1	1	1	**6**
M	**Refuges of Last Resort.** Identify refuges of last resort for those unable to reach designated shelter, including protect in place measures.	X	X	X	X	X	X		X	X	X	EMD, BOS	**D**	New	**$$**	NHMP, CIP, OP	1	0	0	1	1	1	1	**5**
M	**Social –Demographic Impacts.** Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Old Lyme will be affected by natural hazards.	X	X	X	X	X	X	X	X	X	X	BOS, LUO, EMD	**D**	New	**$$**	CIP, OP	0	1	0	0	1	1	1	**4**
M	**Tennant Notification.** Develop a mechanism for tenants to register for disaster notification**.**	X	X	X	X	X	X		X	X	X	EMD	**C**	New	**$**	HMPG, PDM	1	1	0	1	1	1	1	**6**
M	**Webpage.** Update town webpage with the section on Hazard Preparedness for the public. Include maps of evacuation route, storm surge areas, and shelters. Include options for mitigation for residential structures and business recovery and provide links to FEMA, NOAA, DEMHS and RiverCOG websites for additional information.	X	X	X	X	X	X		X	X	X	BOS, EMD, IT	**C**	Partially implemented	**$$**	HMPG, PDM	1	1	0	1	1	1	1	**6**
M	**Information**. Publish materials on additional hazards and encourage additional insurance.	X	X	X	X	X	X	X	X	X	X	BOS, LUO	**C**	New	**$$**	HMGP, CIP, OP	1	1	1	1	1	1	1	**7**
M	**Neighborhood Mitigation.** Engage neighborhood associations annually to participate in implementing the NH Mitigation Plan.	X	X	X	X	X	X	X	X	X	X	BOS, EMD	**D**	New	**$**	HMGP, CIP, OP	1	1	0	1	1	1	1	**6**
M	**Public Participation.** Enlist public participation through public workshops to develop methods for notification of emergencies.	X	X	X	X	X	X	X	X	X	X	EMD, PC	**C**	New	**$**	HMGP, CIP, OP	1	1	1	1	1	1	1	**7**
M	**Wildfire Education.** Educate the public about potential hazard of wildfire caused by campfires or open burning. Develop a warning system for when risks are high.			X						X		FM, Fire Dept.	**C**	DEEP Forestry division is responsible.	**$**	HMPG, PDM	1	1	1	1	1	1	1	**7**

Notes:

1. Responsible Party and Funding Source Definitions are as follows:

*Responsible Party Code		**Funding Source Code	
ACO	= Animal Control Officer	CIP	= Capital Improvement Plan
BO	= Building Official	FMA	= Flood Mitigation Assistance
BOE	= Board of Education	HMGP	= Hazard Mitigation Program Grant
BOF	= Board of Finance	OP	= Other Program
BOS	= Board of Selectman	PDM	= Pre-Disaster Mitigation
EMD	= Emergency Management Director	RFC	= Repetitive Flood Claim
F&EC	= Flood and Erosion Control Commission		
FM	= Fire Marshal	RTP	= Regional Transportation Program
HDC	= Historic District Commission		
LUO	= Land Use Office	SRL	= Sever Repetitive Loss
PC	= Planning Commission	STIP	= State Transportation Improvement Program
PW	= Public Works		
ZC	= Zoning Commission		
ZEO	= Zoning Enforcement Officer		

2. Many mitigation action items have more than one responsible party listed. For those items, the first party listed is the primary contacts.

3. Cost Benefit Review definitions are as follows:

$ = Minimal; current staff time, copying/printing costs, etc.
$$ = Up to $100,000
$$$ = Over $100,000

4. The Mitigation Action Item List includes many projects which may not be considered mitigation by FEMA and are not eligible for FEMA funding. Those projects which are eligible for FEMA funding are labeled with an "**M**" in the left-hand-most column.

Appendix I - Sources of Information (A.4)

BOOKS AND ARTICLES:

Climate of Connecticut, *Joseph Brumbach, State Geological and Natural History Survey of Connecticut, 1965*

Flood Insurance Studies, Federal Emergency Management

Deep River, 1980	Old Lyme, 1983
Essex, 1986	Old Saybrook, 1984
Killingworth, 1981	Lyme, 1978
Westbrook, 1986	

Realizing the Risk, *L.R. Johnston Associates, Westport, CT, 1983, Natural Resources Center*

A New England Tropical Cyclone Climatology 1938-2000, *Abstract, Marc, Mailhot, EMA Storm Coordinator Center, Westbrook, ME*

Tidal Marshes of Long Island Sound, Ecology, History and Restoration, Bulletin No. 34, *The Connecticut College Arboretum, New London, CT, edited by Glenn Dreyer and William Niering, 1995*

Soil Survey of Middlesex County, *USDA, Connecticut Agricultural Experiment Station, 1979*

Suboceanic Landslides, *Steven N. Ward and Simon Day, 2002 Yearbook of Science and Technology, McGraw Hill*

Landslide tsunami, Steven Ward, *Journal of Geophysical Research, Vol. 106, No. 6, Pages 11, 201,-11,125, June 10, 2001*

The Face of Connecticut, People, Geology, and the Land, *Bulletin 110, State Geological and Natural History Survey of Connecticut, Michael Bell, 1985, reprint, 1997*

Movable Shore, *Peter C. Patton, and James M. Kent, Sponsored by the National Audubon Society and the Connecticut Department of Environmental Protection, 1992*

The Ocean's Reach, Digest of a Workshop on Identifying Coastal Flood Hazard Areas and Associate Risk Zones, *New England River Basins Commission, February 1976*

Primer on Natural Hazard Management in Integrated Regional Development Planning, *Department of Regional Development and Environment Executive Secretariat for Economic and Social Affairs, Organization of American States, With support from the Office of Foreign Disaster Assistance United States Agency for International Development, Washington, D.C., 1991*

Public Safety, What is Hazard Mitigation, *Commonwealth of Massachusetts, The Official Website of the Executive Office of Public Safety and Security (EOPSS), 2011*

Best Practices;:Disaster Mitigation Working in Massachusetts; High Marks for Buildings Higher: Hull's Freeboard Incentive Program; Get 'em Up: Situate's Grant Committee Gets Homes in the Air; New Culvert Works: No Flooding at East Street; and New Drainage System Averts Flooding in Melrose; FEMA *Region 1 Mitigation Division as part of DR-1985-MA, June and July 2010*

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Appendix II - Acronyms

For the sake of brevity, this Plan identifies certain terms and entities with particularly long names by their commonly-known acronyms, as follows:

BFE:	Base Flood Elevation
CGS:	Connecticut General Statute
CLEAR:	Center for Land Use Education and Research, University of Connecticut, College of Agriculture and Natural Resources.
CL&P:	Connecticut Light and Power
CRERPA:	Connecticut River Estuary Regional Planning Agency
RiverCOG:	Lower Connecticut River Valley Council of Governments
DEEP:	Department of Energy & Environmental Protection, Connecticut
DOT:	Department of Transportation
DWP:	Department of Public Works
EOC:	Emergency Operation Center
EOP:	Emergency Operations Plan
FEMA:	Federal Emergency Management Agency
FIRM:	Flood Insurance Rate Map
FIS:	Flood Insurance Study
FMA:	Flood Mitigation Assistance
GIS:	Geographical Information System
HMA:	Hazard Mitigation Assistance
HMGP:	Hazard Mitigation Grant Program
LID:	Low Impact Development
LiMWA:	Limit of Moderate Wave Action
MPH:	Miles per Hour
MRPA:	Midstate Regional Planning Agency
NDDB:	Natural Diversity Data Base
NFIP:	National Flood Insurance Program
NFIRA:	National Flood Insurance Reform Act of 1994
NH:	Natural Hazard
NOAA:	The National Oceanic and Atmospheric Administration
NPDES:	National Pollutant Discharge Elimination System
NRCC:	Northeast Regional Climate Center
PDM:	Pre-Disaster Mitigation
POCD:	Plan of Conservation and Development
RFC:	Repetitive Flood Claims
RLP:	Repetitive Loss Property
SFHA:	Special Flood Hazard Area
SLOSH:	Sea, Lake, and Overland Surges from Hurricanes
SLR:	Sea Level Rise
SRL:	Sever Repetitive Loss
STAPLEE:	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
TNC:	The Nature Conservancy
USGS:	United States Geological Survey

Appendix III

Hazus-MH: Hurricane Event Report

Region Name: Old Lyme

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Monday, January 14, 2013

Disclaimer:
Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific Hurricane. These results can be improved by using enhanced inventory data.

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The hurricane loss estimates provided in this report are based on a region that includes 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 23.02 square miles and contains 2 census tracts. There are over 2 thousand households in the region and has a total population of 7,406 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 965 million dollars (2006 dollars). Approximately 92% of the buildings (and 80% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,244 buildings in the region which have an aggregate total replacement value of 965 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Total
Residential	771,665	79.9%
Commercial	130,387	13.5%
Industrial	29,324	3.0%
Agricultural	4,619	0.5%
Religious	12,571	1.3%
Government	4,838	0.5%
Education	12,022	1.2%
Total	**965,426**	**100.0%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire stations, 1 police station and no emergency operation facilities.

Hurricane Scenario

Hazus used the following set of information to define the hurricane parameters for the hurricane loss estimate provided in this report.

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 129 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 5 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

Table 2: Expected Building Damage by Occupancy : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	20	81.35	3	13.32	1	3.50	0	1.65	0	0.18
Commercial	221	85.49	29	11.32	7	2.85	1	0.33	0	0.00
Education	8	90.00	1	8.83	0	1.12	0	0.05	0	0.00
Government	6	86.93	1	10.74	0	2.20	0	0.13	0	0.00
Industrial	74	87.45	9	10.11	2	2.13	0	0.30	0	0.02
Religion	16	87.36	2	10.98	0	1.56	0	0.10	0	0.00
Residential	3,924	81.07	800	16.53	105	2.18	6	0.12	5	0.11
Total	**4,270**	**845**	**116**	**7**	**5**					

Table 3: Expected Building Damage by Building Type : 100 - year Event

	None		Minor		Moderate		Severe		Destruction	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	11	89.26	1	9.12	0	1.54	0	0.07	0	0.00
Masonry	167	83.21	26	13.14	7	3.26	1	0.32	0	0.06
MH	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Steel	147	87.23	16	9.76	4	2.61	1	0.39	0	0.00
Wood	3,601	81.21	732	16.52	91	2.05	5	0.11	5	0.11

Essential Facility Damage

Before the hurricane, the region had no hospital beds available for use. On the day of the hurricane, the model estimates that 0 hospital beds (0%) are available for use. After one week, none of the beds will be in service. By 30 days, none will be operational.

Table 4: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**Probability of at Least Moderate Damage > 50%**	**Probability of Complete Damage > 50%**	**Expected Loss of Use < 1 day**
Fire Stations	1	0	0	1
Police Stations	1	0	0	1
Schools	5	0	0	0

Induced Hurricane Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the hurricane. The model breaks the debris into four general categories: a) Brick/Wood, b) Reinforced Concrete/Steel, c) Eligible Tree Debris, and d) Other Tree Debris. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 14,992 tons of debris will be generated. Of the total amount, 10,324 tons (69%) is Other Tree Debris. Of the remaining 4,668 tons, Brick/Wood comprises 36% of the total, Reinforced Concrete/Steel comprises 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 67 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 2,998 tons of Eligible Tree Debris are collected and processed. The volume of tree debris generally ranges from about 4 cubic yards per ton for chipped or compacted tree debris to about 10 cubic yards per ton for bulkier, uncompacted debris.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the hurricane and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the hurricane. Of these, 0 people (out of a total population of 7,406) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 17.6 million dollars, which represents 1.82 % of the total replacement value of the region's buildings.

Building-Related Losses

The building related losses are broken into two categories: direct property damage losses and business interruption losses. The direct property damage losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the hurricane. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the hurricane.

The total property damage losses were 18 million dollars. 2% of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 91% of the total loss. Table 4 below provides a summary of the losses associated with the building damage.

Table 5: Building-Related Economic Loss Estimates

(Thousands of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Property Damage						
	Building	11,648.33	593.74	131.29	149.06	12,522.42
	Content	3,499.54	139.85	64.75	34.48	3,738.62
	Inventory	0.00	3.65	11.89	2.12	17.66
	Subtotal	**15,147.86**	**737.24**	**207.93**	**185.66**	**16,278.70**
Business Interruption Loss						
	Income	0.00	110.69	2.07	18.56	131.31
	Relocation	577.79	111.65	8.74	27.51	725.69
	Rental	214.04	65.26	1.54	2.52	283.36
	Wage	0.00	91.97	3.40	98.03	193.40
	Subtotal	**791.83**	**379.57**	**15.75**	**146.62**	**1,333.76**
Total						
	Total	**15,939.69**	**1,116.81**	**223.68**	**332.27**	**17,612.46**

Appendix A: County Listing for the Region

Connecticut
- New London

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	**Residential**	**Non-Residential**	**Total**
Connecticut				
New London	7,406	771,665	193,761	965,426
Total	**7,406**	**771,665**	**193,761**	**965,426**
Study Region Total	**7,406**	**771,665**	**193,761**	**965,426**

Appendix IV

Hazus-MH: Earthquake Event Report

Region Name: Old Lyme

Earthquake Scenario: 100 Year Probabilistic

Print Date: January 14, 2013

Totals only reflect data for those census tracts/blocks included in the user's study region.

Disclaimer:
The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social and economic losses following a specific earthquake. These results can be improved by using enhanced inventory, geotechnical, and observed ground motion data.

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General Description of the Region

Hazus is a regional earthquake loss estimation model that was developed by the Federal Emergency Management Agency and the National Institute of Building Sciences. The primary purpose of Hazus is to provide a methodology and software application to develop earthquake losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from earthquakes and to prepare for emergency response and recovery.

The earthquake loss estimates provided in this report was based on a region that includes 1 county(ies) from the following state(s):

Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 23.02 square miles and contains 2 census tracts. There are over 2 thousand households in the region which has a total population of 7,406 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 5 thousand buildings in the region with a total building replacement value (excluding contents) of 965 (millions of dollars). Approximately 92.00 % of the buildings (and 80.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 340 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 5 thousand buildings in the region which have an aggregate total replacement value of 965 (millions of dollars) . Appendix B provides a general distribution of the building value by State and County.

In terms of building construction types found in the region, wood frame construction makes up 86% of the building inventory. The remaining percentage is distributed between the other general building types.

Critical Facility Inventory

Hazus breaks critical facilities into two (2) groups: essential facilities and high potential loss facilities (HPL). Essential facilities include hospitals, medical clinics, schools, fire stations, police stations and emergency operations facilities. High potential loss facilities include dams, levees, military installations, nuclear power plants and hazardous material sites.

For essential facilities, there are 0 hospitals in the region with a total bed capacity of 0 beds. There are 5 schools, 1 fire stations, 1 police stations and 0 emergency operation facilities. With respect to high potential loss facilities (HPL), there are 2 dams identified within the region. Of these, 0 of the dams are classified as 'high hazard'. The inventory also includes 2 hazardous material sites, 0 military installations and 0 nuclear power plants.

Transportation and Utility Lifeline Inventory

Within Hazus, the lifeline inventory is divided between transportation and utility lifeline systems. There are seven (7) transportation systems that include highways, railways, light rail, bus, ports, ferry and airports. There are six (6) utility systems that include potable water, wastewater, natural gas, crude & refined oil, electric power and communications. The lifeline inventory data are provided in Tables 1 and 2.

The total value of the lifeline inventory is over 340.00 (millions of dollars). This inventory includes over 15 kilometers of highways, 17 bridges, 371 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	17	196.90
	Segments	6	109.00
	Tunnels	0	0.00
	Subtotal		**305.90**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	12.60
	Tunnels	0	0.00
	Subtotal		**12.60**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	1	22.30
	Tunnels	0	0.00
	Subtotal		**22.30**
Bus	Facilities	0	0.00
	Subtotal		**0.00**
Ferry	Facilities	0	0.00
	Subtotal		**0.00**
Port	Facilities	0	0.00
	Subtotal		**0.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		**0.00**
	Total		**340.80**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	3.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**3.70**
Waste Water	Distribution Lines	NA	2.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**2.20**
Natural Gas	Distribution Lines	NA	1.50
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**1.50**
Oil Systems	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**0.00**
Electrical Power	Facilities	0	0.00
	Subtotal		**0.00**
Communication	Facilities	0	0.00
	Subtotal		**0.00**
	Total		**7.40**

Earthquake Scenario

Hazus uses the following set of information to define the earthquake parameters used for the earthquake loss estimate provided in this report.

Scenario Name	100 Year Probablistic
Type of Earthquake	Probabilistic
Fault Name	NA
Historical Epicenter ID #	NA
Probabilistic Return Period	100.00
Longitude of Epicenter	NA
Latitude of Epicenter	NA
Earthquake Magnitude	5.00
Depth (Km)	NA
Rupture Length (Km)	NA
Rupture Orientation (degrees)	NA
Attenuation Function	NA

Building Damage

Building Damage

Hazus estimates that about 0 buildings will be at least moderately damaged. This is over 0.00 % of the buildings in the region. There are an estimated 0 buildings that will be damaged beyond repair. The definition of the 'damage states' is provided in Volume 1: Chapter 5 of the Hazus technical manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 below summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

		None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Agriculture	25	0.48	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	259	4.94	0	0.00	0	0.00	0	0.00	0	0.00
Education	9	0.17	0	0.00	0	0.00	0	0.00	0	0.00
Government	7	0.13	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	85	1.62	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	566	10.79	0	0.00	0	0.00	0	0.00	0	0.00
Religion	18	0.34	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	4,275	81.52	0	0.00	0	0.00	0	0.00	0	0.00
Total 5,244	**0**	**0**	**0**	**0**						

Table 4: Expected Building Damage by Building Type (All Design Levels)

	None		Slight		Moderate		Extensive		Complete	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Wood	4,533	86.44	0	0.00	0	0.00	0	0.00	0	0.00
Steel	198	3.77	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	46	0.88	0	0.00	0	0.00	0	0.00	0	0.00
Precast	11	0.22	0	0.00	0	0.00	0	0.00	0	0.00
RM	82	1.57	0	0.00	0	0.00	0	0.00	0	0.00
URM	372	7.09	0	0.00	0	0.00	0	0.00	0	0.00
MH	2	0.04	0	0.00	0	0.00	0	0.00	0	0.00
Total	**0** **5,244**	**0**	**0**	**0**						

*Note:

RM Reinforced Masonry
URM Unreinforced Masonry
MH Manufactured Housing

Essential Facility Damage

Before the earthquake, the region had 0 hospital beds available for use. On the day of the earthquake, the model estimates that only 0 hospital beds (0.00%) are available for use by patients already in the hospital and those injured by the earthquake. After one week, 0.00% of the beds will be back in service. By 30 days, 0.00% will be operational.

Table 5: Expected Damage to Essential Facilities

		# Facilities		
Classification	**Total**	**At Least Moderate Damage > 50%**	**Complete Damage > 50%**	**With Functionality > 50% on day 1**
Hospitals	0	0	0	0
Schools	5	0	0	5
EOCs	0	0	0	0
PoliceStations	1	0	0	1
FireStations	1	0	0	1

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	After Day 7
Highway	Segments	6	0	0	6	6
	Bridges	17	0	0	17	17
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	1	0	0	1	1
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	0	0	0	0	0
Airport	Facilities	0	0	0	0	0
	Runways	0	0	0	0	0

Note: Roadway segments, railroad tracks and light rail tracks are assumed to be damaged by ground failure only. If ground failure maps are not provided, damage estimates to these components will not be computed.

Tables 7-9 provide information on the damage to the utility lifeline systems. Table 7 provides damage to the utility system facilities. Table 8 provides estimates on the number of leaks and breaks by the pipelines of the utility systems. For electric power and potable water, Hazus performs a simplified system performance analysis. Table 9 provides a summary of the system performance information.

Table 7 : Expected Utility System Facility Damage

System	Total #	# of Locations With at Least Moderate Damage	With Completewith Functionality > 50 % Damage	After Day 1	After Day 7
Potable Water	0	0	0	0	0
Waste Water	0	0	0	0	0
Natural Gas	0	0	0	0	0
Oil Systems	0	0	0	0	0
Electrical Power	0	0	0	0	0
Communication	0	0	0	0	0

Table 8 : Expected Utility System Pipeline Damage (Site Specific)

System	Total Pipelines Length (kms)	Number of Leaks	Number of Breaks
Potable Water	186	0	0
Waste Water	111	0	0
Natural Gas	74	0	0
Oil	0	0	0

Table 9: Expected Potable Water and Electric Power System Performance

	Total # of Households	Number of Households without Service At Day 1	At Day 3	At Day 7	At Day 30	At Day 90
Potable Water	2,958	0	0	0	0	0
Electric Power		0	0	0	0	0

Induced Earthquake Damage

Fire Following Earthquake

Fires often occur after an earthquake. Because of the number of fires and the lack of water to fight the fires, they can often burn out of control. Hazus uses a Monte Carlo simulation model to estimate the number of ignitions and the amount of burnt area. For this scenario, the model estimates that there will be 0 ignitions that will burn about 0.00 sq. mi 0.00 % of the region's total area.) The model also estimates that the fires will displace about 0 people and burn about 0 (millions of dollars) of building value.

Debris Generation

Hazus estimates the amount of debris that will be generated by the earthquake. The model breaks the debris into two general categories: a) Brick/Wood and b) Reinforced Concrete/Steel. This distinction is made because of the different types of material handling equipment required to handle the debris.

The model estimates that a total of 0.00 million tons of debris will be generated. Of the total amount, Brick/Wood comprises 0.00% of the total, with the remainder being Reinforced Concrete/Steel. If the debris tonnage is converted to an estimated number of truckloads, it will require 0 truckloads (@25 tons/truck) to remove the debris generated by the earthquake.

Social Impact

Shelter Requirement

Hazus estimates the number of households that are expected to be displaced from their homes due to the earthquake and the number of displaced people that will require accommodations in temporary public shelters. The model estimates 0 households to be displaced due to the earthquake. Of these, 0 people (out of a total population of 7,406) will seek temporary shelter in public shelters.

Casualties

Hazus estimates the number of people that will be injured and killed by the earthquake. The casualties are broken down into four (4) severity levels that describe the extent of the injuries. The levels are described as follows;

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

The casualty estimates are provided for three (3) times of day: 2:00 AM, 2:00 PM and 5:00 PM. These times represent the periods of the day that different sectors of the community are at their peak occupancy loads. The 2:00 AM estimate considers that the residential occupancy load is maximum, the 2:00 PM estimate considers that the educational, commercial and industrial sector loads are maximum and 5:00 PM represents peak commute time.

Table 10 provides a summary of the casualties estimated for this earthquake

Table 10: Casualty Estimates

		Level 1	Level 2	Level 3	Level 4
2 AM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**
2 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**
5 PM	Commercial	0	0	0	0
	Commuting	0	0	0	0
	Educational	0	0	0	0
	Hotels	0	0	0	0
	Industrial	0	0	0	0
	Other-Residential	0	0	0	0
	Single Family	0	0	0	0
	Total	**0**	**0**	**0**	**0**

Economic Loss

The total economic loss estimated for the earthquake is 0.00 (millions of dollars), which includes building and lifeline related losses based on the region's available inventory. The following three sections provide more detailed information about these losses.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the earthquake. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the earthquake.

The total building-related losses were 0.00 (millions of dollars); 0 % of the estimated losses were related to the business interruption of the region. By far, the largest loss was sustained by the residential occupancies which made up over 0 % of the total loss. Table 11 below provides a summary of the losses associated with the building damage.

Table 11: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Single Family	Other Residential	Commercial	Industrial	Others	Total
Income Losses							
	Wage	0.00	0.00	0.00	0.00	0.00	0.00
	Capital-Related	0.00	0.00	0.00	0.00	0.00	0.00
	Rental	0.00	0.00	0.00	0.00	0.00	0.00
	Relocation	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Capital Stock Losses							
	Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Non_Structural	0.00	0.00	0.00	0.00	0.00	0.00
	Content	0.00	0.00	0.00	0.00	0.00	0.00
	Inventory	0.00	0.00	0.00	0.00	0.00	0.00
	Subtotal	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Transportation and Utility Lifeline Losses

For the transportation and utility lifeline systems, Hazus computes the direct repair cost for each component only. There are no losses computed by Hazus for business interruption due to lifeline outages. Tables 12 & 13 provide a detailed breakdown in the expected lifeline losses.

Hazus estimates the long-term economic impacts to the region for 15 years after the earthquake. The model quantifies this information in terms of income and employment changes within the region. Table 14 presents the results of the region for the given earthquake.

Table 12: Transportation System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Highway	Segments	108.99	$0.00	0.00
	Bridges	196.90	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**305.90**	**0.00**	
Railways	Segments	12.62	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**12.60**	**0.00**	
Light Rail	Segments	22.28	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**22.30**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**340.80**	**0.00**	

Table 13: Utility System Economic Losses
(Millions of dollars)

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	3.70	$0.00	0.00
	Subtotal	**3.71**	**$0.00**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	2.20	$0.00	0.00
	Subtotal	**2.23**	**$0.00**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	1.50	$0.00	0.00
	Subtotal	**1.49**	**$0.00**	
Oil Systems	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Electrical Power	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
Communication	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**$0.00**	
	Total	**7.42**	**$0.00**	

Table 14. Indirect Economic Impact with outside aid
(Employment as # of people and Income in millions of $)

LOSS	Total	%
0	0	0

Appendix A: County Listing for the Region

New London,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	New London	7,406	771	193	965
Total State		**7,406**	**771**	**193**	**965**
Total Region		**7,406**	**771**	**193**	**965**

Appendix V

Hazus-MH: Flood Event Report

Region Name: Old Lyme

Flood Scenario: Old Lyme

Print Date: Tuesday, February 26, 2013

Disclaimer:

Totals only reflect data for those census tracts/blocks included in the user's study region.

The estimates of social and economic impacts contained in this report were produced using Hazus loss estimation methodology software which is based on current scientific and engineering knowledge. There are uncertainties inherent in any loss estimation technique. Therefore, there may be significant differences between the modeled results contained in this report and the actual social

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General Description of the Region

Hazus is a regional multi-hazard loss estimation model that was developed by the Federal Emergency Management Agency (FEMA) and the National Institute of Building Sciences (NIBS). The primary purpose of Hazus is to provide a methodology and software application to develop multi-hazard losses at a regional scale. These loss estimates would be used primarily by local, state and regional officials to plan and stimulate efforts to reduce risks from multi-hazards and to prepare for emergency response and recovery.

The flood loss estimates provided in this report were based on a region that included 1 county(ies) from the following state(s):

- Connecticut

Note:
Appendix A contains a complete listing of the counties contained in the region.

The geographical size of the region is 23 square miles and contains 280 census blocks. The region contains over 3 thousand households and has a total population of 7,406 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 5,244 buildings in the region with a total building replacement value (excluding contents) of 965 million dollars (2006 dollars). Approximately 92.32% of the buildings (and 79.93% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 5,244 buildings in the region which have an aggregate total replacement value of 965 million (2006 dollars). Table 1 and Table 2 present the relative distribution of the value with respect to the general occupancies by Study Region and Scenario respectively. Appendix B provides a general distribution of the building value by State and County.

Table 1
Building Exposure by Occupancy Type for the Study Region

Occupancy	Exposure ($1000)	Percent of Total
Residential	771,665	79.9%
Commercial	130,387	13.5%
Industrial	29,324	3.0%
Agricultural	4,619	0.5%
Religion	12,571	1.3%
Government	4,838	0.5%
Education	12,022	1.2%
Total	**965,426**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	696,738	80.6%
Commercial	115,518	13.4%
Industrial	24,284	2.8%
Agricultural	4,107	0.5%
Religion	12,338	1.4%
Government	2,981	0.3%
Education	8,315	1.0%
Total	**864,281**	**100.00%**

Essential Facility Inventory

For essential facilities, there are no hospitals in the region with a total bed capacity of no beds. There are 5 schools, 1 fire station, 1 police station and no emergency operation centers.

Flood Scenario Parameters

Hazus used the following set of information to define the flood parameters for the flood loss estimate provided in this report.

Study Region Name:	Old Lyme
Scenario Name:	Old Lyme
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 367 buildings will be at least moderately damaged. This is over 43% of the total number of buildings in the scenario. There are an estimated 17 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 of the Hazus Flood Technical Manual. Table 3 below summarizes the expected damage by general occupancy for the buildings in the region. Table 4 summarizes the expected damage by general building type.

Table 3: Expected Building Damage by Occupancy

	1-10		11-20		21-30		31-40		41-50		Substantially	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0
Commercial	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0
Industrial	0	0	0	0	0	0	0	0	0	0	0	0
Religion	0	0	0	0	0	0	0	0	0	0	0	0
Residential	0	0	47	12.81	53	14.44	41	11.17	209	56.95	17	4.63
Total	**0**		**47**		**53**		**41**		**209**		**17**	

Table 4: Expected Building Damage by Building Type

	1-10		11-20		21-30		31-40		41-50		Substantially	
BuildingType	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	0	0	0	0	0	0	0	0	0	0	0	0
ManufHousing	0	0	0	0	0	0	0	0	0	0	0	0
Masonry	0	0	0	0	0	0	0	0	5	100	0	0
Steel	0	0	0	0	0	0	0	0	0	0	0	0
Wood	0	0	47	13.02	53	14.68	41	11.36	203	56.23	17	4.71

Essential Facility Damage

Before the flood analyzed in this scenario, the region had 0 hospital beds available for use. On the day of the scenario flood event, the model estimates that 0 hospital beds are available in the region.

Table 5: Expected Damage to Essential Facilities

	# Facilities			
Classification	Total	At Least Moderate	At Least Substantial	Loss of Use
Fire Stations	1	0	0	0
Hospitals	0	0	0	0
Police Stations	1	0	0	0
Schools	5	0	0	0

If this report displays all zeros or is blank, two possibilities can explain this.

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.
(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

Hazus estimates the amount of debris that will be generated by the flood. The model breaks debris into three general categories: 1) Finishes (dry wall, insulation, etc.), 2) Structural (wood, brick, etc.) and 3) Foundations (concrete slab, concrete block, rebar, etc.). This distinction is made because of the different types of material handling equipment required to handle the debris.

Analysis has not been performed for this Scenario.

Social Impact

Shelter Requirements

Hazus estimates the number of households that are expected to be displaced from their homes due to the flood and the associated potential evacuation. Hazus also estimates those displaced people that will require accommodations in temporary public shelters. The model estimates 412 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 617 people (out of a total population of 7,406) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 73.22 million dollars, which represents 8.47 % of the total replacement value of the scenario buildings.

Building-Related Losses

The building losses are broken into two categories: direct building losses and business interruption losses. The direct building losses are the estimated costs to repair or replace the damage caused to the building and its contents. The business interruption losses are the losses associated with inability to operate a business because of the damage sustained during the flood. Business interruption losses also include the temporary living expenses for those people displaced from their homes because of the flood.

The total building-related losses were 72.99 million dollars. 0% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 74.63% of the total loss. Table 6 below provides a summary of the losses associated with the building damage.

Table 6: Building-Related Economic Loss Estimates

(Millions of dollars)

Category	Area	Residential	Commercial	Industrial	Others	Total
Building Loss						
	Building	33.79	3.84	0.47	0.44	38.54
	Content	20.79	10.46	0.82	2.09	34.17
	Inventory	0	0.16	0.1	0.02	0.29
	Subtotal	**54.59**	**14.47**	**1.39**	**2.55**	**72.99**
Business Interruption						
	Income	0	0.06	0	0	0.06
	Relocation	0.05	0.01	0	0	0.06
	Rental Income	0.01	0	0	0	0.01
	Wage	0	0.05	0	0.05	0.1
	Subtotal	**0.06**	**0.12**	**0**	**0.05**	**0.23**
	Total	**54.65**	**14.59**	**1.39**	**2.6**	**73.22**
	ALL					

Appendix A: County Listing for the Region

Connecticut

- New London

Appendix B: Regional Population and Building Value Data

	Building Value (thousands of dollars)			
	Population	**Residential**	**Non-Residential**	**Total**
Connecticut				
New London	7,406	771,665	193,761	965,426
Total	**7,406**	**771,665**	**193,761**	**965,426**
Total Study Region	**7,406**	**771,665**	**193,761**	**965,426**

Appendix VI – Meeting Minutes

OLD LYME PLANNING COMMISSION
SPECIAL MEETING
THURSDAY, NOVEMBER 14, 2013

PRESENT WERE: Harold Thompson, Robert McCarthy, Steven Ross, Chris Kerr and Edgar Butcher. Also present were Alternates Todd Machnik and Don Willis.
Chairman Thompson called the meeting to order at 5:00 p.m.

NATURAL HAZARDS MITIGATION PLAN
Thompson reported that the commission recently received a copy of the Hazardous Mitigan Plan. He stated after a cursory review he noted the document talked about a Technical Advisory Committee under the Planning Commission. He stated he invited Jeremy DeCarli, Lower Connecticut River Valley Council of Governments to give the commission an overview of the document. DeCarli distributed copies outlining what a Hazard Mitigation Plan is. He noted the Town of Old Lyme adopted a Hazard Mitigation Plan in 2006 and this was meant to be an update. He noted the requirements have changed and these plans are considerably larger than they were in 2006. He noted the plan is a FEMA requirement. He noted the plans outlines different things the town can do to protect itself from some of these hazards. He noted the Hazardous Mitigation Grant program assists the town each time the state receives a disaster declaration because a portion of the money is used for the mitigation action items outlined in the plan such as rebuilding beaches or planting dunes or upgrading bridges. He noted those funds are only accessible if the town has a FEMA approved Hazard Mitigation Plan.

He stated the Planning Commission does not to have own this plan. He said in some towns they delegate it to the ZEO and Board of Selectmen. DeCarli stated ultimately the town owns the plan and it is approved by the Board of Selectmen and it has to be updated every 5 years. Thompson asked since the previous plan was done in 2006 is it currently null and void? DeCarli stated that was correct. Ross stated the present plan is still in effect but just needs to be updated. DeCarli stated the 2006 plan is not in effect because it was adopted in 2006 and expired in 2011.

Todd Machnik stated there is a lot of work that could be happening along the beaches that could help the Board of Finance. He said the easier it is to obtain this money the more helpful it would be to the town and its residents. He stated any financial assistance we can receive from this grant money would help the taxpayers and they would not have to incur the burden of these improvements.

Ross suggested the current plan be updated. He noted the proposed plan has a lot of data that may not be useful or necessary. DeCarli stated the original plan was written by CRERPA and the reason the new draft is so big is the FEMA requirements have grown tremendously.

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Ross further explained that the grant monies that are available do not cover the costs to develop a study to repair the damaged areas. Therefore whatever studies are needed prior to doing the work those costs are not covered. DeCarli stated that was correct but he noted there is a 75/25 match. So 25 percent of the money could be used to fund the study.

The commission invited Jeremy DeCarli to attend their December 12th meeting at 5:00 to further discuss the plan. DeCarli also agreed to forward the commission a copy of the 2005 plan.

UPDATE SUBDIVISION REGULATIONS
Thompson reported that Attorney Cassella and Tom Metcalf, Consulting Engineer have been working on updating the Subdivision Regulations. He noted this document needs to be consistent with the Design and Construction Standards as well as current state statutes. The commission reviewed the first draft update of the Subdivision Regulations. The commission will continue working on the document at their next meeting. The Design and Construction Standards have been forwarded to the Board of Selectmen for their review. The commission requested in their letter to the Board of Selectmen that any changes made to the Standards is sent back to the commission for their review.

2014 MEETING CALENDAR
Harold Thompson made a motion to approve the meeting calendar and set their Regular Meeting time at 5:00 p.m. Steve Ross seconded the motion. The motion passed unanimously.

APPROVAL OF THE SEPTEMBER MEETING MINUTES
Chris Kerr made a motion to approve the meeting minutes. Robert McCarthy seconded the motion. The motion passed unanimously.

Respectfully submitted,
Kim Groves
Land Use Administrator

MINUTES
OLD LYME PLANNING COMMISSION
DECEMBER 12, 2013

PRESENT WERE: Harold Thompson, Steven Ross, Edgar Butcher, Chris Kerr and Alternates Todd Machnik and Don Willis. Also present were Attorney Ed Cassella, Tom Metcalf, P.E. and Jeremy DeCarli.

Chairman Thompson called the meeting to order at 5:00 p.m.

DISCUSSION UPDATING SUBDIVISION REGULATIONS

The commission reviewed the latest changes incorporated into the proposed rewrite of the Old Lyme Subdivision Regulations. The commission discussed in detail some of the discretionary items in Section 5 of the Subdivision Design and Construction Standards. The commission agreed to review the draft document and incorporate any comments and changes at the January meeting. A public hearing will be held in February.

Robert McCarthy will be seated for the remainder of the meeting.

NATURAL HAZARDS MITIGATION PLAN – JEREMY DECARLI

Jeremy DeCarli was present to discuss with the commission what they would like their role to be in plan process. Thompson asked how the neighboring towns had handled their involvement in the process. DeCarli stated some towns had chosen to not be involved and others created a sub-committee. He said it has really been a town to town decision.

Todd Machnik stated he had reviewed the document and felt it was mostly a narrative of facts that doesn't have a whole lot to do with the Planning Commission. He further stated there needs to be something in place to assist people in the FEMA process.

Discussion ensued.

Steven Ross made a motion that the Planning Commission recommend to the Board of Selectmen that they establish a town wide committee (including various land use boards and emergency management) to work with the Lower Ct. River Valley Council of Governments to update the Natural Hazard Mitigation Plan. Chris Kerr seconded the motion. The motion passed unanimously.

The Planning Commission also stated that they consider the plan to be important to the town because of the Federal Funding.

Kim Groves
Land Use Administrator

Town of Old Lyme NHMP Committee
Special Meeting
Friday, 14 February 2014
2nd Floor Conference Room

The Natural Hazards Mitigation Plan Committee held a Special Meeting at 1:00 PM on Friday, 14 February 2014 in the 2nd Floor Conference Room of the Old Lyme Memorial Town Hall. Jeremy DeCarli, RiverCOG, Harry Plaut, Ellie Czarnowski, Dave Roberge, John Flower, Kim Barrows and First Selectwoman Bonnie Reemsnyder were present. Ed Adanti was excused absent.

1. **Introductions:** Introduction of participants was made.

2. **Review of Draft Plan:** Jeremy DeCarli explained the timeline of the Natural Hazards Mitigation Plan, which was first drafted as a Regional Plan in 2006 by CRERPA. NHMP's should be updated every five years, but with all of the natural disasters experienced over the last three years, it was agreed that each town should adopt their own plan. Jeremy has been working together with many of the original nine towns of CRERPA to develop their plan for final approval by CT DEEP and FEMA. The plan for Old Lyme has gone to the Planning Commission, and it was agreed that it should be reviewed by a Committee for any suggested changes. Jeremy further explained that once the draft plan is approved by the Committee, it will be submitted to CT DEEP for approval, and will then be submitted to FEMA. Finally, it will go to the Board of Selectmen for recommendation to a Town Meeting for approval. All of this is targeted to happen by August, 2014.
   Ellie Czarnowski reviewed several items in the draft plan that she had questions about, and changes were suggested. Jeremy will review these areas and make any recommended changes. It was agreed that all committee members would review the draft plan and email their questions, comments and suggestions to Jeremy DeCarli before the next meeting.

3. **Other Business:** There was discussion about the schedule of meetings, and the number of meetings anticipated. Everyone agreed that if each member reviewed the document carefully and returned with suggestions, it was possible to limit the meetings to no more than two additional meetings. The next meeting was scheduled for Friday, 21 February 2014 at 1:00 PM in the 2nd Floor Conference Room, and a follow up meeting was scheduled for Friday, 7 March 2014 at 1:000 PM in the same location.

4. **Public Comment:** There was no public comment

5. **Adjournment:** The meeting was adjourned at 2:22 PM.

Respectfully submitted,

Bonnie A. Reemsnyder

Town of Old Lyme NHMP Committee
Special Meeting
Friday, 21 February 2014
1:00 PM
2nd Floor Conference Room

The Natural Hazards Mitigation Plan Committee held a Special Meeting at 1:00 PM on Friday, 14 February 2014 in the 2nd Floor Conference Room of the Old Lyme Memorial Town Hall. Jeremy DeCarli, RiverCOG, Ellie Czarnowski, Dave Roberge, John Flower, Kim Barrows and First Selectwoman Bonnie Reemsnyder were present. Ed Adanti and Harry Plaut were excused absent.

1. **Approval of Minutes of 14 February 2014:** Motion was made by Kim Barrows to approve the minutes as submitted. Second by Ellie Czarnowski. **SO VOTED.**

2. **Review of Questions, Comments Suggestions:** The plan was further reviewed by all members present and corrections, suggestions and questions were discussed. Jeremy DeCarli will make all changes necessary.

3. **Plan for Public Involvement:** There was discussion about the survey put together by Jeremy DeCarli, and he asked everyone to take part in it over the next few days. Questions and comments should be sent to him to make sure any errors are corrected or suggestions addressed. Everyone agreed that it is important to get the survey out as soon as possible, so that data collected can be considered in the plan prior to submitting to the CT DEEP. A public information meeting was discussed and it was decided that a meeting should be held on Saturday, Mar. 8, 2014 at 10:00 AM in the Meeting Hall of Memorial Town Hall. At that time, the updated plan will be reviewed and the public will have an opportunity to ask questions and make suggestions.

4. **Public Comment:** There was no public comment

5. **Adjournment:** The meeting was adjourned at 2:36 PM.

Respectfully submitted,

Bonnie A. Reemsnyder

Town of Old Lyme NHMP Committee

Special Meeting
Friday, 7 March 2014
1:00 PM
Mezzanine Conference Room

The Natural Hazards Mitigation Plan Committee held a Special Meeting at 1:00 PM on Friday, 7 February 2014 in the Mezzanine Conference Room of the Old Lyme Memorial Town Hall. Jeremy DeCarli, RiverCOG, Ellie Czarnowski, Dave Roberge, John Flower, Kim Barrows, Ed Adanti and First Selectwoman Bonnie Reemsnyder were present. Harry Plaut was absent.

1. **Approval of Minutes of 21 February 2014:** Motion was made by Kim Barrows to approve the minutes as submitted. Second by Dave Roberge. **SO VOTED.**

2. **Final Review of Draft and changes:** Jeremy DeCarli sent out the latest draft, and the committee reviewed comments since that draft. Suggestions for corrections or amendments were made and agreed upon. Jeremy will make changes and provide the latest draft to committee. It was suggested that a deadline for all updates be established. Survey returns so far were up to 6, and there was discussion about how to get the word out to get people to fill out the survey.

3. **Plan for Public Involvement:** It was agreed that copies of the plan and survey should be distributed to several outlets, including Coffee's, Senior Center, schools, Library, Teddy's Pizza, Beach Associations, Koffee Works, Park and Rec, EOC Facebook page and various commission meetings. It was agreed that the survey could continue to be available until just before we submit the plan to FEMA.

4. **Other Business**: It was agreed that we should get any results from the survey on Mar. 26th, make any changes based on those survey results, schedule a meeting by Mar. 28th to update anything needed and get the plan in the mail to DEEP by April 1st. The committee also needs to work on the Comprehensive Mitigation Action Items, including adding any items, and the status (not ongoing or maintain). Committee should send suggested additions directly to Jeremy by email.

5. **Public Comment:** There was no public comment

   The next meeting is scheduled for Mar. 28th at 1:00 PM in the Mezzanine Conference Room.

6. **Adjournment:** Motion to adjourn at 2:02 PM by Kim Barrows. Seconded by Ellie Czarnowski. So moved.

Respectfully submitted,

Bonnie A. Reemsnyder

Town of Old Lyme NHMP Committee
Public Information Meeting
Saturday, 8 March 2014
10:00 AM
Meeting Hall, Old Lyme Town Hall

The Natural Hazards Mitigation Plan Review Committee held a Public Information Meeting on **Saturday, Mar. 8, 2014 at 10:00 AM** in the Meeting Hall of the Old Lyme Town Hall. Present were First Selectwoman Bonnie Reemsnyder, Jeremy DeCarli of the RiverCOG, and Ellie Czarnowski, committee member. There were two guests.

First Selectwoman Bonnie Reemsnyder reviewed the process for the Natural Hazards Mitigation Plan, which was first adopted regionally in 2006 through CRERPA, the regional planning agency of the time. Since the events of 2011 and 2012, with two hurricanes and a blizzard, the member towns decided that it was prudent to adopt individual town plans, and Jeremy DeCarli, Planner from the Lower CT River Estuary Council of Governments (RiverCOG) has been helping the towns accomplish this update.

Mr. DeCarli went through a Power Point presentation which articulated what the NHMP covers, the need for a plan, and the updates to our plan. There were several questions from the audience. All those present were encouraged to take part in the survey, which can be found online at www.oldlyme-ct.gov under Current Projects.

Respectfully submitted,

Bonnie A. Reemsnyder
First Selectwoman

Appendix VII – Screen Shots

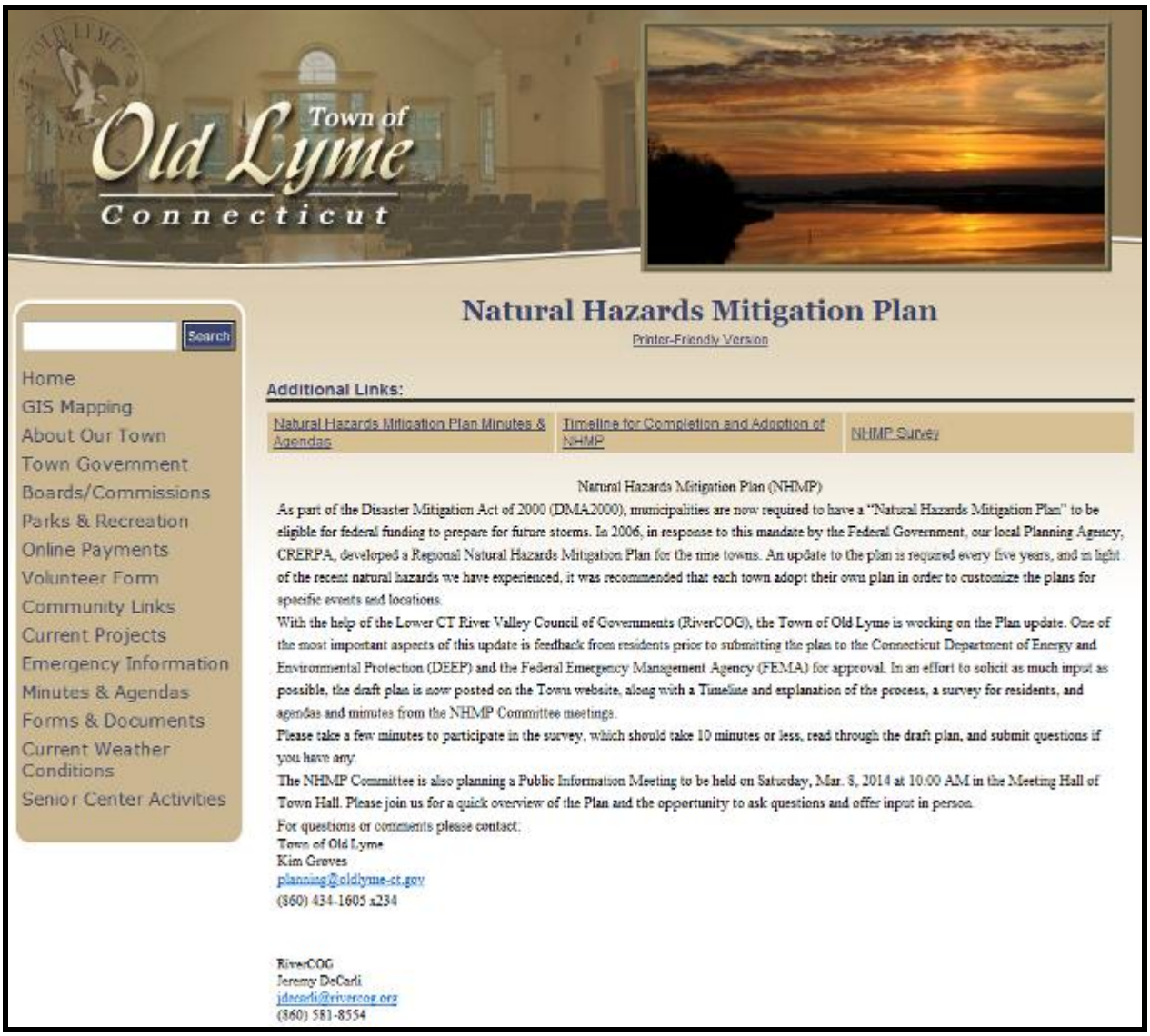


Figure A – Announcement of NHMP on Old Lyme Website.

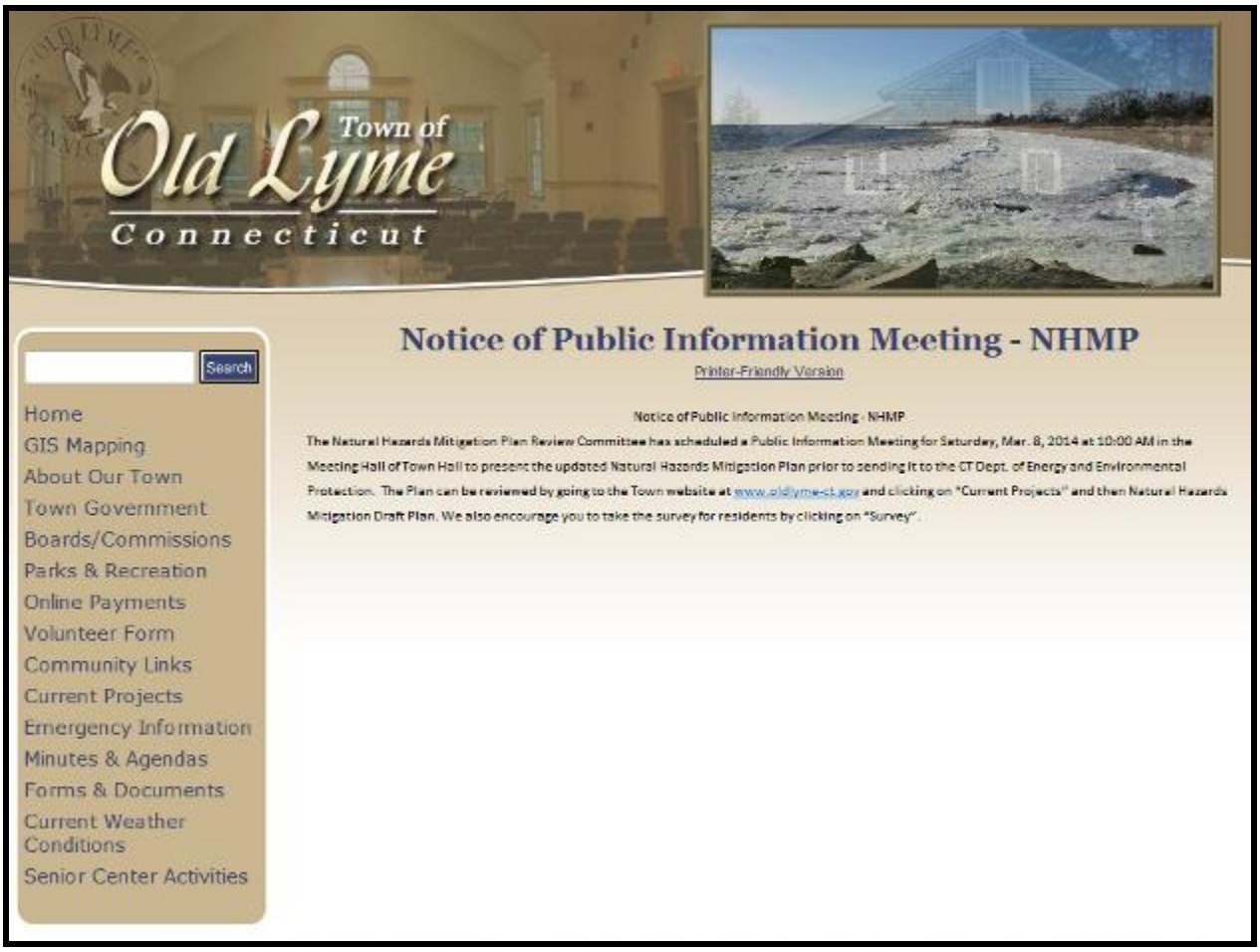


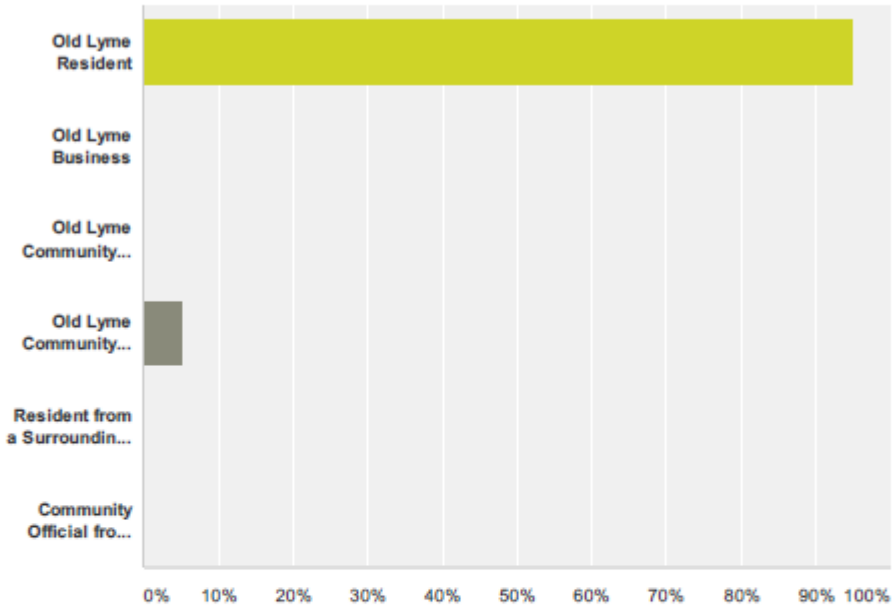
Figure B - Announcement of Public Informational Meeting on Town Website.

Figure C – Old Lyme NHMP page on RiverCOG website.

Appendix VIII – Public Survey Questions and Responses

Q1 Are you responding as:

Answered: 19 Skipped: 0



Answer Choices	Responses	
Old Lyme Resident	94.74%	18
Old Lyme Business	0.00%	0
Old Lyme Community Organization	0.00%	0
Old Lyme Community Official	5.26%	1
Resident from a Surrounding Town	0.00%	0
Community Official from a Neighboring Town or Regional, State or Federal Agency	0.00%	0
Total		19

#	Other (please specify)	Date
	There are no responses.	

Q2 For what town or agency do you work?

Answered: 0 Skipped: 19

! No matching responses.

Answer Choices	Responses	
Lyme	0.00%	0
East Lyme	0.00%	0
Old Saybrook	0.00%	0
Other Town or Governmental Agency (please specify)	0.00%	0
Total		0

#	Other Town or Governmental Agency (please specify)	Date
	There are no responses.	

Q3 Are you actively involved in Natural Hazard Mitigation?

Answered: 0 Skipped: 19

! No matching responses.

Answer Choices	Responses	
No	0.00%	0
Yes	0.00%	0
Total		0

Q4 Have natural hazards in Old Lyme impacted your town, region or agency?

Answered: 0 Skipped: 19

! No matching responses.

Answer Choices	Responses	
No	0.00%	0
Yes (please specify)	0.00%	0
Total		0

#	Yes (please specify)	Date
	There are no responses.	

Q5 Please add any suggestions, ideas, concerns or comments that you would like the Old Lyme NHMP Committee to consider.

Answered: 0 Skipped: 19

#	Responses	Date
	There are no responses.	

Q6 Are there inter-town or regional mitigation actions that need to be coordinated?

Answered: 0 Skipped: 19

! No matching responses.

Answer Choices	Responses	
No	0.00%	0
Yes (please specify)	0.00%	0
Total		0

#	Yes (please specify)	Date
	There are no responses.	

Q7 If you are responding as a resident or business, please indicate the neighborhood or general area of Old Lyme in which you are located:

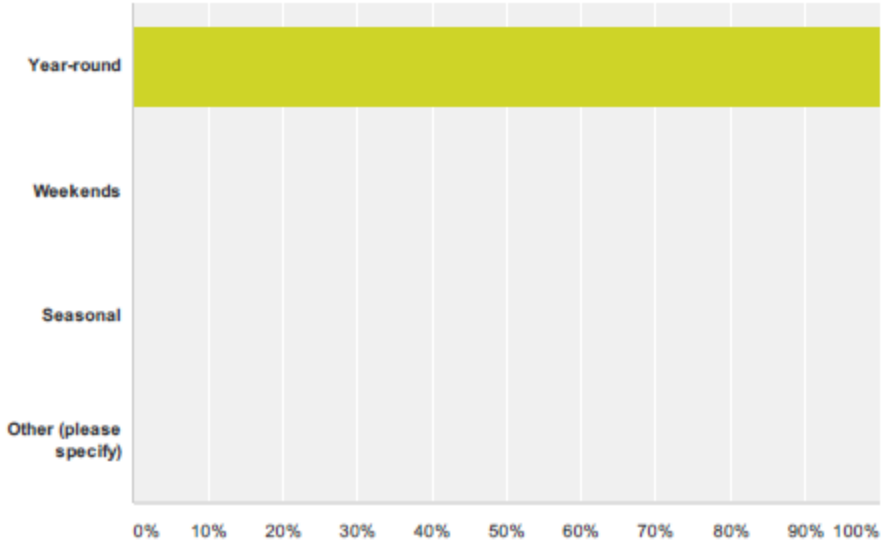
Answered: 10 Skipped: 9

Neighborhood / Area	Boston Post Road (Rt 1)	Hawks Nest	Old Lyme Shores	Point 'o Woods	Historic District	South Lyme	Rogers Lake	Shore Road	Total
Please select an area from the drop-down list.	10.00% 1	20.00% 2	0.00% 0	0.00% 0	10.00% 1	10.00% 1	0.00% 0	50.00% 5	10

#	Other (please specify)	Date
1	Chestnut Hills	3/17/2014 4:23 PM
2	"the forgotten" area: Flat Rock Hill Road/Hatchetts Hill	3/13/2014 10:30 AM
3	Short Hills	3/11/2014 7:48 PM
4	Black Hall area	3/11/2014 5:10 PM
5	Four Mile River Rd.	3/1/2014 7:18 AM
6	Shore Rd Rte 156	2/26/2014 3:51 PM

Q8 If you are a resident of Old Lyme, please indicate for what portion of the year you live here.

Answered: 15 Skipped: 4



Answer Choices	Responses	
Year-round	100.00%	15
Weekends	0.00%	0
Seasonal	0.00%	0
Other (please specify)	0.00%	0
Total		15

#	Other (please specify)	Date
	There are no responses.	

Q9 There are many types of natural hazards that have affected or could affect Old Lyme. From the list below, please indicate each hazard that you have experienced in Old Lyme.

Answered: 15 Skipped: 4

	I have experienced this natural hazard	Total Respondents
Flood	100.00% 9	9
Hurricane or Tropical Storm	100.00% 13	13
High Wind / Tornado	100.00% 11	11
Winter Storm	100.00% 14	14
Nor'easter	100.00% 15	15
Drought	100.00% 7	7
Wildfire	0.00% 0	0
Earthquake	0.00% 0	0
Heat Wave	100.00% 9	9
Tsunami	0.00% 0	0
Sea Level Rise	100.00% 1	1
Marine Debris	100.00% 5	5

Q10 From the list of natural hazards, please indicate if you have had any losses from the hazard category.

Answered: 15 Skipped: 4

	I have suffered losses due to this type of event	I have been inconvenienced but have not suffered any losses	I have neither been inconvenienced nor had any losses	Total
Flood	25.00% 3	66.67% 8	8.33% 1	12
Hurricane or Tropical Storm	69.23% 9	30.77% 4	0.00% 0	13
High Wind / Tornado	30.00% 3	70.00% 7	0.00% 0	10
Winter Storm	30.77% 4	69.23% 9	0.00% 0	13
Nor'easter	23.08% 3	76.92% 10	0.00% 0	13
Drought	0.00% 0	62.50% 5	37.50% 3	8
Wildfire	0.00% 0	0.00% 0	100.00% 5	5
Earthquake	0.00% 0	0.00% 0	100.00% 4	4
Heat Wave	0.00% 0	87.50% 7	12.50% 1	8
Tsunami	0.00% 0	0.00% 0	100.00% 5	5
Sea Level Rise	0.00% 0	0.00% 0	100.00% 5	5
Marine Debris	0.00% 0	28.57% 2	71.43% 5	7

Q11 From the list of natural hazards on the left, please indicate your level of concern about the hazard recurring in the future.

Answered: 15 Skipped: 4

	I am not concerned	I am somewhat concerned	I am very concerned	Total
Flood	20.00% 3	53.33% 8	26.67% 4	15
Hurricane or Tropical Storm	0.00% 0	40.00% 6	60.00% 9	15
High Wind / Tornado	7.69% 1	69.23% 9	23.08% 3	13
Winter Storm	6.67% 1	60.00% 9	33.33% 5	15
Nor'easter	0.00% 0	60.00% 9	40.00% 6	15
Drought	27.27% 3	54.55% 6	18.18% 2	11
Wildfire	55.56% 5	33.33% 3	11.11% 1	9
Earthquake	100.00% 8	0.00% 0	0.00% 0	8
Heat Wave	25.00% 3	58.33% 7	16.67% 2	12
Tsunami	100.00% 9	0.00% 0	0.00% 0	9
Sea Level Rise	20.00% 2	60.00% 6	20.00% 2	10
Marine Debris	33.33% 3	55.56% 5	11.11% 1	9

Q12 What are the best ways for you to get information about what you can do to prevent future losses from natural hazards? Please check all that apply.

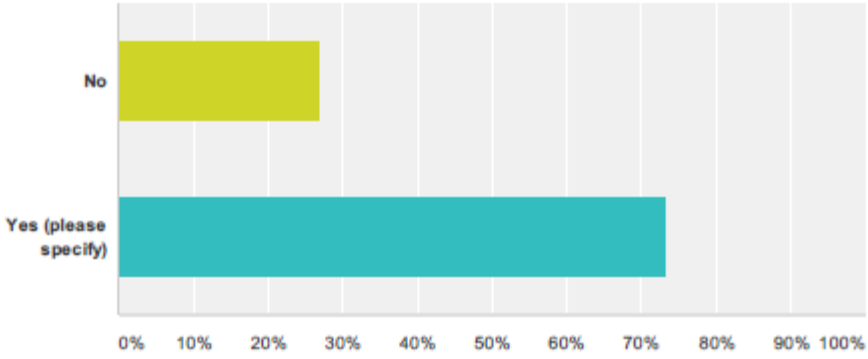
Answered: 15 Skipped: 4

Answer Choices	Responses	
Paper Mailing	60.00%	9
Newspaper stories about what other people have done	60.00%	9
Public Meetings / Informational Workshops	53.33%	8
Schools	20.00%	3
TV News	66.67%	10
TV public Sevrice announcements	40.00%	6
Radio News	26.67%	4
Radio Pubic Service Announcements	13.33%	2
Old Lyme Internet Website	66.67%	10
Other Internet Websites (NOAA, NWS, Weather Radar, FEMA, State of CT, etc.)	46.67%	7
Chamber of Commerce	6.67%	1
Church	13.33%	2
Library	13.33%	2
Old Lyme Police Dept.	0.00%	0
Old Lyme Fire Dept.	6.67%	1
Old Lyme Land Use Dept.	20.00%	3
Old Lyme Building Dept.	13.33%	2
Other (please specify)	6.67%	1
Total Respondents: 15		

#	Other (please specify)	Date
1	emails	3/11/2014 5:43 PM

Q13 Have you taken actions (e.g.replacing windows with wind resistent glass, removing large trees close to your house or business, etc.) to protect your home or business from natural hazards that might occur?

Answered: 15 Skipped: 4

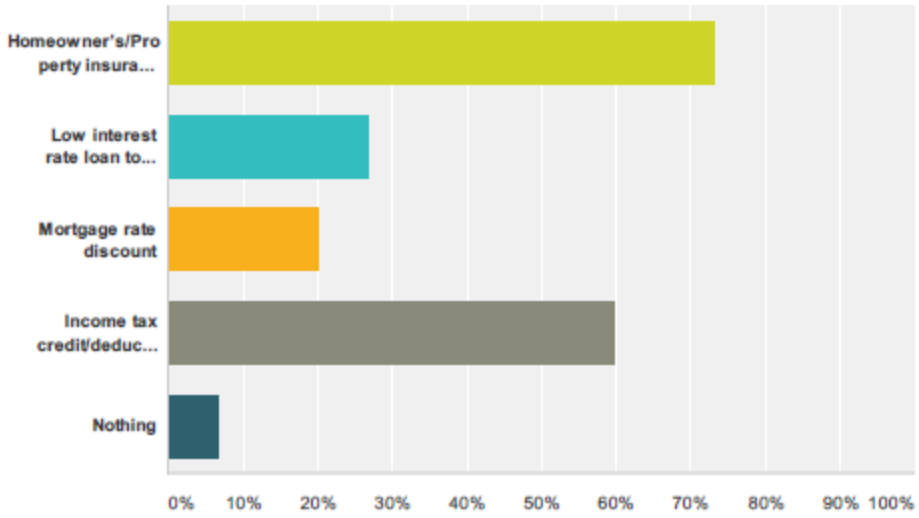


Answer Choices	Responses	
No	26.67%	4
Yes (please specify)	73.33%	11
Total		15

#	Yes (please specify)	Date
1	removing tree limbs that might overhang house roof.	3/21/2014 12:03 PM
2	Replaced some windows and trimmed some trees by residence	3/17/2014 4:24 PM
3	trees removed	3/12/2014 4:07 PM
4	remove tree, purchased and installed storm shutters	3/12/2014 12:48 PM
5	removing trees close to the house	3/12/2014 11:53 AM
6	Kept our house away from the immediate shoreline.	3/12/2014 8:55 AM
7	Removed trees close to house	3/11/2014 5:43 PM
8	some trees down or trimmed. Need more done	3/11/2014 5:13 PM
9	tree removal	3/2/2014 11:45 AM
10	Smart landscaping, maintenance on home, newer energy efficient windows	3/1/2014 7:20 AM
11	remove trees	2/26/2014 3:52 PM

Q14 What financial incentives would motivate you to mitigate against natural hazards to your home or business?

Answered: 15 Skipped: 4

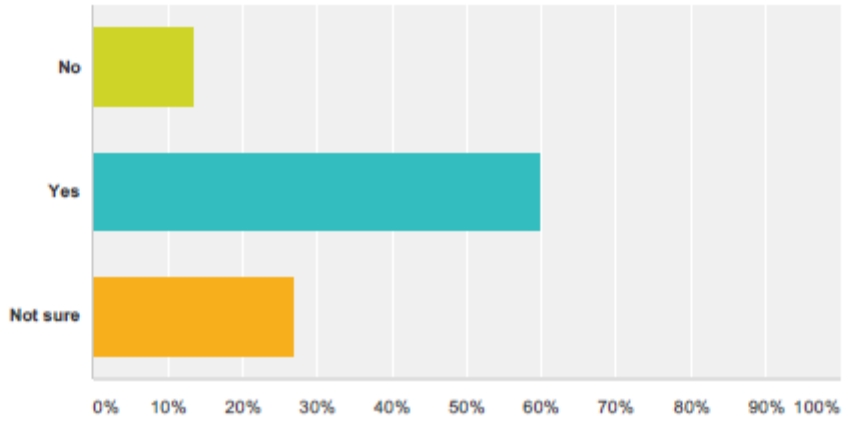


Answer Choices	Responses	
Homeowner's/Property insurance discount	73.33%	11
Low interest rate loan to floodproof a structure	26.67%	4
Mortgage rate discount	20.00%	3
Income tax credit/deduction	60.00%	9
Nothing	6.67%	1
Total Respondents: 15		

#	Other (please specify)	Date
	There are no responses.	

Q15 Are you in favor of spending public funds on mitigation projects (e.g. elevating flood prone roads, improving capabilities at the Old Lyme Emergency Operations Center, strengthening seawalls, etc.) for the benefit of the entire community?

Answered: 15 Skipped: 4

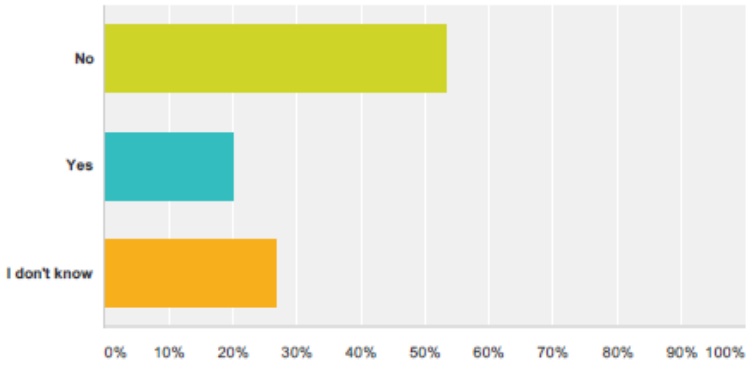


Answer Choices	Responses	
No	13.33%	2
Yes	60.00%	9
Not sure	26.67%	4
Total		15

#	Comments	Date
1	with grants	3/17/2014 4:24 PM
2	develop a local emergency power plant	3/12/2014 4:07 PM
3	Only public roads. No private roads or private property seawalls	3/12/2014 12:48 PM
4	but not adding new sea walls	3/12/2014 11:53 AM
5	I would be in favour of spending public funds to buy out targeted shoreline houses and removing them from harms way.	3/12/2014 8:55 AM
6	only public roads, not private roads especially the beach communities.	3/11/2014 7:52 PM

Q16 Is your home or business located in a flood zone?

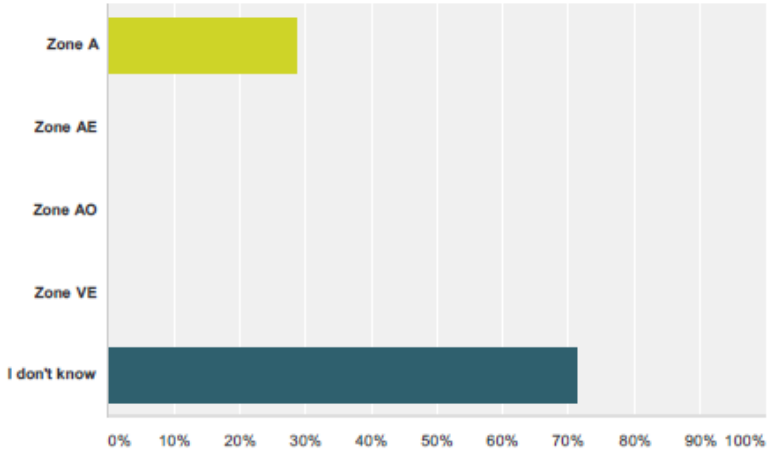
Answered: 15 Skipped: 4



Answer Choices	Responses	
No	53.33%	8
Yes	20.00%	3
I don't know	26.67%	4
Total		15

Q17 What flood zone is your home or business located in?

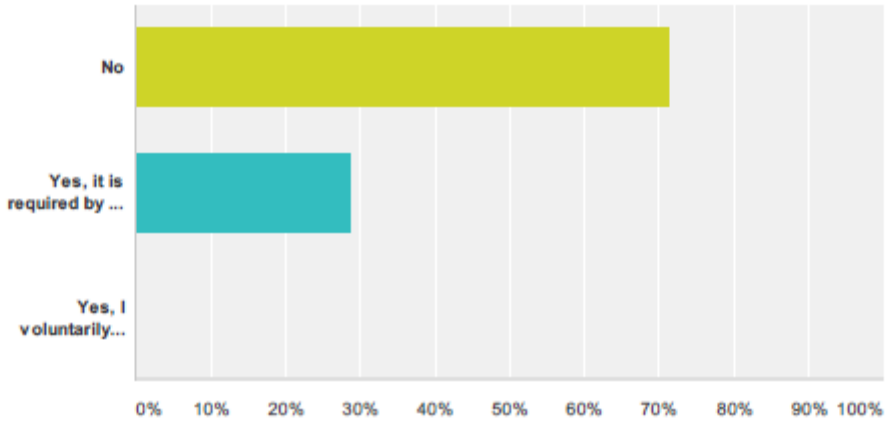
Answered: 7 Skipped: 12



Answer Choices	Responses	
Zone A	28.57%	2
Zone AE	0.00%	0
Zone AO	0.00%	0
Zone VE	0.00%	0
I don't know	71.43%	5
Total		7

Q18 Do you currently have flood insurance?

Answered: 7 Skipped: 12

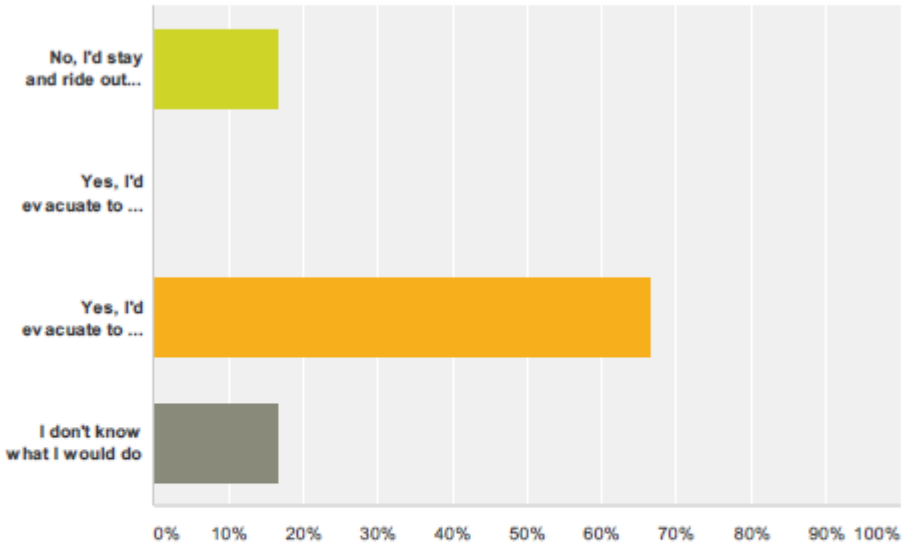


Answer Choices	Responses	
No	71.43%	5
Yes, it is required by my mortgage lender	28.57%	2
Yes, I voluntarily purchased it	0.00%	0
Total		7

#	Comments	Date
1	My house if up high on a hill	3/11/2014 5:15 PM

Q19 In the event that a severe flood is forecast, would you evacuate to a safer location?

Answered: 6 Skipped: 13

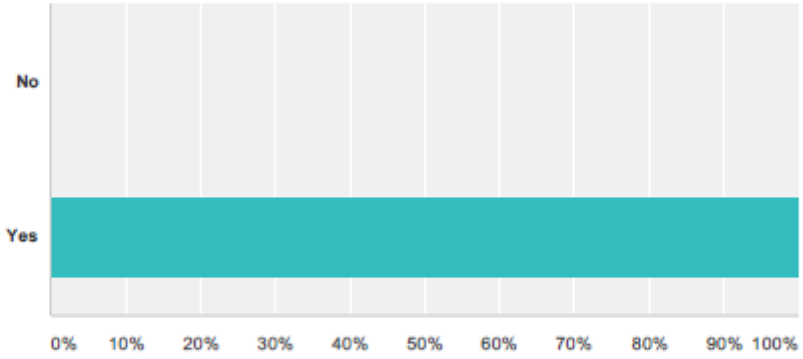


Answer Choices	Responses	
No, I'd stay and ride out the storm	16.67%	1
Yes, I'd evacuate to the Town Shelter	0.00%	0
Yes, I'd evacuate to the home of a friend or relative outside the flood area	66.67%	4
I don't know what I would do	16.67%	1
Total		6

#	Comments	Date
1	My house is on top of a hill. Even with worse flooding so far the water has only hit the street level.	3/21/2014 12:05 PM
2	Probably stay home unless it looked like we would not have necessities for staying	3/11/2014 5:15 PM

Q20 If your home or business were to experience repeated flood damage, would you consider moving from the affected area if you could sell your property at a fair market value as reimbursement for it to become open space?

Answered: 6 Skipped: 13

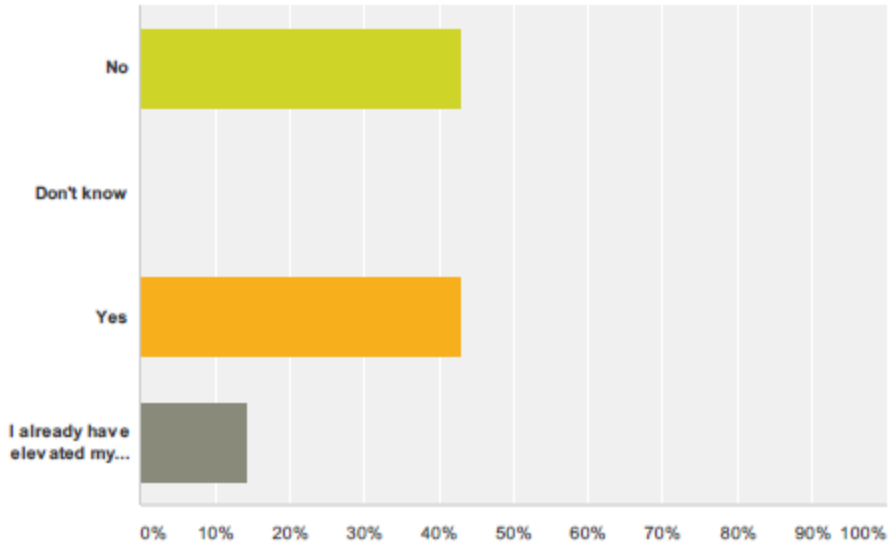


Answer Choices	Responses	
No	0.00%	0
Yes	100.00%	6
Total		6

#	Comments	Date
1	I wish people would who live in those areas	3/11/2014 5:15 PM

Q21 If you live/were to live in a flood hazard area, would you be willing to elevate your house to prevent flood damage?

Answered: 7 Skipped: 12

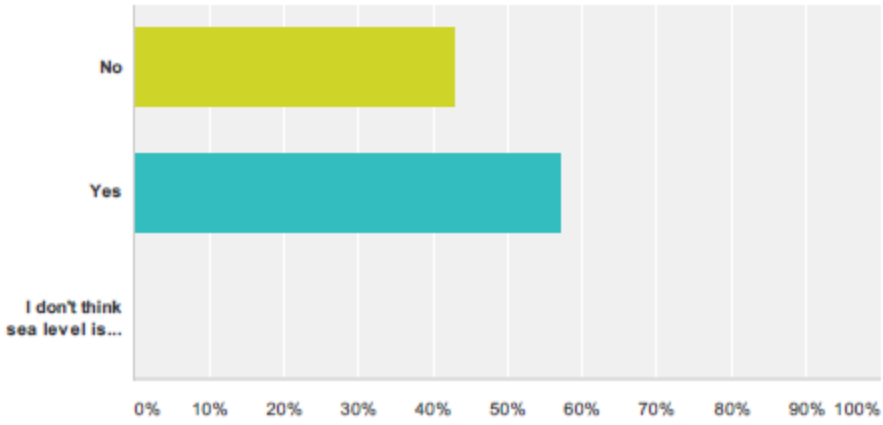


Answer Choices	Responses	
No	42.86%	3
Don't know	0.00%	0
Yes	42.86%	3
I already have elevated my house	14.29%	1
Total		7

#	Comments	Date
	There are no responses.	

Q22 Are you concerned about sea level rise?

Answered: 7 Skipped: 12



Answer Choices	Responses	
No	42.86%	3
Yes	57.14%	4
I don't think sea level is rising	0.00%	0
Total		7

#	Comments	Date
1	Concerned that I would not be able to leave my street. I would be safe in my house on the hill though.	3/21/2014 12:05 PM
2	as it affects the cost of repairing shorefront property	3/12/2014 4:09 PM
3	But we are up high enough. I definitely think it is rising.	3/11/2014 5:15 PM

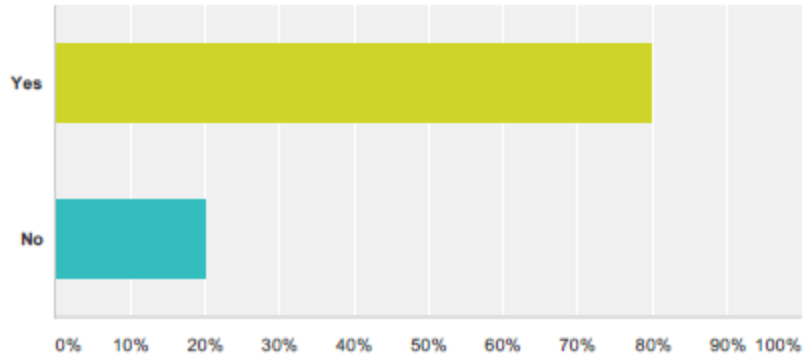
Q23 Please add any suggestions you may have about how individuals and the Town can reduce or eliminate damages from future natural hazard events.

Answered: 11 Skipped: 8

#	Responses	Date
1	Go around to the beach communities and discuss what type of shelter/help is available to them if a crisis arises and urge them to leave when necessary. Keep key businesses open by generators. Provide assistance to the elderly who may be stranded in their houses without food and medicine. Develop hotline to Town Hall to help accommodate the needs of these people.	3/21/2014 12:09 PM
2	Education and information. For example the new flood maps were not shared proactively with the town.	3/17/2014 4:24 PM
3	Many people in town have generators and might be willing to 'host' people during storm related power outages (or at least keep frozen food in their refrigerator.) It might be worth asking about a voluntary list for anyone willing to help during these times.	3/13/2014 10:37 AM
4	Require elevation of structures that experience two flood events within 10 years.	3/12/2014 12:51 PM
5	The only sensible and long-term mitigation is to get people and their property off the beaches and other highly vulnerable flood and damage prone areas. Also, we must end subsidized flood insurance for properties that are vulnerable to repeated damage from storms which just encourages people to build and live in hazardous areas. These areas should be put off limits for future building and dedicated common lands for the benefit of all citizens could be created.	3/12/2014 9:02 AM
6	I believe Old Lyme should adopt a no rebuild policy for property on the water that is damaged/destroyed by "Acts of God" like hurricanes or floods. This could open the shoreline to public. Promote responsible land use.	3/11/2014 7:59 PM
7	continue to work on potential downed trees on lines . Dredge small water inlets to avoid flooding	3/11/2014 5:45 PM
8	Focus on professional management of our public beaches	3/2/2014 11:47 AM
9	Look for funding opportunities for education and mitigation	3/1/2014 7:21 AM
10	"Eliminating damages" is like signing a blank check and giving it to the state and to insurance companies; there will never be enough money or enough preparation to take the place of common sense. The big flood of 1982 reminded people about building too close to normally benign streams. The recent hurricane showed that beaches can be risky. The 1938 hurricane showed that far worse things can happen...and yet the town survived quite well, overall. I am suspicious about centralized planning for catastrophic events. I am less suspicious of phased-in, slow adaptations to mitigate losses at perennial trouble spots.	2/28/2014 8:27 PM
11	just checking the length here The primary purpose of a Natural Hazard Mitigation Plan is to identify natural hazards and risks, existing capabilities, and activities that can be undertaken by a community to prevent loss of life and reduce property damages associated with identified hazards. The Disaster Mitigation Act of 2000 requires local communities to have a Federal Emergency Management Agency (FEMA)- approved mitigation plan in order to be eligible to receive Pre-Disaster Mitigation Program grants and Post-Disaster Hazard Mitigation Grant Program funds under the Hazard Mitigation Assistance program. This Plan was prepared by the Lower Connecticut River Valley Council of Governments (RiverCOG) in conjunction with the Town of Old Lyme. It is an update of a NHMP first developed by the Connecticut River Estuary Regional Planning Agency (CRERPA) in 2006.	2/26/2014 3:57 PM

Q24 Do you want to review all proposed mitigation action items?

Answered: 15 Skipped: 4



Answer Choices	Responses	
Yes	80.00%	12
No	20.00%	3
Total		15

	Strongly support	Support	Neither support or oppose	Oppose	Strongly oppose	Total
Caches. Consider creating stores of emergency supplies in areas of town that will be cut off during major flooding events.	18.18% 2	27.27% 3	18.18% 2	36.36% 4	0.00% 0	11
Construction Standards. Ensure that flood proof construction standards for roads and structures within the flood plain are strictly enforced.	63.64% 7	18.18% 2	9.09% 1	0.00% 0	9.09% 1	11
Critical Facilities. Upgrade as necessary all facility mechanicals, such as generators, in municipal and other critical facilities.	45.45% 5	54.55% 6	0.00% 0	0.00% 0	0.00% 0	11
Data for Plans. Use GIS database to develop better mitigation plans.	50.00% 5	40.00% 4	10.00% 1	0.00% 0	0.00% 0	10
Drinking Water Cache. Install drinking water tanks with a supply of bleach for private well water purification. (Batteries?)	18.18% 2	36.36% 4	27.27% 3	18.18% 2	0.00% 0	11
Dry Hydrants. Continue to require dry hydrants or fire ponds in new developments where water supply is inadequate.	54.55% 6	27.27% 3	9.09% 1	9.09% 1	0.00% 0	11
Electronic Records Preservation. Design databases for records keeping. Create a back-up of existing electronic records, including geographic information system (GIS) data.	40.00% 4	50.00% 5	10.00% 1	0.00% 0	0.00% 0	10
Engineering Reports. Implement strategic enforcement actions to include engineering reports for structural expansion or alterations on properties within the 1% annual chance flood zone.	30.00% 3	20.00% 2	50.00% 5	0.00% 0	0.00% 0	10
Firefighting Infrastructure Analysis. Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.	40.00% 4	50.00% 5	10.00% 1	0.00% 0	0.00% 0	10
Geographic Information System. Annually review and update as necessary existing town GIS data.	50.00% 5	30.00% 3	20.00% 2	0.00% 0	0.00% 0	10

GIS Database. Establish a comprehensive GIS database to better identify and assess areas, structures and populations potentially affected by natural disasters. These data will provide the town with information necessary to assess natural hazard risks and develop plans to mitigate risks to people and property.	**40.00%** 4	**50.00%** 5	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Municipal Buildings Capable of being Shelters. Future investment in municipal structures should include funding for new construction or renovation that will assure the structure is compliant with the standards for use as a shelter, to the extent possible.	**40.00%** 4	**30.00%** 3	**20.00%** 2	**10.00%** 1	**0.00%** 0	10
Oblique Imagery. Over the next five (5) years obtain oblique imagery in order to allow for assessment of such factors as extent of fire damage, compliance with building standards, identification of shoreline hardening and shoreline erosion and accretion.	**20.00%** 2	**20.00%** 2	**50.00%** 5	**0.00%** 0	**10.00%** 1	10
Off-street parking. Construct public parking lots to deter on-street parking that hinders emergency access and evacuation in high-density neighborhoods or high-intensity areas.	**10.00%** 1	**20.00%** 2	**30.00%** 3	**30.00%** 3	**10.00%** 1	10
Paper Records Preservation. Convert all paper records maintained by the municipality to an electronic format, consistent with any State recommendations, to ensure their survival. Establish protocols for practices going-forward.	**40.00%** 4	**50.00%** 5	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Pool. Construct a public pool to enhance ability to swim of both emergency responders and residents.	**10.00%** 1	**20.00%** 2	**10.00%** 1	**30.00%** 3	**30.00%** 3	10
Promote Self Inspection. Develop a list of techniques for homeowner self-inspection especially for those located in coastal areas.	**50.00%** 5	**50.00%** 5	**0.00%** 0	**0.00%** 0	**0.00%** 0	10
Public Works Garage & Transfer Station Generator. Purchase and install a generator for back-up power.	**30.00%** 3	**10.00%** 1	**50.00%** 5	**10.00%** 1	**0.00%** 0	10
Risk Reduction. Develop a strategy and funding program to elevate or relocate structures of flood-prone properties or acquire RL properties that request a "buy-out".	**40.00%** 4	**10.00%** 1	**10.00%** 1	**20.00%** 2	**20.00%** 2	10
RL and SRL Properties. Encourage property owners of repetitive loss and several repetitive loss properties to obtain assistance for hazard mitigation funding from DEEP/FEMA for elevation of structures and repairs where applicable.	**40.00%** 4	**30.00%** 3	**10.00%** 1	**10.00%** 1	**10.00%** 1	10
Road Evaluation. Evaluate to develop plans, and improve for emergency access and evacuation.	**40.00%** 4	**40.00%** 4	**20.00%** 2	**0.00%** 0	**0.00%** 0	10
Road Reconstruction. Develop a priority list for road reconstruction and elevation for routes which experience frequent flooding or are integral to evacuation. See Map 7 for some of these locations.	**30.00%** 3	**50.00%** 5	**10.00%** 1	**10.00%** 1	**0.00%** 0	10
Safer Location of Town Buildings. Future municipal structures should be located outside of known hazardous locations such as floodplains, to the extent possible.	**30.00%** 3	**50.00%** 5	**10.00%** 1	**10.00%** 1	**0.00%** 0	10
Schools. Visit schools and educate children about the risks of floods, hurricanes, and other natural hazards and how to prepare for them.	**50.00%** 5	**50.00%** 5	**0.00%** 0	**0.00%** 0	**0.00%** 0	10
Storm water Infrastructure Inventory. Implement mapping and monitoring of catch basins, storm water outfalls and related infrastructure.	**30.00%** 3	**60.00%** 6	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Storm water Infrastructure Maintenance. Provide for annual maintenance of storm water infrastructure, including detention basins.	**30.00%** 3	**60.00%** 6	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Structural Reports. Continue to require structural engineering reports for expansion or alteration of buildings within the V zone. Evaluate benefits of requiring structural engineering reports for expansion or alteration of buildings within other zones.	**30.00%** 3	**40.00%** 4	**30.00%** 3	**0.00%** 0	**0.00%** 0	10

Telecommunication Tower Generators (Private). Evaluate whether generators are needed for back-up power at telecommunications facilities.	30.00% 3	40.00% 4	30.00% 3	0.00% 0	0.00% 0	10
Underground Utilities. Require underground utilities for new development; require retrofitting during redevelopment of existing sites to bury utilities where appropriate to mitigate NHs.	60.00% 6	40.00% 4	0.00% 0	0.00% 0	0.00% 0	10
Upgrade Fire Fighting Infrastructure. Upgrade existing fire ponds to ensure adequate water supply is available. Construct new fire ponds, fire wells and dry hydrants where water is not currently available.	40.00% 4	30.00% 3	30.00% 3	0.00% 0	0.00% 0	10
Wind Code Compliance. Consider establishing a policy that all building permit applicants be encouraged to construct their projects to meet 110 mile per hour wind resistance standard, whenever possible.	20.00% 2	20.00% 2	40.00% 4	0.00% 0	20.00% 2	10
Assist Property Owners with Buyouts. Develop strategy and program for flood prone property owners who request a buyout.	40.00% 4	10.00% 1	0.00% 0	40.00% 4	10.00% 1	10
Below Base Flood Elevation Funding. Encourage property owners whose homes are below BFE to obtain assistance from DEEP and FEMA to acquire hazard mitigation funds to elevate structures where appropriate.	30.00% 3	40.00% 4	10.00% 1	20.00% 2	0.00% 0	10
Boats. Identify places where people could store their boats during flooding and hurricane events that would reduce the damage to them and that they cause to the waterfront infrastructure when they break from moorings. Contact boat marinas to ascertain how many boats might need to be removed from docks and moorings.	10.00% 1	70.00% 7	10.00% 1	10.00% 1	0.00% 0	10
Dam Inventory. Update inventory of dams and assess downstream risks due to catastrophic failure. Include State, Town, and Privately owned dams.	30.00% 3	50.00% 5	20.00% 2	0.00% 0	0.00% 0	10
Dune Restoration. Implement dune restoration and marshland protection techniques for flood storage and surge protection.	60.00% 6	40.00% 4	0.00% 0	0.00% 0	0.00% 0	10
Drought Study. Conduct town-wide study of ground- and surface water capacity as it relates to planning for droughts.	10.00% 1	50.00% 5	30.00% 3	10.00% 1	0.00% 0	10
FIRMs. Work with Federal Emergency Management Agency (FEMA) to incorporate updated Flood Insurance Rate Maps (FIRMs) into town's planning, outreach and mitigation actions.	30.00% 3	40.00% 4	20.00% 2	0.00% 0	10.00% 1	10
Flood Enforcement. Enforce through existing zoning, building and flood permitting processes, construction standards to minimize flood risks.	40.00% 4	40.00% 4	10.00% 1	0.00% 0	10.00% 1	10
Land Acquisition. Advance an assertive land acquisition plan to reserve vacant land subject to NHs.	50.00% 5	30.00% 3	10.00% 1	10.00% 1	0.00% 0	10
Park Maintainer. Fund a dedicated Park Maintainer to act as steward of public open spaces, including parks, forests, drainage basins, conservation easements, coastal access points, and forests, and to mitigate NHs at Town-owned properties.	40.00% 4	20.00% 2	20.00% 2	20.00% 2	0.00% 0	10
Risk Assessment. Use GIS to conduct NH risk assessments that identify potentially affected areas and depicts evacuation routes.	20.00% 2	50.00% 5	20.00% 2	0.00% 0	10.00% 1	10
Storm water Management. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basis as advised by a professional engineer.	40.00% 4	50.00% 5	10.00% 1	0.00% 0	0.00% 0	10
Street Tree Program. Implement a tree hazard management program to encourage appropriate planting practices to minimize future storm damage to buildings, utilities and streets.	30.00% 3	70.00% 7	0.00% 0	0.00% 0	0.00% 0	10
Assist Beach Associations. Review mitigations goals and objectives with beach associations at the beginning of each season. Encourage the association's help to educate homeowners.	20.00% 2	50.00% 5	20.00% 2	0.00% 0	10.00% 1	10
Circulate Existing Literature. Access existing literature prepared by regional groups and the chamber of commerce and FEMA and display for public distribution in the Town Hall and Library.	20.00% 2	60.00% 6	20.00% 2	0.00% 0	0.00% 0	10

Drought Education. Coordinate with Connecticut Water Company on public education and public service announcements during droughts.	**20.00%** 2	**40.00%** 4	**40.00%** 4	**0.00%** 0	**0.00%** 0	10
Educate About Risk Where People Live. Educate residents at high risk due to demographic or social attributes about the risk(s) relative to the areas that they populate.	**30.00%** 3	**40.00%** 4	**30.00%** 3	**0.00%** 0	**0.00%** 0	10
Hotline. Publicize emergency "hotline" phone number or website for public information and volunteer support.	**30.00%** 3	**50.00%** 5	**20.00%** 2	**0.00%** 0	**0.00%** 0	10
Incident Notification System. Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.	**20.00%** 2	**70.00%** 7	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Interpretation in Shelters. Request information regarding the need for providing non-English language speakers during natural disasters from the Old Lyme School administration; and coordinate a shared service for non-emergency and emergency operations.	**10.00%** 1	**30.00%** 3	**40.00%** 4	**20.00%** 2	**0.00%** 0	10
Natural Hazard Training. Continue to train and educate emergency responders about mitigating NHs.	**30.00%** 3	**60.00%** 6	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Outreach. Promote owner participation in mitigation efforts to protect their property.	**30.00%** 3	**60.00%** 6	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Pet Sheltering. Distribute hurricane preparedness information including pet sheltering plans.	**40.00%** 4	**40.00%** 4	**20.00%** 2	**0.00%** 0	**0.00%** 0	10
Preparedness Webpage. Keep up-to-date Town website with NH preparedness information, including hazard areas, evacuation routes deemed appropriate per NH event and locations of shelters.	**20.00%** 2	**70.00%** 7	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Proactive Pamphlets. Provide pamphlets and refer to web-based information for property owners for hazards listed in this document to show options for obtaining additional insurance, structural alterations to protect against various hazard damage, and emergency procedures for families during a hazard. Include information for contractors and homeowners on the risks of building in hazard prone areas.	**10.00%** 1	**40.00%** 4	**50.00%** 5	**0.00%** 0	**0.00%** 0	10
Recovery Webpage. Post on Town website information about recovery assistance following NH events.	**30.00%** 3	**60.00%** 6	**10.00%** 1	**0.00%** 0	**0.00%** 0	10
Refuges of Last Resort. Identify refuges of last resort for those unable to reach designated shelter.	**40.00%** 4	**50.00%** 5	**0.00%** 0	**10.00%** 1	**0.00%** 0	10
Social –Demographic Impacts. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Old Lyme will be affected by natural hazards.	**20.00%** 2	**0.00%** 0	**60.00%** 6	**20.00%** 2	**0.00%** 0	10
Tennant Notification. Develop a mechanism for tenants to register for disaster notification.	**20.00%** 2	**50.00%** 5	**30.00%** 3	**0.00%** 0	**0.00%** 0	10
Webpage. Update town webpage with the section on Hazard Preparedness for the public. Include maps of evacuation route, storm surge areas, and shelters. Include options for mitigation for residential structures and business recovery and provide links to FEMA, NOAA, State OEM and RiverCOG websites for additional information.	**40.00%** 4	**60.00%** 6	**0.00%** 0	**0.00%** 0	**0.00%** 0	10
Information. Publish materials on additional hazards and encourage additional insurance.	**22.22%** 2	**33.33%** 3	**22.22%** 2	**22.22%** 2	**0.00%** 0	9
Neighborhood Mitigation. Engage neighborhood associations annually to participate in implementing the NH Mitigation Plan.	**20.00%** 2	**60.00%** 6	**20.00%** 2	**0.00%** 0	**0.00%** 0	10
Public Participation. Enlist public participation through public workshops to develop methods for notification of emergencies.	**30.00%** 3	**40.00%** 4	**30.00%** 3	**0.00%** 0	**0.00%** 0	10
Wildfire Education. Educate the public about potential hazard of wildfire caused by campfires or open burning. Develop a warning system for when risks are high.	**30.00%** 3	**30.00%** 3	**20.00%** 2	**20.00%** 2	**0.00%** 0	10

Amend Flood Ordinance. Consider adding a "freeboard" – an additional height above the flood level – to add a greater margin of safety. In the case of nonresidential structures, the insurance rates do not go down until a structure is flood proofed at least one (1) foot above the BFE.	**33.33%** 3	**33.33%** 3	**11.11%** 1	**22.22%** 2	**0.00%** 0	9
Benefit-Cost Analysis. Evaluate opportunities for public funding of mitigation projects on private property where public benefits exceed the cost for RL properties or for properties otherwise eligible for buy-out.	**11.11%** 1	**66.67%** 6	**0.00%** 0	**11.11%** 1	**11.11%** 1	9
Best Management Practices. Continue to use best management practices (BMPs) as described in the Connecticut DEEP Storm water Management Guidelines on a site-by-site basic as advised by a professional engineer.	**25.00%** 2	**62.50%** 5	**12.50%** 1	**0.00%** 0	**0.00%** 0	8
Business Recovery Plan. Develop business recovery plan cooperatively with other region towns and distribute to town businesses.	**0.00%** 0	**55.56%** 5	**44.44%** 4	**0.00%** 0	**0.00%** 0	9
Capital Improvement Program. Use Capital Improvement Program (CIP) to set aside funds for infrastructure improvements to reduce loss of life and property during natural hazard (NH) events.	**22.22%** 2	**44.44%** 4	**22.22%** 2	**0.00%** 0	**11.11%** 1	9
Conservation Planning. Educate the public about how the Town uses planning, regulation, and ordinances to mitigate NHs via LID, aquifer recharge, riparian buffer, rain gardens, open burning ordinances, house numbering, etc.	**33.33%** 3	**44.44%** 4	**11.11%** 1	**11.11%** 1	**0.00%** 0	9
Cooperative Agreements for Shelters. Develop supporting documentation and encourage the Board of Selectmen to establish agreements for shelters that can provide specialized services, throughout the region. Shelters with the capacity to provide for companion pets and medical equipment needs for individuals with disabilities are two examples of such specializations. Support changes in the laws that require every town to provide facilities capable of serving the most severe of handicapped individuals such that towns could pool their resources to better serve these individuals and their families by giving them the option to go to a regional shelter better equipped to handle theirs, and their family's needs.	**12.50%** 1	**62.50%** 5	**12.50%** 1	**0.00%** 0	**12.50%** 1	8
Design Standards. Continue to implement State Building/Fire Code and local Flood Code for construction that minimizes loss of life and property damage due to NHs. Develop guidelines for HDC and ARB to retrofit existing structures in a manner that is respectful to significant or contributing structures and to overall neighborhood preservation.	**22.22%** 2	**44.44%** 4	**33.33%** 3	**0.00%** 0	**0.00%** 0	9
[Immobile] Evacuees. Review annually the program to evacuate persons without means of transport, including registration and house numbering.	**33.33%** 3	**66.67%** 6	**0.00%** 0	**0.00%** 0	**0.00%** 0	9
Flood Zone Study. Update flood zone study for the town to incorporate changed conditions upland and within the floodplain, and an expected sea level rise over the next twenty years.	**50.00%** 4	**37.50%** 3	**0.00%** 0	**12.50%** 1	**0.00%** 0	8
Forest Management Plan. Hire a consulting forester to establish a forest management plan to enable ability of firefighters to access forest fires during periods of drought.	**33.33%** 3	**11.11%** 1	**44.44%** 4	**11.11%** 1	**0.00%** 0	9
Grants. Identify and apply for grants to fund infrastructure improvements and other mitigation tasks identified in this plan.	**33.33%** 3	**44.44%** 4	**22.22%** 2	**0.00%** 0	**0.00%** 0	9
Land Use Regulation. Maintain, and strengthen as appropriate, subdivision and zoning regulations to make safer new roads and lots within flood zones.	**33.33%** 3	**44.44%** 4	**11.11%** 1	**0.00%** 0	**11.11%** 1	9
Landlord/ Land Owner Incentives. Research what kind of incentives would motivate land owners to make the additional investment that would reduce potential damages to their properties and loss of life of their tenants.	**11.11%** 1	**44.44%** 4	**11.11%** 1	**22.22%** 2	**11.11%** 1	9

Local Sea Level Rise Study Committee. BOS should establish an ad-hoc committee to research medium and long-range impacts to coastal areas from SLR, to investigate possible mitigation actions and to assess legal, financial and policy implications.	**44.44%** 4	**33.33%** 3	**0.00%** 0	**22.22%** 2	**0.00%** 0	9
Local Social Resources. Identify local resources to assist with those populations (i.e. elderly, disabled, non-English speakers, who may frequent, reside, or work) in Old Lyme. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Old Lyme will be affected by natural hazards.	**22.22%** 2	**66.67%** 6	**0.00%** 0	**11.11%** 1	**0.00%** 0	9
No net runoff from development. Require all new development to be built using techniques to eliminate run-off.	**44.44%** 4	**33.33%** 3	**11.11%** 1	**11.11%** 1	**0.00%** 0	9
Owner Participation. Promote owner participation in mitigation efforts to protect their own properties.	**44.44%** 4	**33.33%** 3	**22.22%** 2	**0.00%** 0	**0.00%** 0	9
Possible Open Space Criteria. The Conservation Commission should consider making possible inundation by future sea level rises to its considerations for preserving open space .	**44.44%** 4	**44.44%** 4	**11.11%** 1	**0.00%** 0	**0.00%** 0	9
Post Disaster School Arrangements. Work with Regional School District 18 to establish reciprocal arrangements with other school districts for getting students back into classes during extended recovery periods.	**33.33%** 3	**33.33%** 3	**22.22%** 2	**11.11%** 1	**0.00%** 0	9
Potential Financial Impact of Recent Storm. Provide a reference point; ask the Tax Assessor if he can provide a figure for the lost property value resulting from Tropical Storm Irene and the potential lost tax revenue if the structures are not restored before the next taxing period.	**33.33%** 3	**22.22%** 2	**33.33%** 3	**11.11%** 1	**0.00%** 0	9
Potential Financial Impact of Probable Events. Estimate the municipal tax revenue that could potentially be lost in various events to provide the Board of Selectmen and Board of Finance with an idea of how large a "rainy day" fund might be necessary to cover that post disaster period when there would be minimal income and maximum output of public funds at all levels of government.	**33.33%** 3	**33.33%** 3	**22.22%** 2	**11.11%** 1	**0.00%** 0	9
Private Property Funds. Evaluate opportunities for public funding for projects on private property where the benefits exceed the costs.	**22.22%** 2	**11.11%** 1	**33.33%** 3	**22.22%** 2	**11.11%** 1	9
Public Transit Funding. Support regional transportation system (RTD) to facilitate movement of people without means of transportation prior to NH events.	**33.33%** 3	**44.44%** 4	**22.22%** 2	**0.00%** 0	**0.00%** 0	9
Recovery & Reconstruction Plan. Develop a post-disaster recovery and reconstruction plan to re-establish infrastructure and public services, etc. damaged or destroyed by any NH event, including establishment of a "rainy day" fund in case Federal assistance is insufficient or delayed.	**33.33%** 3	**22.22%** 2	**44.44%** 4	**0.00%** 0	**0.00%** 0	9
Sea Level Rise Study. Work with The Nature Conservancy (TNC), DEEP, educational institutions, and state federal agencies to study impacts of sea level rise on (SLR) coastal flooding in Old Lyme.	**44.44%** 4	**22.22%** 2	**11.11%** 1	**11.11%** 1	**11.11%** 1	9
Regulations. Strengthen existing subdivision regulations to either optimally prevent road or house construction within the floodplain, or alternatively raise structures above BFE.	**44.44%** 4	**22.22%** 2	**22.22%** 2	**11.11%** 1	**0.00%** 0	9
Zoning Map Audit. The Town should conduct a comprehensive audit of the zoning map to considering what changes might be advisable so that the free market investing is not misguided back towards areas that are at high risk from natural disasters.	**44.44%** 4	**44.44%** 4	**11.11%** 1	**0.00%** 0	**0.00%** 0	9

Appendix IX – Resolution to Adopt

A RESOLUTION TO ADOPT THE

TOWN OF OLD LYME NATURAL HAZARD MITIGATION PLAN UPDATE, 2014

WHEREAS, the Disaster Mitigation Act of 2000 encourages communities to prepare a Natural Hazard Mitigation Plan to outline natural hazard vulnerabilities and potential mitigation measures; and

WHEREAS, the primary goal of the Natural Hazard Mitigation Plan Update, 2014 is to reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters; and

WHEREAS, in light of continuing natural disasters that severely impacted public infrastructure and private properties in the Town of Old Lyme, the Town developed a Natural Hazard Mitigation Plan Update, 2014 to document local conditions, risks and plan accordingly; and

WHEREAS, in an effort to solicit input and recommendations from the public and to review the plan, as required by law, public committee meetings were held between November 14, 2013 and March 7, 2014; a public information meeting was held on March 8, 2014; an article was published in newspapers and online media sources; and a survey was distributed; and

WHEREAS, the Natural Hazard Mitigation Plan Update, 2014 recommends many hazard mitigation actions that will protect the people and property affected by the natural hazards that potentially face the town; and

WHEREAS, some of the recommended mitigation actions may qualify for Federal funding, but only if the Town of Old Lyme officially adopts the Natural Hazard Mitigation Plan Update, 2014; and

WHEREAS, the Town of Old Lyme shall implement, maintain, and update the Hazard Mitigation Plan Update, 2014 through the appropriate municipal departments and commissions;

BE IT RESOLVED by the Board of Selectmen of the Town of Old Lyme that the Natural Hazard Mitigation Plan is hereby adopted as an official plan of the Town of Old Lyme, and that the appropriate municipal departments will report annually on their activities, accomplishments, and progress relative to the Natural Hazard Mitigation Plan Update, 2014 for the Town of Old Lyme.

BE IT FURTHER RESOLVED that the Town of Old Lyme is authorized to apply for and accept any future Federal or State grant assistance to accomplish the goals of the Natural Hazard Mitigation Plan Update, 2014.

Adopted this 18 day of Aug. 2014 by the Board of Selectmen of Old Lyme, Connecticut

Bonnie A. Reemsnyder, First Selectwoman | Mary Jo Nosal, Selectwoman | Arthur E. Sibley, Jr., Selectman

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Old Lyme this 20th day of August, 2014.

(Eileen Coffee, Town Clerk)