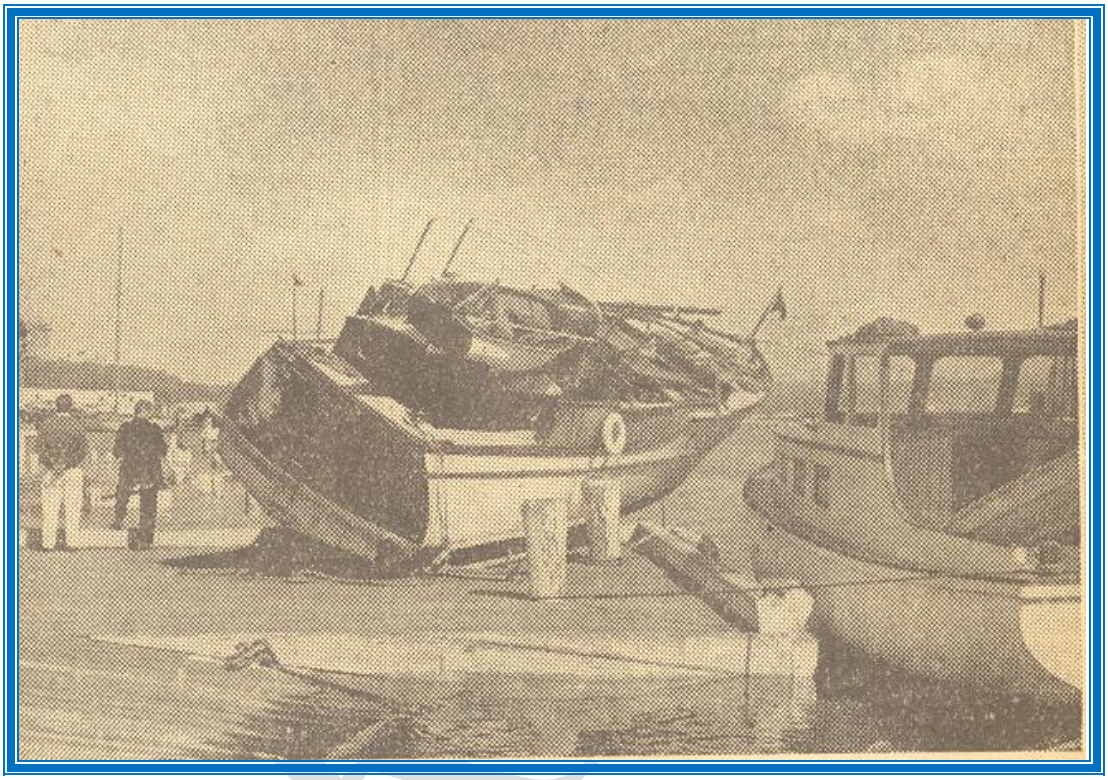
Essex, Connecticut
Natural Hazards Mitigation Plan



Prepared for
Essex Planning Commission

To be adopted by
Town of Essex, Connecticut
_____, 2013

Prepared by
Lower Connecticut River Valley Council of Governments
145 Dennison Road
Essex, CT 06426
www.rivercog.org

On the Cover:

Photo1: **Damage to Essex Boatyard from 1938 Hurricane**
Source: New London Day

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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). *Both the State of Connecticut Department of Energy & Environmental Protection (DEEP) and the State of Connecticut Department of Emergency Services and Public Protection (DESPP)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).*

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). The Essex Planning Commission, along with town officials and RiverCOG staff reviewed and edited the draft plan.

B. Purpose & Benefits

Natural 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). Natural 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 Essex 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 every five years 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 town 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 and when the Federal/State agencies award funds for hazard mitigation actions.

The goal of this 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 form the natural hazards.*

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.

- Town officials and commission members have a better understand of 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 Snowstorm Alfred in September and October of 2011, respectively and Hurricane Sandy in October 2012.

The Connecticut Department of Energy & Environmental Protection (DEEP) awarded a Hazard Mitigation Assistance (HMA) grant to RiverCOG to assist member towns 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; and Daniel Bourret, GIS Specialist provided technical assistance with generating HAZUS reports.

The Town of Essex provided significant in-kind contributions from its Land Use Department staff including Joe Budrow, Zoning / Wetlands Enforcement Officer and John Guszkowski, Essex Planning Consultant.

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

The Essex Planning Commission, which is responsible for the town's NHMP, designated members of the commission and town officials to work with RiverCOG to complete this plan update. RiverCOG, with assistance from this Technical Advisory Committee (TAC) reviewed the former plan for implementation status. The TAC included: John Guszkowski, Essex Planning Consultant; Keith Nolin, Building Official; Steve Olsen, Fire Chief, William Buckridge, Emergency Management Director; and David Caroline, Public Works Director, and Planning Commission member Carla Feroni.

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

The Essex Planning Commission, through its Land Use staff and representatives at the Lower CT River Valley Council of Governments solicited input from local officials about ongoing implementation and maintenance of the Plan, information about recent experiences, adequacy of recommended infrastructure improvements, and need for additional and ongoing in-house expertise.

This Plan update is significantly different in format from the original 2006 version. The new format was developed using the new FEMA standards for Hazard Mitigation Planning. This Plan update includes a more

thorough analysis of natural hazards, including sea level rise, high wind and tornadoes, drought and wildfires, earthquakes and hurricanes. The new format of this plan update addresses all requirements of FEMA for hazard mitigation and offers a way for incorporation into other planning documents such as the town Plan of Conservation and Development (POCD). For each hazard type, this format addresses past events, vulnerability of the town, likelihood of a future event, and mitigation specific to that hazard risk.

The purpose of a hazard mitigation plan is for communities to identify the natural hazards that impact 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)). Notwithstanding 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."

All maps displayed within this plan are to be used for planning purposes only.

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

All meetings and discussions of the Natural Hazards Mitigation Plan update preparation were open to the public with notice to the Town Clerk where required, as well as the Town's website.

Once completed by the TAC, the draft plan was posted on the Town website for review on X/X/X. Additional copies were also made available in the Town Hall and the Essex Library. An online survey was created and made available on "Survey Monkey." A notice about the survey was sent out to various groups in town, on facebook, and on the town website. It was also referred to officials in neighboring communities. The survey was available from X/X/XX to X/X/XX, paper copies were made available at Town Hall. Results of the survey can be found in **Appendix IX.** In addition, the draft Plan was referred to other towns in the regional planning area with the notice of the online survey. After receiving and incorporating public comments through the survey and the Planning Commission meetings, the Planning Commission submitted the completed Plan to DEEP and FEMA for review and to the Board of Selectmen and a Town Meeting for final adoption.

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

RiverCOG staff along with the Town's consulting Planner began the Plan update process by reviewing the 2006 Plan to become familiarized with its implementation status. Additionally, RiverCOG staff 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, RiverCOG incorporated Elements of the original 2006 "Natural Hazard Mitigation Plan, Town of Essex, Individual Town Mitigation," into the 2012 Plan. Information from the towns Zoning Regulations, Subdivision Regulations, and Plan of Conservation and Development were also used. 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 at a regular meeting and set an effective date. See Appendix V for resolution.

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

The Plan prescribes specific actions and assigns priorities, responsibilities, and resources for each. The Plan uses four broad categories of actions:

1) ***Local Plans and Regulations*** include: changes to plans and regulations across a variety of town departments and commissions for the purpose of strengthening future documents ;
2) ***Structure and Infrastructure Projects*** include: rights-of-way, land, housing, or utilities for public purposes, and road specifications;
3) ***Natural Systems Protection*** include: flood zone regulations, fire prevention, and acquisition of hazard prone land;
4) ***Educations and Awareness Programs*** include: information to residents students in schools, and systems to alert residents of impending hazard events.

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 implement 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 FEMA 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 FEMA 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 FEMA 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 FEMA 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 natural hazard mitigation planning and the implementation of 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 using prioritization methods updated annually without reference to state allocations, quotas and quotas. This grant is administered by both the Connecticut Department of Energy and Environmental Protection (DEEP).

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 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 following 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 Hurricane

Sandy and resulting power outage), 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 years projects. The annual meeting should be during the second quarter of each fiscal .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.

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 below for a more detailed schedule.

It is RiverCOG's responsibility to obtain the necessary funding to produce the Plan update and form the Planning Committee. All other update functions will be carried out by the full Planning Committee after its formation.

Update and Maintenance Schedule	FY 2014 - 2015				FY 2015 - 2016				FY 2016 - 2017				FY 2017 - 2018				FY 2018 - 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				X			
Report on Action Items Status to Town	X				X				X				X				X			
Action Progress Meeting - Public		X				X				X				X				X		
Budget Action Items Based on Review			X				X				X				X				X	
Plan Update Committee Formation (RiverCOG)													X							
Determine Funding Source for Plan Update (RiverCOG)											X									
Apply for Funding to Complete Plan Update (RiverCOG)												X								
Begin Full Plan Review in Anticipation of Update												X								
Public Meetings, Drafts, Re-Writes													X	X	X	X				
Complete Final Draft to be Submitted																	X			
Completion of 5 Year Plan Update (Submission to DEEP and FEMA and Adoption by Town)																		X		
FEMA Approval and Adoption by Town																			X	X

Figure 1: **Plan Update and Maintenance Schedule**

Quarters are based on Town Fiscal Years, which begin July 1 and end June 30.

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 Essex, including flooding, wind and tornado, drought and wildfire, winter storm, earthquake, hurricane. 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 Essex's topography, location on the Connecticut River and land use patterns, specific areas of the town are most vulnerable to flooding, hurricane, flooding and high winds.

1. **Geography & Land Use Patterns**

The total area in Essex is 12.2 square miles of which 10.70 square miles is land area. Geographically, Essex is the smallest town within the RiverCOG region. It is bordered to the north by Deep River and to the south by Westbrook and Old Saybrook (see Map 1). Approximately 1.5 square miles within the town's boundaries are occupied by the Connecticut River and its coves, leaving less than 11.0 square miles of land area. Historically, development has focused on three village centers: Essex Village, Centerbrook, and Ivoryton. The most intensively developed area is east of Route 9, surrounding Essex Village. In recent years, residential subdivisions have been developed west of Route 9, and new commercial and industrial development has located in the Centerbrook area.

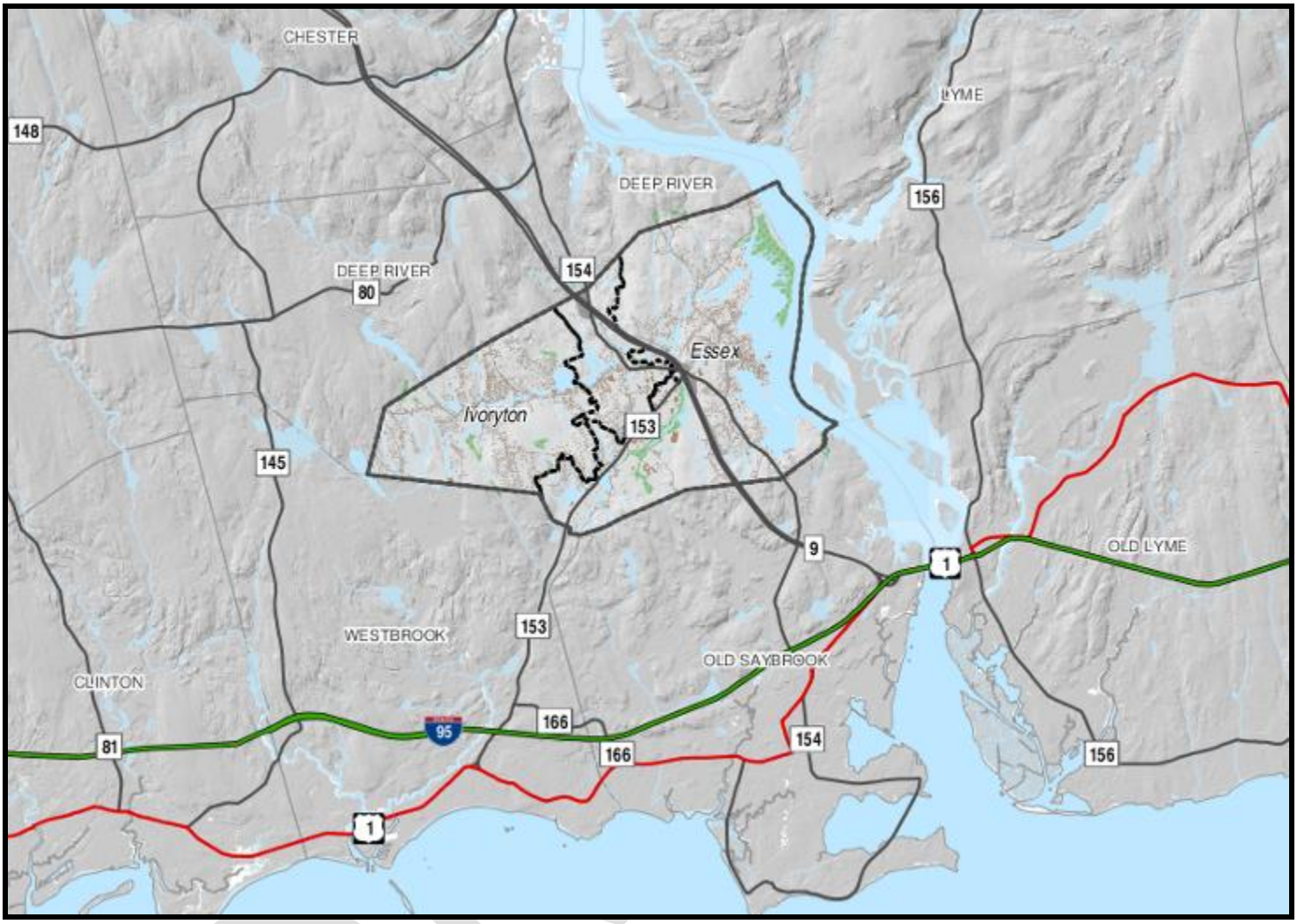
Less than half of the land area in Essex is committed to a specific use. About 8% of the land area in Essex is committed open space. Residential use occupies about 28% of the land area. Commercial uses, development along Plains Road and Westbrook Road, occupy about 1.6% of the land area. Industrial uses are located mostly in the Centerbrook area west of Exit 3 off Route 9, and occupy about 2.2% of the land area of Essex. Institutional uses occupy about 2.2% of the land area. Transportation uses include Route 9, and the Valley Railroad property occupying about 6.4% of land area.

Essex is located at the junction of Route 153, Route 154 and Route 9 which are major highways within the region, and the town receives high traffic over local roads as well as these state roads. For this reason, there is pressure for development along these routes, some of which are intersected by major streams and wetland areas. Careful monitoring of septic systems and existing soil conditions have been a factor in controlling development in these areas.

The town geology is typified by lowland tidal areas along the Connecticut River and rolling hills with ledge outcrops in the western areas of the town. Elevations range from near sea level at the Connecticut River to approximately 310 feet along the northern boundary of the town. The predominant soil type along the Falls River is outwash sand and gravel deposited by glacial streams within the study area. Small areas of artificial fill consisting of sand and gravel are present in the vicinity of Ivoryton, the Valley Railroad, and State Route 9. Areas of glacial till, a non-sorted, non-stratified deposit of debris ranging from clay size particles to large boulders, are situated on the north-central shore of Mill Pond and at the eastern end of the study area. Also present from the east end of Mill Pond to the eastern extremity of State Route 9 is an area of alluvium. The alluvium consists of a water deposited mixture of sand, silt, and gravel. The stream also passes through a small area of exposed bedrock in the eastern portion of Mill Pond.

The soil layers for the town are unique from other adjacent towns. The northern hills of Essex are dominated by Charlton/ Chatfield complex. The central area of the town is characterized by a mixing bowl of Paxton and Montauk complex, Agawam Fine Sandy Loam, Canton Hollis Complex, Ninigret and Tisbury Soils, Merrimac-Urban Complex, Adrian and Palm Soils, Windsor Loamy Sand and Carlisle Muck. This area appears to be the primary drainage basin for the Falls River.

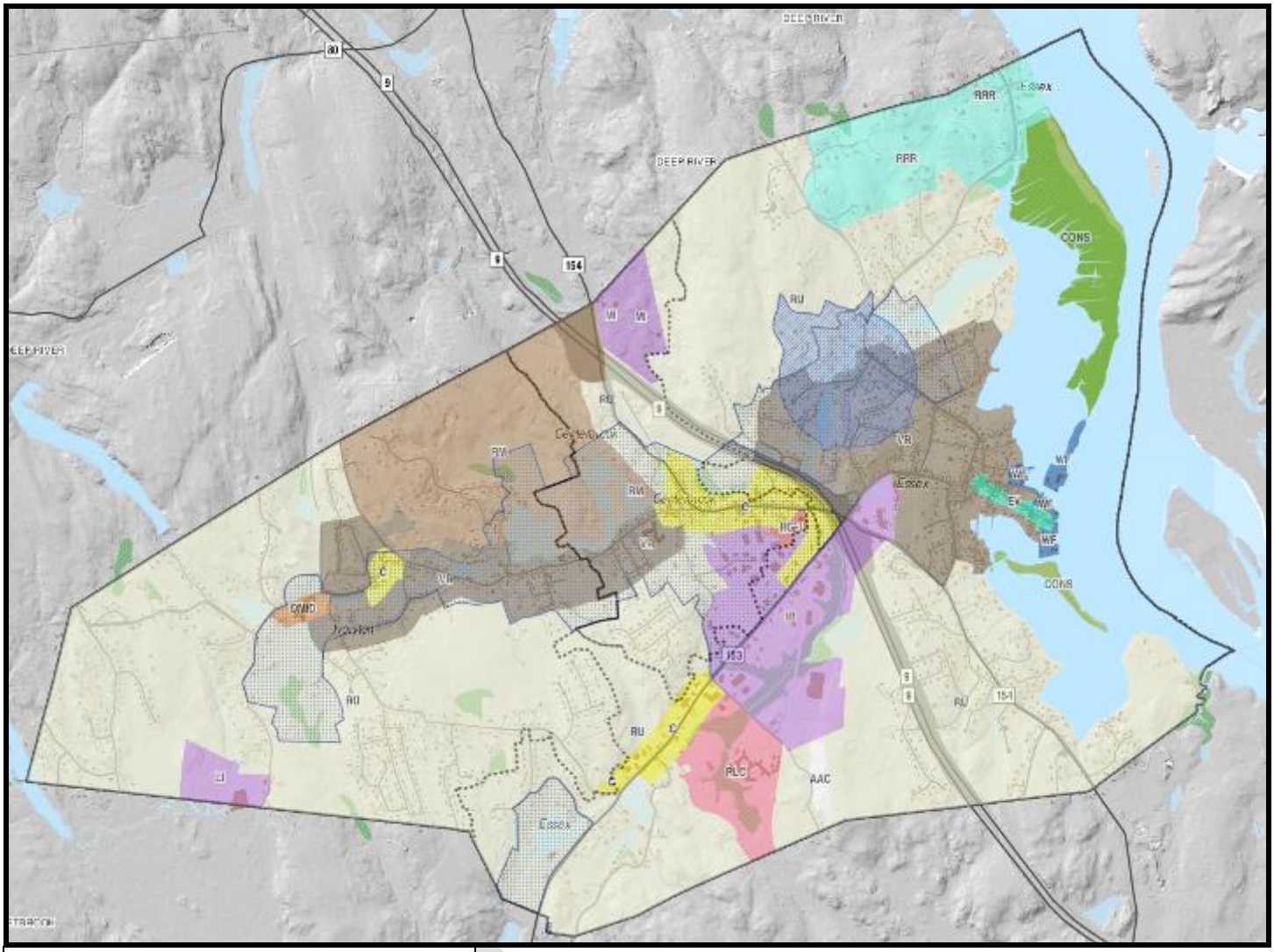
Photo 2: **Essex Village Center,** Main Street.
Source: Panoramio.com/fall02



Map 1: **Essex** and surrounding towns.

This map depicts Essex among surrounding towns. The map also shows Essex's relationship to the Connecticut River as well as major roads.

Source: Essex GIS (4/2013)



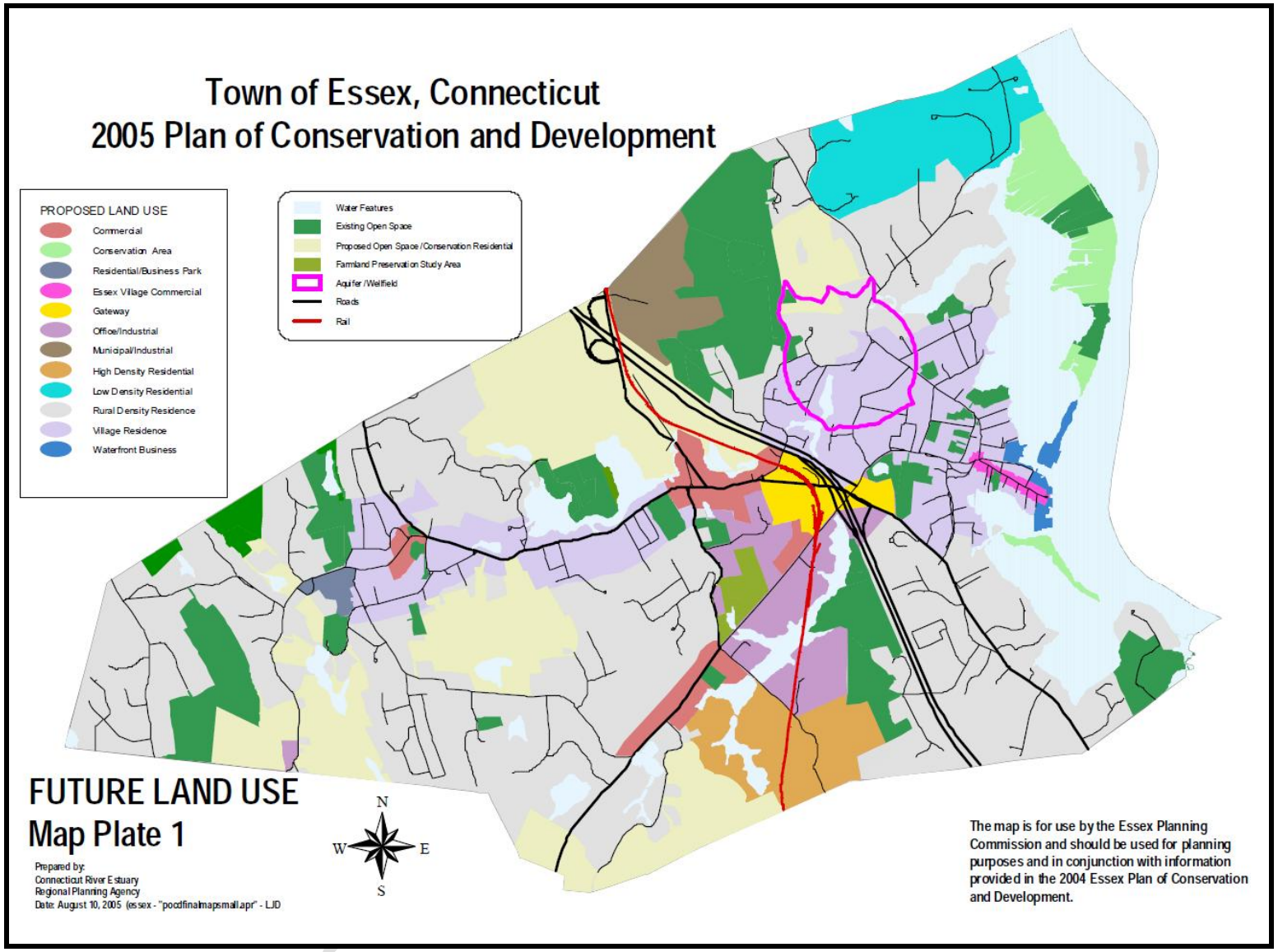
Zoning Legend

- Commercial District
- Conservation District
- Design Municipal Industrial District
- Essex Village District
- Heritage Gateway
- Limited Industrial District
- Municipal & Industrial Service Zone
- Residential Life Care District
- River Road Residential
- Rural Residential
- Rural Residential-Multi Family
- Village Residence District
- Waterfront Business District
- Active Adult

Map 2: **Zoning Districts**

This map depicts the relationships among Essex's Zoning Districts.

Source: Essex GIS (4/2013)



Map 3: **Future Land Use.** This map depicts the future land use throughout the town of Essex based on current Land Use and Zoning Regulations.

Source: Essex POCD, 2005

2. Demographics & Critical Facilities

The 2010 Census reported a town population of 6,683 people which represents a 2.74% increase from 2000. This compares to the previous decade when the population grew by 10.18%. Stagnation of population growth allows the Town to focus on factors in natural hazard mitigations effect on population, such as its distribution and make-up.

22.1% of Essex's 2010 population was over age 65 which is more than the statewide average of 14%. The block-level data indicates that 34% of the 65 and over population lives in the southern part of town, an area which is heavily forested and can be susceptible to power outages caused by downed trees and wires. Many of these people live at Essex Meadows, a retirement community for ages 55 and over. Age-related dispositions and disabilities are a specific factor for the Town to take into account in mitigating against natural hazards.

According to the 2000 census, **18.2% of the total population has disabilities**. Unfortunately, at this time, more current information is not available. The distribution by age of these disabilities is:

disability	**age 5-15**	**age 16-64**	**age 65+**	
sensory		24	90	
physical		79	245	
mental	12	69	50	
self-care	6	42	87	
go outside house		72	160	
limited employment		278		
totals	18	564	639	**1214 persons**

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

The U.S. Census Bureau defines disabilities as the following:

- **Sensory Disability** Conditions that include blindness, deafness, or a severe vision or hearing impairment.
- **Physical Disability** Conditions that substantially limit one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying.
- **Mental Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty learning, remembering or concentrating.
- **Self-care Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty dressing, bathing, or getting around inside the home.

- **Go-outside-home Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty going outside the home alone to shop or visit a doctor's office.
- **Employment Disability** Because of a physical, mental, or emotional condition lasting 6 months or more, the person has difficulty working at a job or business.

292 persons, or 4.6% of Essex's 2010 population, were characterized as non-English speaking. Indo-European languages are spoken by 3.5% of the population while just 1% of the population speaks Spanish or Spanish Creole languages. 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.

The 2010 U.S. Census reported a total of 3,261 residential structures. Of the residential structures, 2,317 are "owner-occupied" leaving 599 renter occupied structures that may or may not have tenants during all or portions of the year. The census indicated a total of 345 unoccupied structures, of which 151 were seasonal structures. 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.

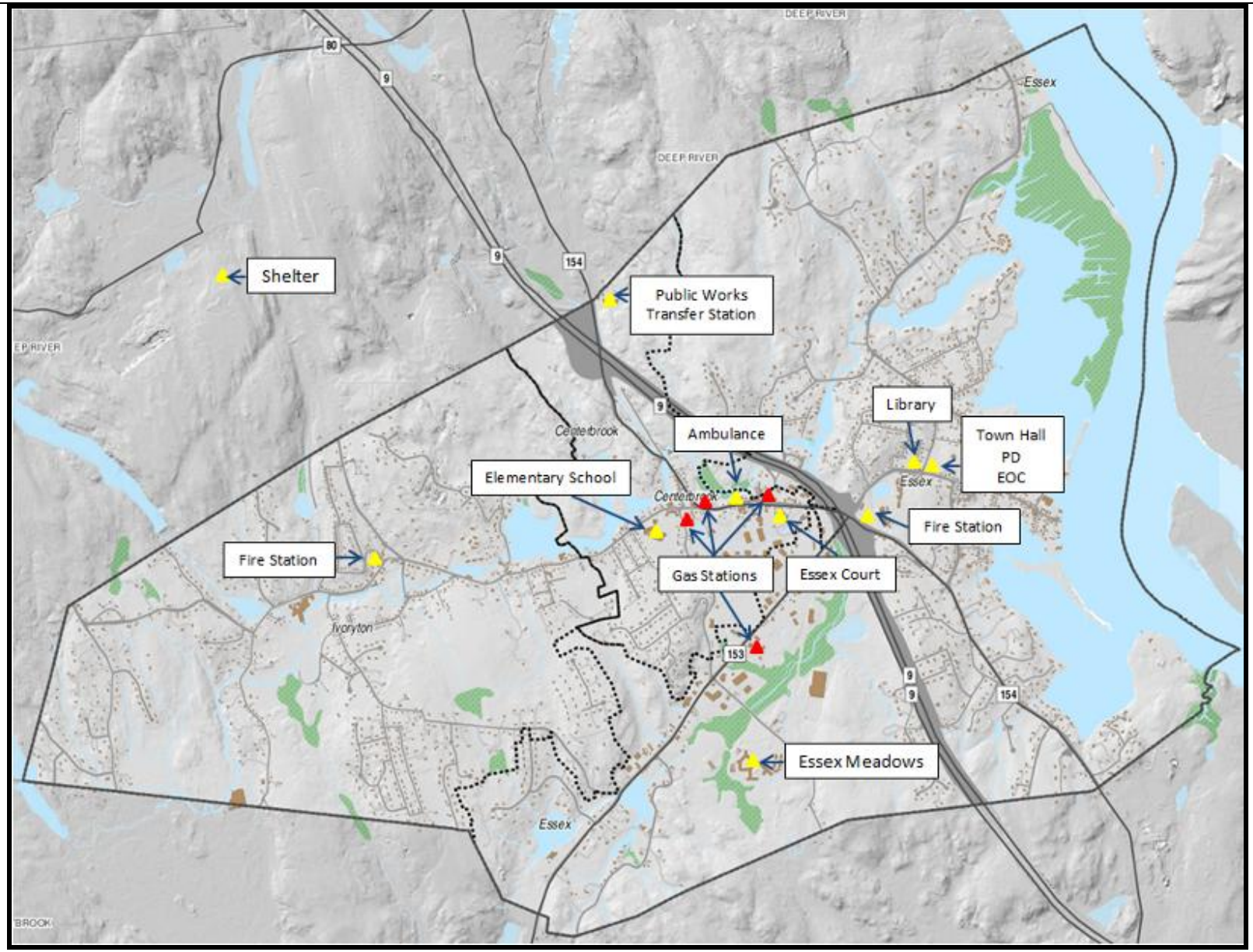
In Essex, structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic or water-reactive materials may exist primarily in the Light Industrial District along Route 153, Industrial Park Road and Westbrook Road. These areas are mostly outside of the 100-year floodplain.

There are no hospitals in Essex at present; however, two retirement communities do exist. Essex Meadows is a large over 55 residential community in the southern end of town located off Bokum Road. In addition, Essex Village at South Cove is located just off Route 154 in the Centerbrook section, near Route 9. This is both a retirement community and an assisted living facility. Essex is also currently home to Middlesex Hospital's Shoreline Clinic, a stand-alone emergency room. A replacement facility is set to open in Westbrook sometime in 2014, moving this facility out of town. These facilities are likely to contain occupants that may not have sufficient mobility to evacuate during a major hazard event and may require additional emergency services. Although these facilities are required to have their own emergency plans, a large scale disaster may be more than the facilities can manage on their own.

The Town's police station and Emergency Operations Center are both located at the Essex Town Hall, 29 West Avenue out of flood hazard

areas. There are two Fire Stations in Essex one is located just south of the Route 154/153/9 intersection, the other is located at 12 Summit Street in the Ivoryton Village. The Essex Ambulance Association provides ambulance services to Essex and is located at the intersection of Route 154 and Dennison Road, in the Centerbrook section of town. The Essex Public Works facility and equipment storage is located on Dump Road, near Route 154 and Exit 4 off from Route 9. All of these facilities are outside of flood hazard areas. Essex uses many of its public buildings for minor natural hazard events, such as cooling centers during heat waves. The Town's principal shelter is the John Winthrop Middle School, located at 1 John Winthrop Rd, Deep River off of Route 80 west of Route 9 Exit 5, which is outside special flood hazard areas. John Winthrop Middle School is part of Regional School District 18, serving Chester, Deep River and Essex. This facility is the emergency shelter for those towns as well. The shelter does not accommodate pets but is capable of providing food, a place to sleep and shower as well as charging of personal electronic devices.

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. Gas stations in Essex are located along Route 154 and Route 153. After Tropical Storm Irene in 2011 and Hurricane Sandy in 2012, residents were forced to travel outside of town if they were in need of gasoline for cars and generators. Gas stations in Essex are not equipped with back-up 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.



Map 4: **Critical Facilities** throughout Essex
Source: RiverCOG

3. Economics & Cultural Resources

The primary business and industry sectors in Essex are as follows:

	% of total	
2005 sector	**establishments**	**employment**
services	43.7%	37.6%
trade	22.8%	25.2%
const. and mining	10.6%	9.9%
finance, ins. & real estate	7.2%	5.7%
manufacturing	7.5%	13.4%
government	2.7%	1.8%
transportation & utilities	3.3%	4.8%
agriculture	2.2%	1.7%
	100%	**100%**

Figure 3: **Economic Sectors in Essex**
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 Hurricane Sandy in October 2012, the economic core of Essex is vulnerable to loss of electricity and communication services due to downed utility lines. These storms resulted in many closed businesses and week-long school closings (and subsequent extension of the school year). 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 Essex. Fortunately, most of this use does not lie within a flood zone. Therefore, it is unlikely that a large flood would negatively impact tax revenue. Residential Properties most at risk lie along the Falls River, which flows easterly through town to the Connecticut River.

Designated open space is not a significant generator of tax revenue, but may serve as a buffer to absorb storm effects, thus protecting the value of nearby developed land. Essex has focused on preserving wetlands (See Map 6). Preserving open space in flood hazard areas protects against future development in these areas and therefor threat of damage.

Therefore, vacant land may have potential to similarly provide protection of developed properties if set aside as open space.

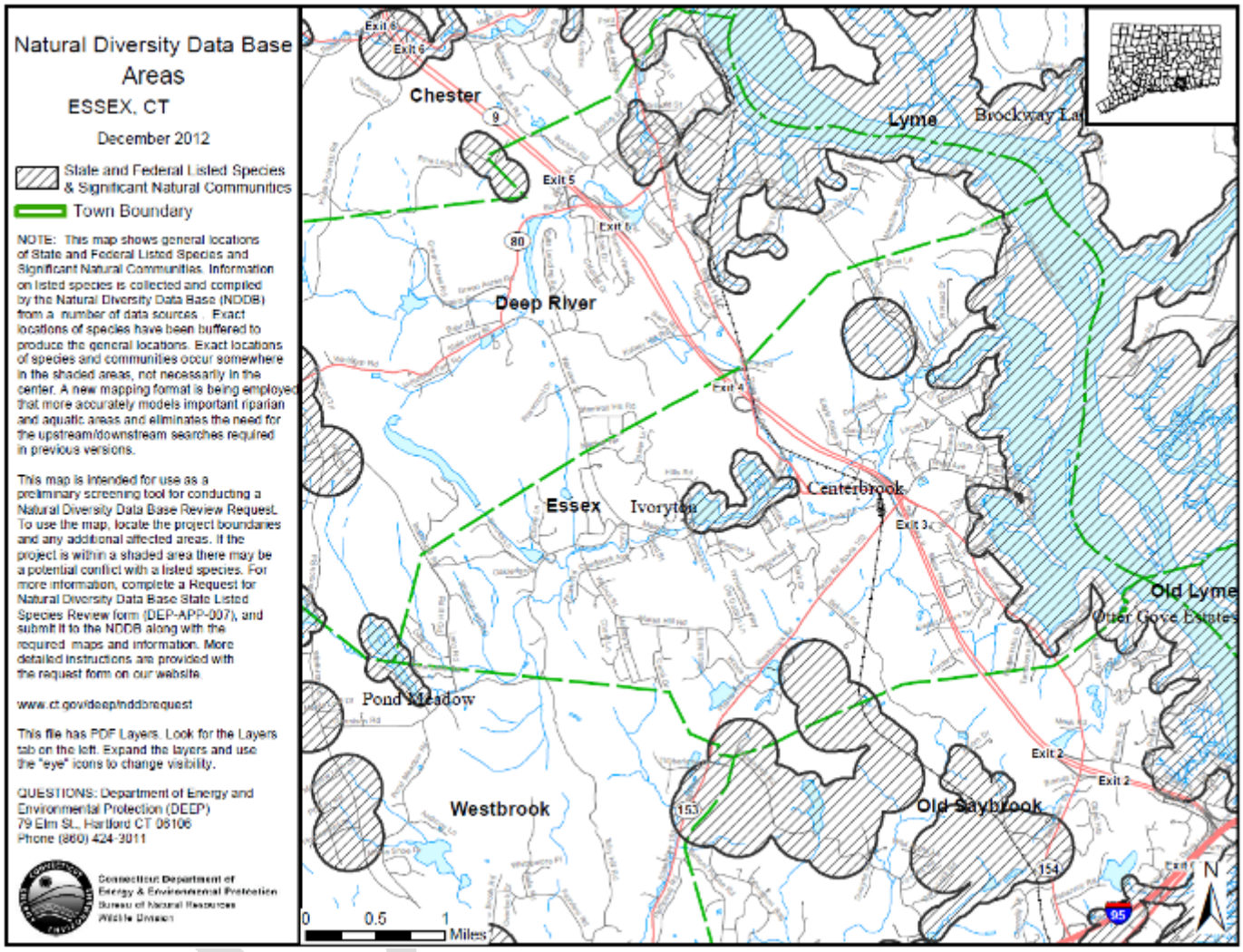
Essex is home to many of the major tourist destination within the RiverCOG Region. These destinations include the Essex Steam Train, the Ivoryton Playhouse, and the Connecticut River Museum. The Connecticut River Museum is susceptible to large storms, including hurricanes and has been damaged in the recent past as a result of storms. Long-term closures of any of these destinations as a result of a storm could result in loss of income and tax dollars for the town.

Photo 3: **Essex Village Center** is situated along the Connecticut River. This photo shows the relationship with the river (right) and Middle Cove (bottom left).

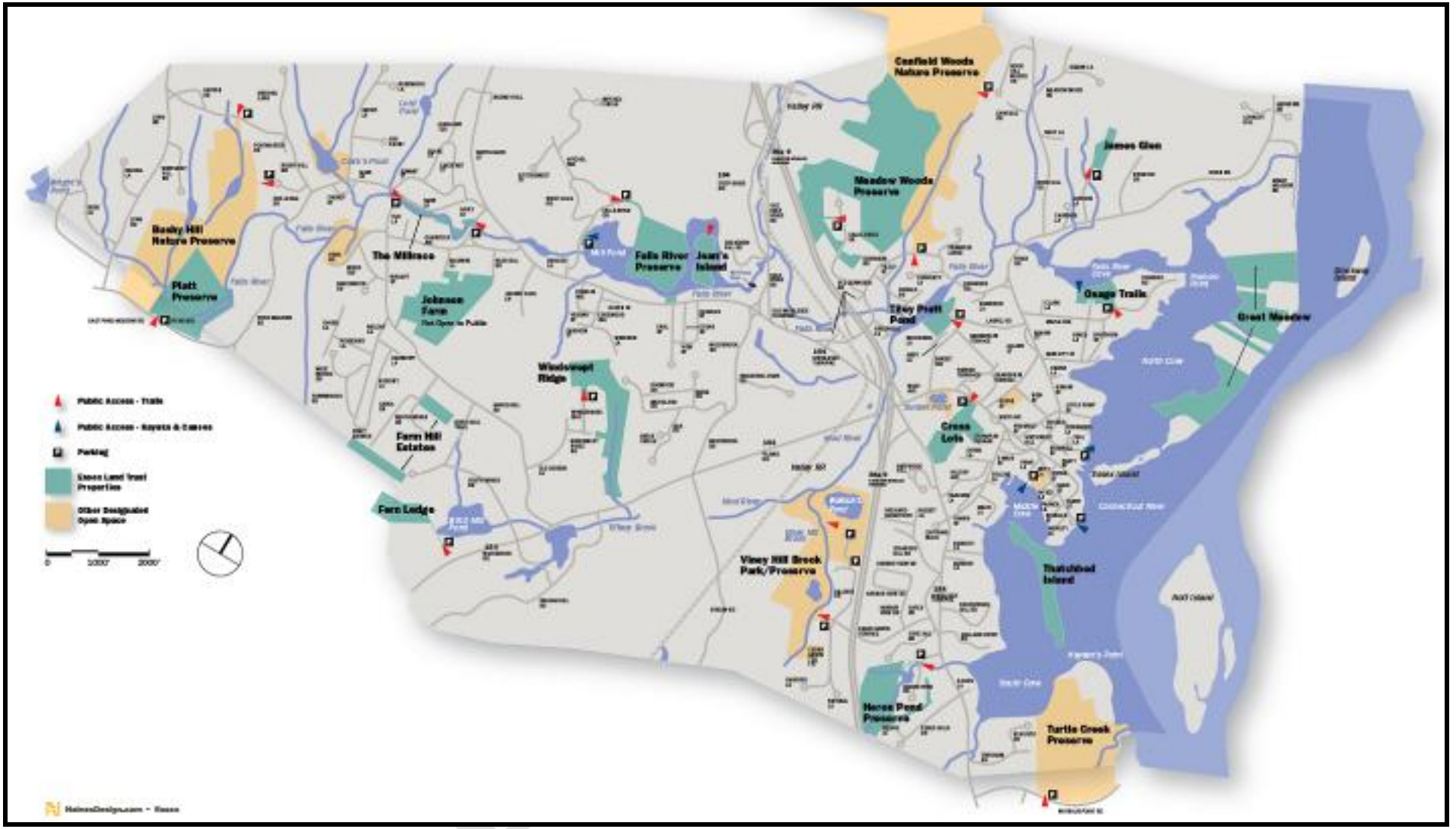
Source: Google Earth (3/2012)

4. Environment and Ecological Resources

Essex is endowed with many ecological and environmental assets. Inland wetlands, ponds, lakes, and large tracts of uninterrupted forest are just a few of the blessings of nature bestowed upon the town.



Map 5: **Natural Diversity** Area locations include State and Federally listed species and significant natural communities. Information on listed species is collected and compiled by the Natural Diversity Data Base (NDDB) from a number of data sources. Exact locations of species have been buffered to produce the general locations. Exact locations of species and communities occur somewhere in the shaded areas, not necessarily in the center.
Source: DEEP



Map 6: **Essex Open Space**
This map shows designated open space throughout Essex, both lands owned by the Essex Land Trust and lands owned by other entities designated as open space.
Source: Essex Land Trust (4/2013)

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

Essex 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*	*Extreme Heat*
Coastal Erosion (CE)	X	X	X					
Building Damage (BD)	X	X	X	X	X	X		
Downed trees & branches (DT)	X	X	X	X				
Flooding – Coastal (FC)	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	X
High Wind (HW)	X	X	X	X				
Hail (H)		X						
Ice (I)			X					
Lightning (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)	financial 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	0-1	1
Drought	3	0-1	1
Extreme Heat	2	0	3
Flood	2	2	3

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

Natural hazard events can affect different parts of Essex, 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.

Natural Hazards affecting the Lower Connecticut River Valley Region including Deep River		
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, FS,HW, PF, ID
September 1944	**Great Atlantic Hurricane** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
August 30, 1954	**Hurricane Carol** (Cat. 2)	CE, BD, DT, FC, FI, FS,HW, PF, ID
September 1960	**Hurricane Donna** (Cat. 1)	CE, BD, DT, FC, FI, FS,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, FS,HW, PF, ID
August 1991	**Hurricane Bob** (Cat. 1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
October 1991	**Hurricane Grace** "The Perfect Storm"	CE, BD, DT, FC, FI, FS,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, FS,HW, PF, ID
April 2007	nor'easter	HW, FC, 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	**Hurricane Sandy** (Cat.1)	CE, BD, DT, FC, FI, FS,HW, PF, ID
February 2013	**Blizzard**	S, HW, PF

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 Essex 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.

a. Geographic Extent (B.1)

Essex lies within the lower Connecticut River valley with about three and a half miles of linear shoreline, not including shoreline along the North, Middle and South Coves. The Falls River, Mud River and other smaller streams that drain to the Connecticut River also run through Essex creating the risk for inland flooding during major events. Flood hazard zones in town mostly follow the Falls and Mud Rivers.

Water power for industry and access to the water for maritime businesses was a significant influence on the development patterns within the Town of Essex. The Falls River was the source of hydro-power for many factories and mills in Essex, resulting in numerous dams along the river and extensive commercial and residential development in close proximity to the Falls River and the Connecticut River.

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

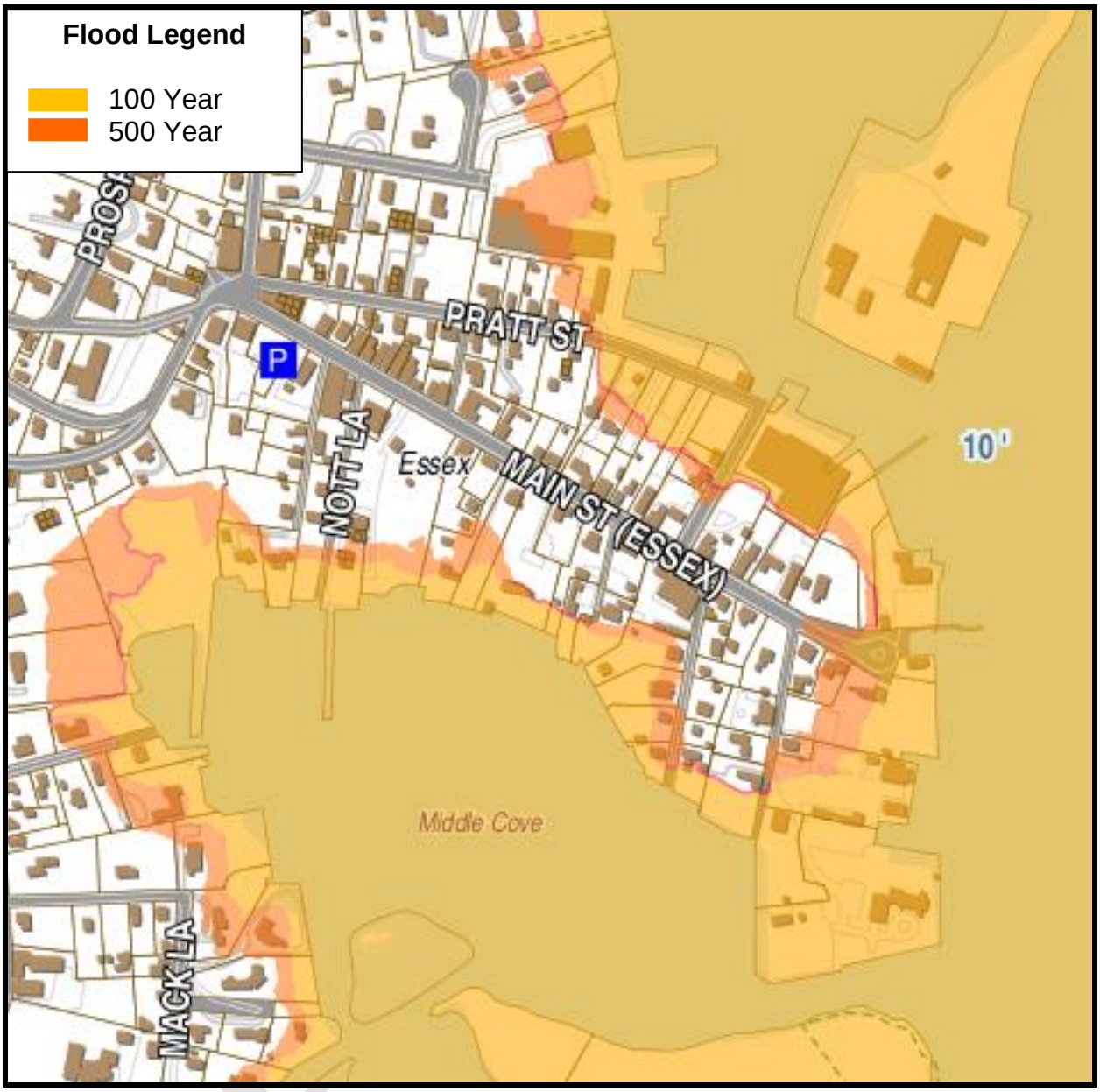
For a list of notable occurrences of this natural hazard, see Figure 6 – Natural Hazards affecting the Lower Connecticut River Valley region.

The most damaging flooding in Essex occurred in 1982 when heavy rainfall lead to the collapse of the Bushy Hill Reservoir Dam upstream in Deep River, leading to extensive flooding along the Falls River.

c. Probability of Occurring Again (B.2)

Floods are a *likely* hazard in Essex. Nuisance flooding which causes little to no damage is far more likely than widespread flooding capable of heavy damage. High-intensity localized storms can cause flooding along the river shoreline and of the relatively short inland watercourses. Particularly heavy snowfalls can also

cause localized flooding as snow begins to melt during the spring season.



Map 7: **Special Flood Hazard Area** surrounding Essex Village Center.

This map shows the flood zone that runs through Essex's economic center. Visible is the extent of the downtown property that lies within the flood zone. This map is based on the latest FIRM, adopted August 28, 2008.

Source: Essex GIS (4/2013)

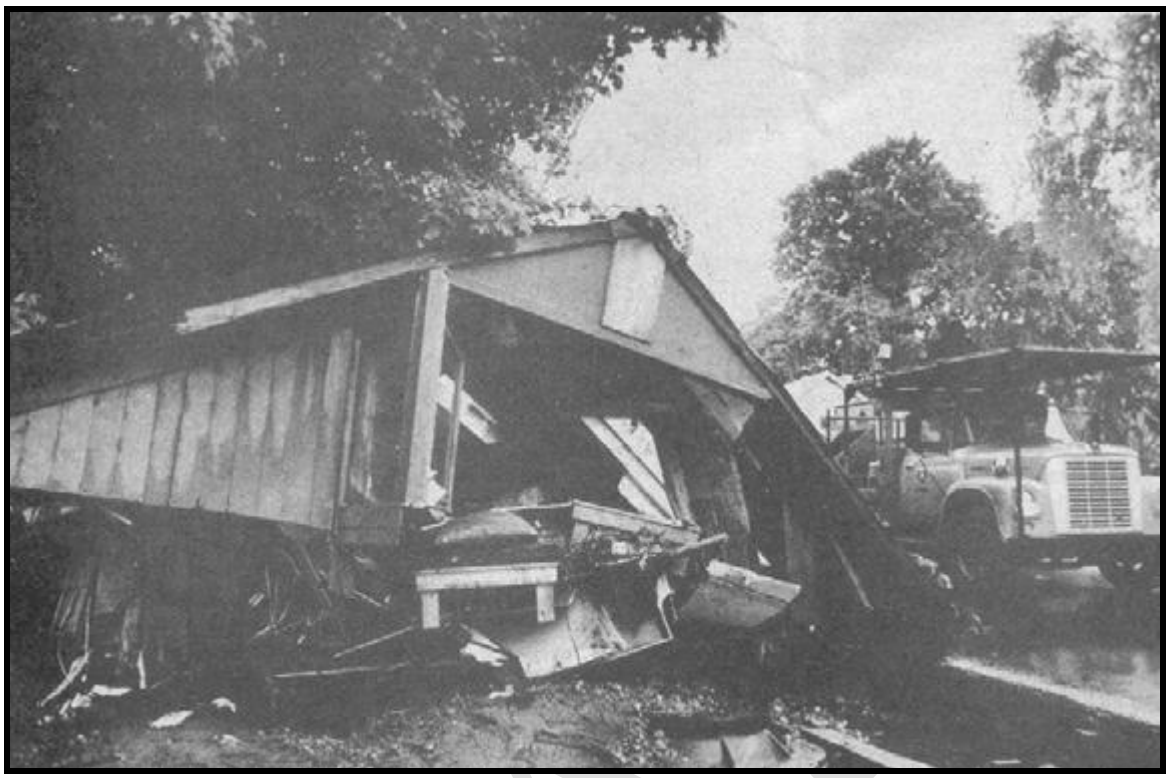


Photo 4: **Bridge Washout in Ivoryton** after the flood of 1982.
Source: Hartford Courant

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

The impacts from flooding can range from localized nuisance flooding to much more widespread flooding along the river shoreline.

Similar to nearby communities, the densest development lies in and around the three village centers, all located near ponds and streams. These locations were important for industry to grow when water was the main power source for any industrial practices. Dams were built upstream and rushing water provided the power needed to turn mills. Today, these downstream locations are where significant flooding can occur with large storms. As was seen in the 1982 flood, much of the area surrounding the Falls River is susceptible to stream flooding. Should a dam break, rushing water would be sent downstream toward the village centers.

Another significant repercussion of flooding events is the adverse impacts such events have on evacuation and emergency access. Flooding which affects roadways in Essex are caused primarily by three factors: (1) low-lying elevations prone to river or stream flooding, (2) undersized culverts creating restrictions to the flow of flood waters, and (3) reduction of the cross section of stream and

river channels by bridge abutment encroachment, thereby causing channel restriction in a manner similar to culverts.

Essex has experienced flooding resulting from all three causes. Repairs to damage from the 1982 flood have mitigated potential damage from future stream flood events. The remaining concerns for infrastructure include existing dams, especially privately owned, which require repair and maintenance, and roads which are still subject to stream or river flooding. This would include areas near North and South Coves and the Connecticut River. A review was conducted at the time of the 2006 NHMP by the town of areas located on Maps 8 and 11 to set priorities for repair and renovation. A new review should be conducted to update the status of each area.

Almost yearly, the town is subject to flood waters from the Connecticut River as the spring thaw and snow melt brings a significant amount of water from throughout New England to the lower Connecticut River.

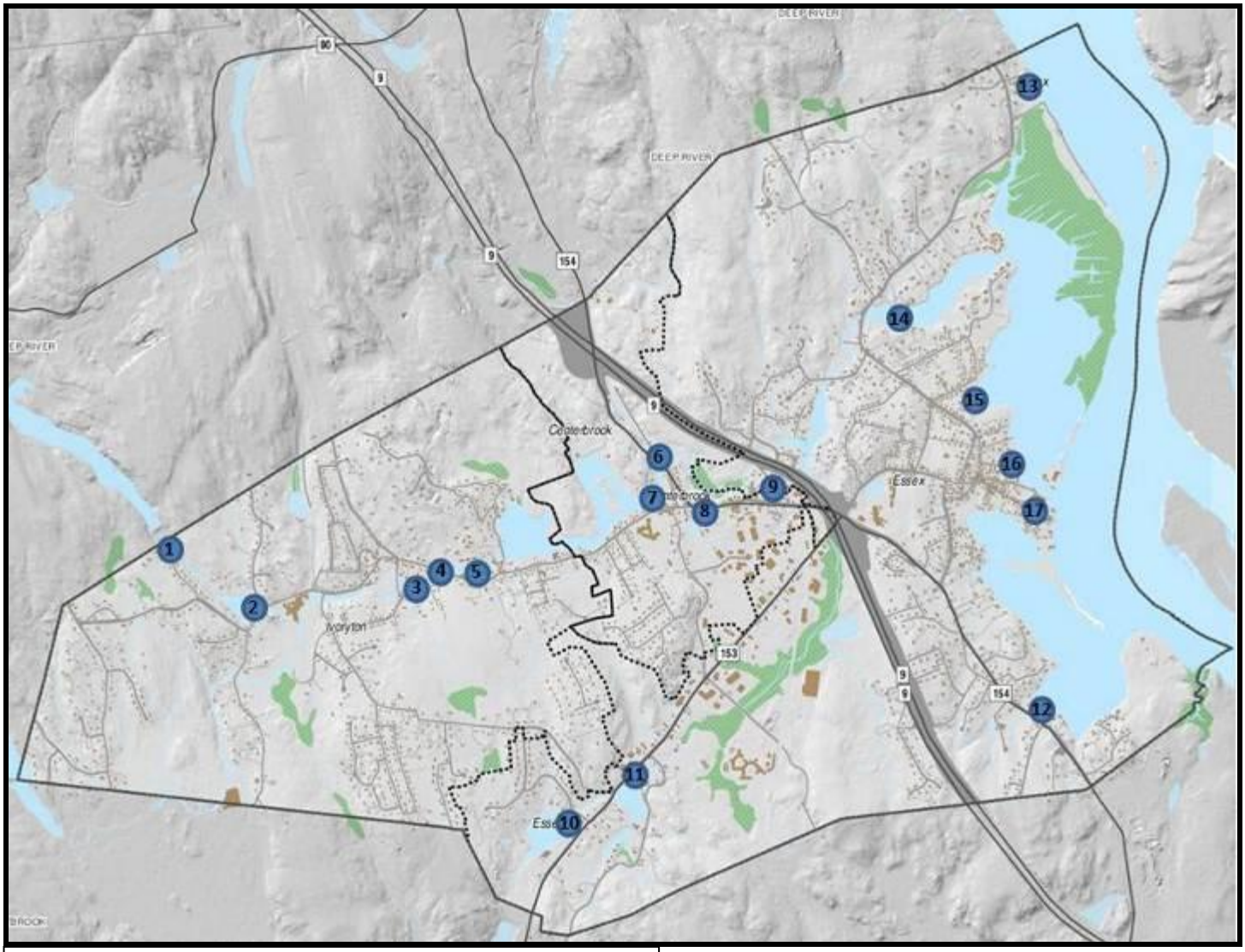
There are a number of roads that are subject to nuisance flooding as well as to more significant river flooding (See Map 8). These include portions of River Road, Pratt Street, Ferry Street during high tides with storm surge, and Ivory Street during heavy rains.

In some cases, flooding events are exacerbated by inadequate storm water management infrastructure. During times of high tides and annual spring flooding resulting from snow melt, storm water drainage can back up and cause flooding associated with this restriction point.

A HAZUS-MH Flood Event Report was generated using a 100 Year Flood Event scenario. This report generates loss estimates based on 2000 U.S. Census Data. Below is a chart detailing estimated building damage by the type of building thorughout Essex for such an event. For the full report, see Appendix III HAZUS – MH Flood Event Report.

Building	1-10		11-20		21-30		31-40		41-50		Substantially	
Type	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Manuf. Housing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	2	40.00	2	40.00	0	0.00	0	0.00	1	20.00	0	0.00
Steel	4	44.44	4	44.44	1	11.11	0	0.00	0	0.00	0	0.00
Wood	1	2.94	4	11.76	3	8.82	10	29.41	16	47.06	0	0.00

Figure 7: **Building Damage by Type** from 100 Year Flood Event
Source: HAZUS MH



Hazard Legend

1. Bushy Hill Dam – Private Owner in Deep River
2. Clarks' Pond Dam – Private Owner
3. Residential Area – Density w/in flood plain
4. Commercial Flooding – Density w/in flood plain
5. Ivoryton Pond Dam – Private Owner
6. Dam Maintenance
7. Mill Pond Dam – Private Owner
8. Centerbrook Commercial and Residential Flooding
9. Flooding Under Route 9
10. Dam Maintenance - Private
11. Dam Maintenance - Private
12. Residential Area – Storm Surge and River Flooding
13. Residential Area – Storm Surge and River Flooding
14. Residential Area – Storm Surge and River Flooding
15. Residential Area – Storm Surge and River Flooding
16. Marina District – Storm Surge and River Flooding
17. Village Commercial and Residential Flooding

Map 8: **Infrastructure Hazard Areas**

This map depicts areas that are prone to nuisance and storm flooding, as well as other hazards, throughout town. Areas are based on a review completed by the Town for the 2006 NHMP.

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

The Town of Essex 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. Essex is committed to continuing NFIP compliance and standards, as has been demonstrated through zoning regulations. The Flood Plain District was updated and changed to reflect the new FIRMs from 2008. The Town will continue to update and change regulations any time FEMA updates the FIRMs.

Within the Essex Zoning and Subdivision Regulations and the Building Code, there are standards and criteria designed to meet NFIP requirements that govern the location and elevation of structures, construction methods, and the placement or removal of fill. For construction within the special flood hazard areas, the Zoning Enforcement Officer, Building Official and Town Engineer review and issue a flood permit and conduct follow-up inspections to confirm compliance with the permit. The Flood Plain District regulations also apply to substantial improvements to existing structures located in SFHAs. Substantial improvements are defined as "any combination of repairs, reconstruction, alteration, or improvements to a structure taking place within a ten-year period, in which the cumulative cost equals or exceeds 50% of the market value of the structure." Within A Zones in the SFHAs, all new construction and substantial improvements require that structures be elevated above the base flood elevation while in V Zones structures must be elevated above base flood elevations and have foundations that are open to flood water flow or have breakaway walls that will fail under minimal flood conditions.

Section 103 of the Essex Zoning Regulations defines the Flood Plain District and lists requirements for anyone building or doing any construction activities within the management area. The zone designations are as they appear on the August 28, 2008 FIRM. Failure to adhere to these requirements can result in a Cease and Desist Order on the property. Some of the requirements of the area include:

- maintaining records of pre- and post-construction flood elevation and flood proofing certificates;
- standards for manufactured homes and recreational vehicles;
- increased elevation standards for all new construction of critical facilities in SFHAs; and

- standards for use restrictions.

Since 2008, FEMA has conducted a new Flood Insurance Study for Middlesex County that includes updated factors on still water elevations, wave height analysis, wave breaking data, wave overtopping data, erosion, shoreline protection structures and development. New Maps were adopted by the town August 28, 2008. Any future FIRM updates will be adopted as they are made available.

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, five (5) properties have been listed as RLPs with two being located in Flood Zones along inland streams and three being in the Flood Zone along the Connecticut River.

In addition, the Public Works department cleans all catch basins yearly, or more if needed. The Department also has an inventory of all catch basins, detentions areas and other storm water infrastructure throughout town.

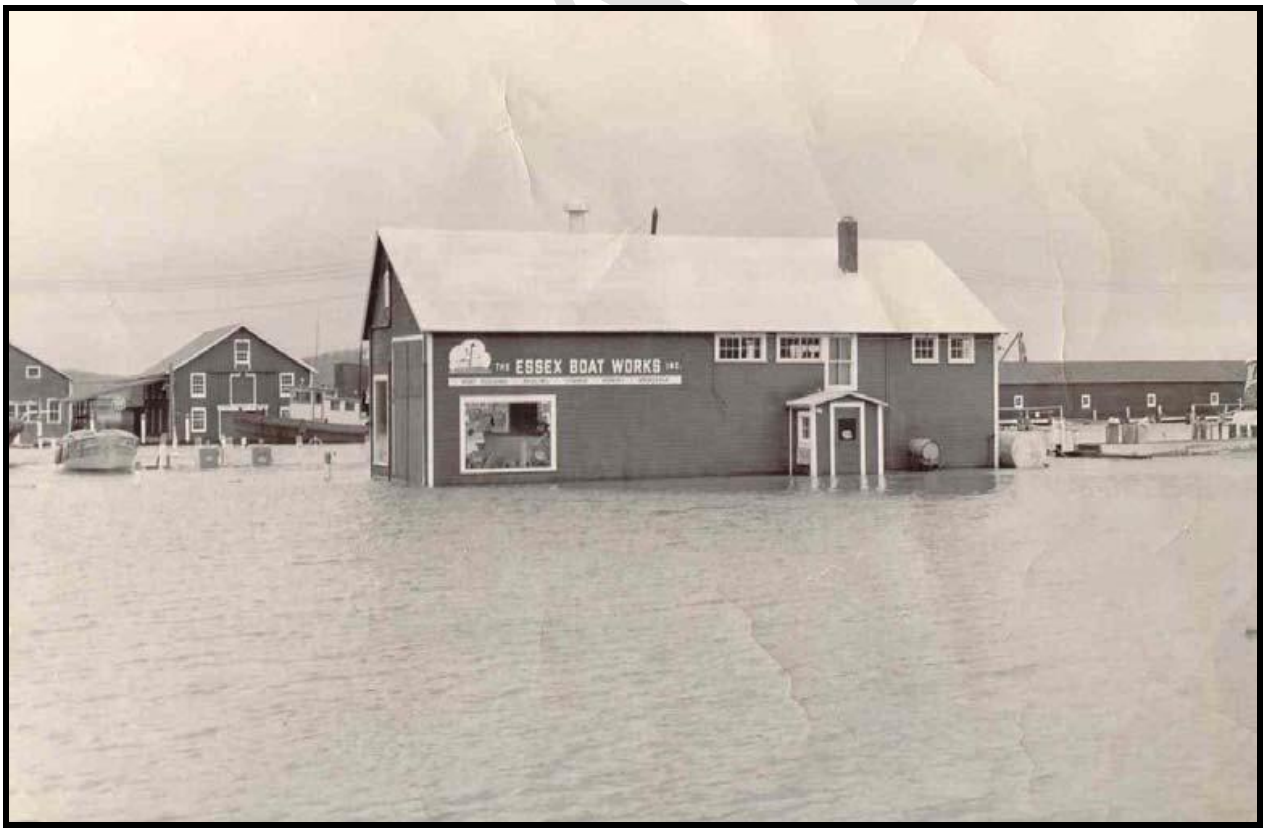
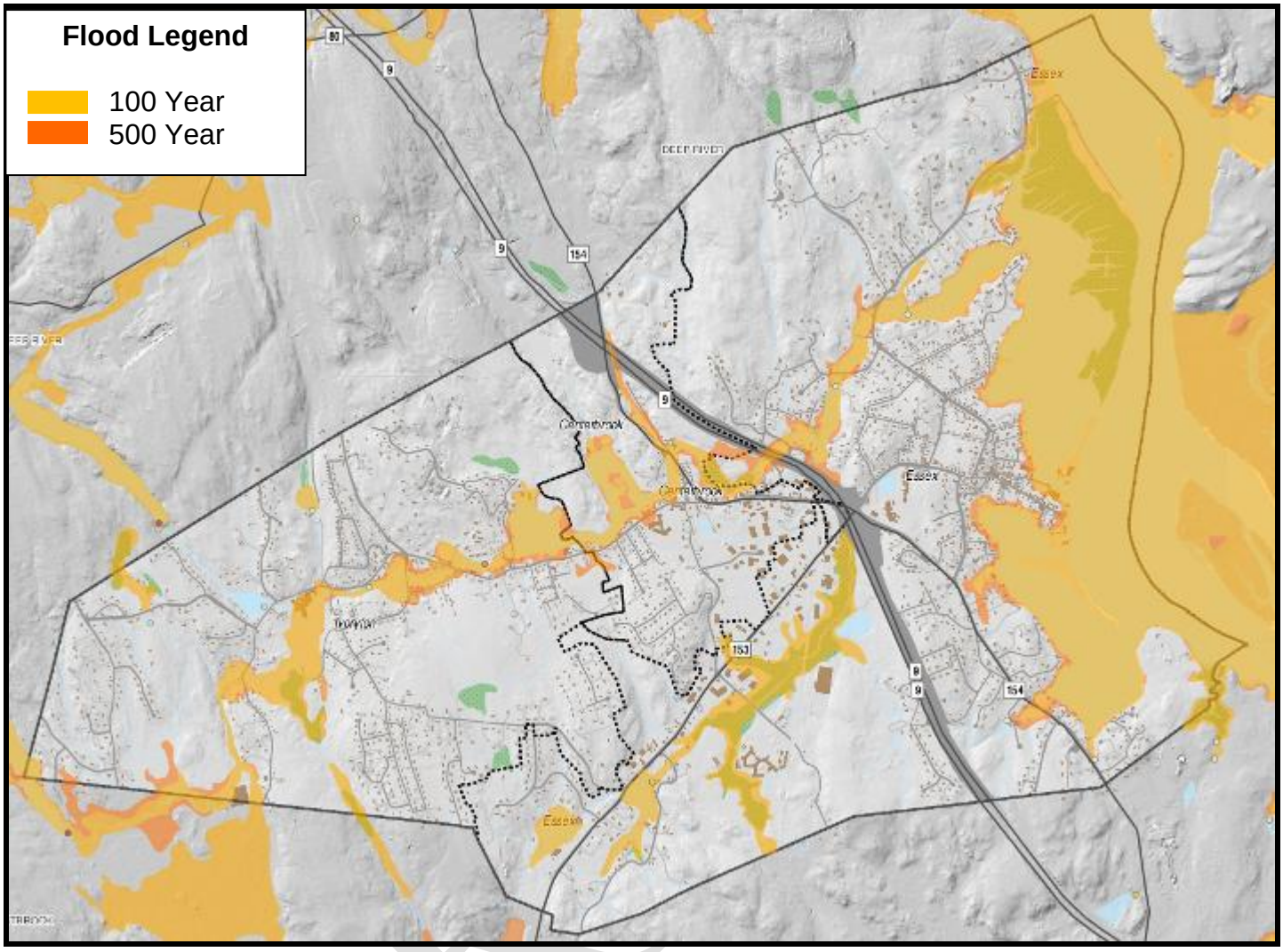


Photo 5: **Essex Boat Works and Marina District** during the 1955 flood.

Source: W. Olsen, former CRERPA Staff

Photo 6: **Connecticut River Museum** at the end of Main Street along the Connecticut River. The building is often subject to flooding events, most recently during Hurricane Sandy in October 2012.

Source: Connecticut River Museum



Map 9: **Flood Zones** in Essex.

This map depicts flood zones through Essex. Much of the flood zone occurs along the Connecticut River with a length along the Falls River (north) and the Mud River (south).

Source: Essex GIS (4/2013) Based on August 28, 2008 FIRM

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

See Section III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Future mitigation measures should focus on using past flood events on the Connecticut River and the tributaries to Falls River as benchmarks for the potential extent of damage. Measures could include flood proofing, elevation of structures, relocation, or acquisition. These options should be determined on a case by case basis. The upland version of a “severe” flooding event last occurred

in Essex in 1982. At that time, the current flood initiatives were in place to a great extent. Therefore, reconstruction afterwards occurred in a manner consistent with today's flood standards (for the most part) – bridges and roads were elevated, structures were rebuilt outside of the flood-prone areas or built so that they would withstand similar floods.

A simple measure for mitigation would be to properly train town officials, especially the Building Official and the Town Emergency Management Director. Training can be obtained through the Emergency Management Institute, most expenses would be covered through this federal program.

1. Existing Infrastructure

A Town-wide effort to mitigate hazards on properties and utilities specifically identified for flood-proofing should focus on identified areas listed on Map 8. Mitigation actions should include the following:

- Ensure that flood proof construction standards for structures within the flood plain are strictly enforced. In addition consider adding a freeboard (as much as up to three feet) requirement above base flood elevation for any structure within the flood plain.
- Update the flood zone study for the Falls River and Falls River Watershed. Changing conditions upland and within the floodplain, in addition to topographic changes as a result of the 1982 flood, and an expected sea level rise over the next twenty years, warrant a complete update of the flood zone limits along with a study of critical areas and flows.
- Conduct a full evaluation of dams in conjunction with state review, including a timeline and allocation of funding for repairs.
- Implement strategic requirement actions to include engineering reports for structural expansion or alterations on properties within the 100 year flood zone.
- Continue to update town-wide Geographic Information System (GIS) mapping through increased use of GIS databases, and coordinate for accuracy with FEMA layers and location of flood prone buildings. Using HAZUS software supported by ESRI software, the RiverCOG will be able to better evaluate local flood problems that possess an inter-town component.

2. Flood-Proofing Existing Structures

Within Essex, there are approximately 135 properties/structures near or within the existing Connecticut River 100-500 year flood zones with the predominant number of structures in the 100 year

flood zone. There are approximately 65 properties/structures within the 100 -500 year flood zone of the Falls River. The most important aspect of these floodplain structures is their high real estate and structural value given their waterfront location. Many of the homes exceed $1 million dollars in appraised value. There are also a number of commercial structures in the 100 year flood zone, with a predominance of marine dependent uses. The cost of flood damage to these structures is likely to be significant. (See Figure 2)

As There are five Repetitive Loss Properties in Essex, two of which are located along inland streams and three along the Connecticut River. The Connecticut River experiences repeat seasonal flooding due to rain and snow melt in the spring months. Mitigation measures appropriate for both business and home owners include structural alterations and hazard planning

Examples of Mitigation Options for Flood Prone Structures:

a. Relocation

Relocation is often used for structures that are particularly significant such as historic structures and landmarks. In Essex, the history of the Town is such that significant historic structures and landmarks are located in areas away, and for the most part, out of designated flood areas. Structures that are within the flood zone should be evaluated to determine whether or not they are viable candidates for relocation. The town should encourage property owners to understand the benefits of relocating out of the flood zone and work with property owners that may be willing to relocate. The town should make the permitting process as streamlined as possible.

b. Acquisition

Acquisition is considered one of the most effective methods of flood hazard mitigation because it assures that buildings in harm's way will cease to be subject to flood damage. This approach to flood hazard mitigation tends to be most cost effective in areas subject to severe hazards – where protection measures aren't feasible. Acquisition is primarily undertaken by Government agencies and tends to be more cost effective in areas subject to severe flood hazards where other mitigation measures are not effective. Although the ideal method of eliminating flood damage risk for structures within flood hazard areas is to remove them entirely, this alternative is unlikely in Essex.

c. Building Elevation

Due to their age, many structures in Essex are not built to current flood requirements, specifically elevations which will sustain flood damage. Elevation of these A Zone structures will greatly reduce potential losses under most conditions and is likely the most effective flood mitigation proposal that can be made. Although such a proposal would change the appearance of the area, it would go far in achieving the hazard mitigation necessary to protect life and property.

If a government program of subsidizing the elevation of these structures is undertaken, it would have to be with the understanding that many individual projects should be given to the consideration of streamlining zoning regulations to allow for elevation of properties. Proper oversight by local officials would ensure that structures are elevated to resist flooding to be sure that non-code septic systems are replaced with code-compliant systems, especially if reconstruction and potential expansion of structures is anticipated. It should be noted that these code compliance projects cannot be funded through FEMA programs, other funding sources would need to be found.

d. Flood-proofing

Flood-proofing measures are often utilized where flooding conditions are not as severe as other areas, including areas of infrequent low-velocity shallow flooding. In such areas, barriers and dry/wet flood-proofing can be effective.

e. Insurance

Flood insurance helps to recover costs incurred from the losses that can accompany floods. The two primary types of insurance that can be used include flood insurance acquired through the NFIP and ‘water backup insurance’ protection acquired through the homeowners insurance company. In order for property owners to have access to affordable subsidized flood insurance, the community must actively participate in the NFIP. Membership allows local insurance agents to sell a separate flood insurance policy under rules and rates set by FEMA at the federal level. Rates do not change after claims are paid; they are set on a national basis. “Water backup insurance’ is issued by insurance companies as an add on to homeowners insurance and covers seepage and sewer backup for an added deductible provided the problem was caused by a flooding event in the area. Although several insurance companies offer this type of insurance, the coverage, exclusions, deductibles and arrangements can differ widely.

i. Residential Property Owners

The existence of 135 properties within the Connecticut River floodplain is an important item for consideration. Many of these properties have structures which are vulnerable to flooding from the Connecticut River. Hazard mitigation for properties located within these flood zones begins informing residents within the area of the risks associated with their location. Techniques should include education using up-to-date flood mapping and evidence of past events that occurred on the Connecticut River prior to 1978. For structures within the flood zone there are specific measures that can minimize damage.

ii. Business Owners

For business, the primary mitigation objective is to minimize revenue loss due to a flood or hazard event. The town should help to educate business owners of useful records. An accurate record of all expenses, including hours worked, is important for insurance company reimbursement. Maintenance of a client list enables communication for a business that will be closed for an extended amount of time due to storm damage. Potential damage and loss estimates, as well as maintenance of a construction/repair vendor list can lend a sense of preparedness when hazard strikes. It is also important to keep a record of the business needs off-site in the event of a flood. These procedures will equip a business with the tools for a quick recovery from a hazard event.

f. Village Specific Recommendations

i. Ivoryton

Ivoryton is one of three commercial centers within Essex. It is located near the northwestern town border near the headwaters of the Falls River. The business district is located at the confluence of several streams within the Falls River drainage basin. In addition, dams upstream from the Ivoryton business district place several commercial structures and many residential structures in jeopardy of flood damage. In 1982, Ivoryton was one of the areas in Essex severely affected by the floodwaters. (See Map 10) Damage from a wall of water resulting from collapse of the Bushy Hill Dam upstream in Deep River included the destruction of several homes as well as damage to commercial and industrial structures.

Wince the 1982 flood, the Bushy Hill Dam has been repaired.

While this has mitigated similar future damage the fact remains that this structure is a class C dam. There is also a Class BB Dam downstream along the Falls River.

ii. Centerbrook

Within the Village of Centerbrook, business district flooding is limited to the rear portion of the commercial properties on Main Street (See Map 9). Past events have not shown significant damage to structures. These properties cannot be relocated, so awareness for flooding potential and possible mitigation measures for 100 or 500 year flood events are the best alternatives for these properties. One important mitigation measure is dam maintenance on the two dams upstream from Centerbrook village. There are several business properties in this area that could be affected by major flooding. The village is also located near a dam on the Falls River near the corner of Route 154 and Main Street. Particularly large rain storms can lead to flooding along the Falls River within this area. Suggestions for mitigation for this village and business district include:

• Long range business strategy planning for small businesses within the business district
• Repair and maintenance of dam structures upstream of Centerbrook

iii. Essex

The village of Essex is located within the lower estuary region of the Connecticut River. Historically a maritime community with shipbuilding and marine dependent uses, Essex has a significant number of structures and a business district that are vulnerable to river flooding due to spring thaws and more specifically severe coastal storms and hurricanes. (See Map 7) In addition, large rain events that increase stream flooding coupled with river flooding can lead to significant damage in Essex Village. For this reason, the business district owners and merchants as well as residential property owners should implement special mitigation measures for the village to include:

• Evaluation of storm-water outlets and maintenance
• Long range business strategy planning for small businesses within the business district

g. Flood-Proofing Critical Facilities

Within the community there are critical facilities identified as those municipal and private installations that are important to the health and welfare of the community during an emergency (See Map 4).

These include: the fire department building and apparatus, the police department and vehicles, the sewer pump station and/or treatment facility, evacuation routes, schools, and the town hall which houses critical town records. Fortunately, Essex does not appear to have any critical facilities in the high hazard flood zone.

h. Other Mitigation Actions to Consider

Land Acquisition – Advance an assertive land acquisition plan to reserve vacant land subject to flooding. The town should consider creating a Land Use subcommittee in order to guide land acquisition for the town and to regularly evaluate opportunities to acquire lands for municipal purposes, including floodplain protection and relocation of critical facilities.

Open Space Criteria – Consider creating an Open Space Committee who would make recommendations based on flood plains on what land to pursue the purchase of.

Stormwater Infrastructure Inventory – Complete mapping and monitoring of catch basins, storm water outfalls and related infrastructure. DPW has a recent inventory of all storm water management infrastructure.

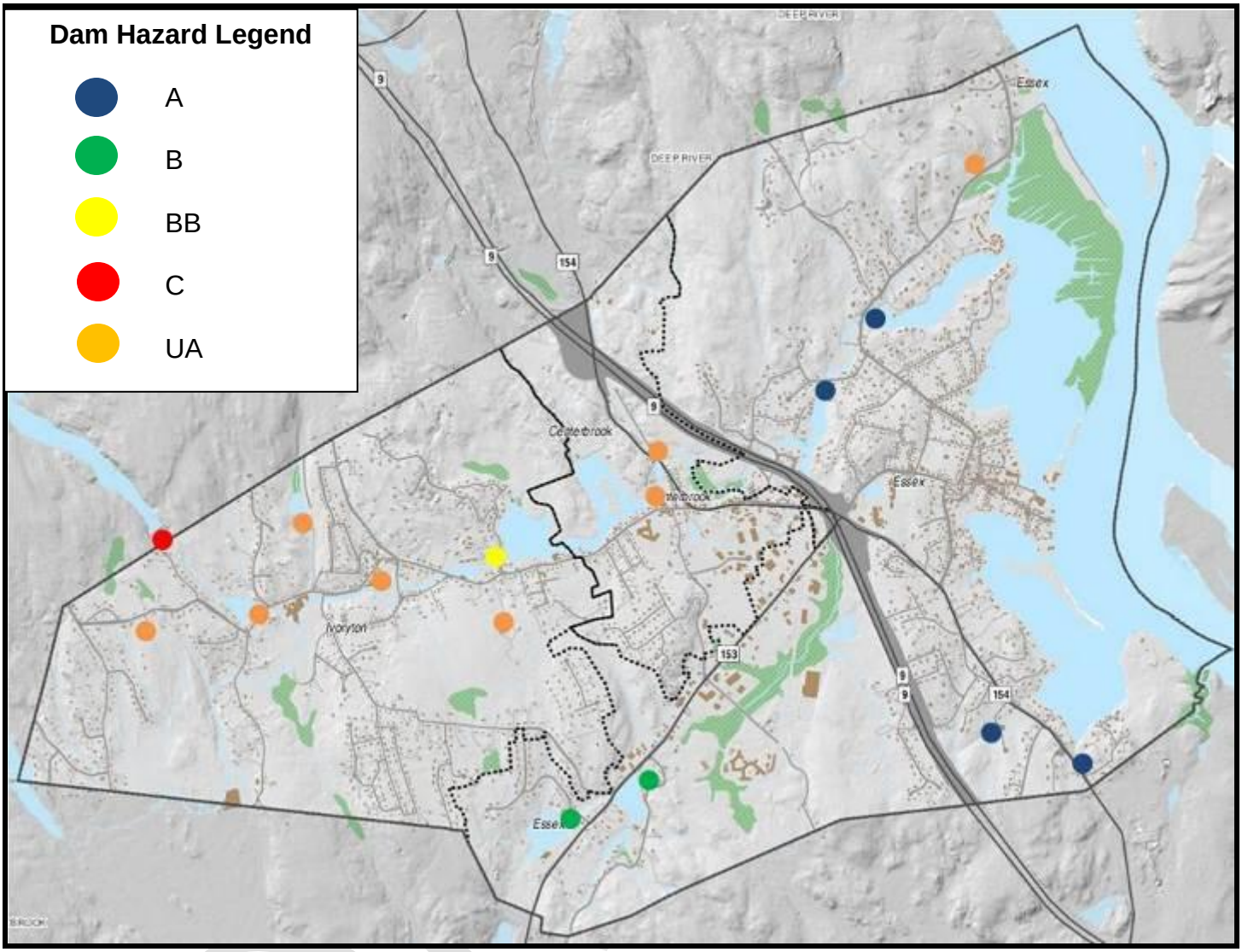
Stormwater Infrastructure Maintenance – Continue to provide for annual maintenance of storm water infrastructure, including catch basins, detention basins and outfalls. DPW annually cleans catch basins.

Stormwater Management – Continue land use permitting that requires stormwater retention within new and redeveloping areas (rain gardens, curb less roads, etc.). The Town should consider requiring the use of pervious surfaces and sheet flow into storm water swales in new parking lots, driveways, and roads.

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 – Develop a list of roads needing improvement or elevation for emergency access and evacuation.

Repetitive Loss Elevation Funding – Assist RL property owners in obtaining 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.



Map 10: **Dam Hazards**

This map depicts the locations of dams and flood zones in Essex and indicates their hazard potential classification. Note that the Bushy Hill Dam, the only High Hazard Dam is located in neighboring Deep River, though water flowing over the dam proceeds into Essex, approximately 350 feet downstream.

Source: Essex GIS (4/2013)

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 Essex 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)

There are fourteen dams in Essex. With Hazard A being the least hazardous and Hazard C being the highest hazard, four are classified as Hazard Type A dams, one is classified as a Hazard Type B dam, one is classified as a Hazard Type C Dam, two are classified as Hazard Type BB dams, and six are as yet unassigned (See Map 11). All the dams are privately owned and therefore repair is either non-existent or sporadic and dependent on the financial resources of the owner. Six of these dams are located on the Falls River, of which one is classified as a high hazard dam. The other high hazard dam is located on Tiffany Brook.

b. **Occurrences**

In 1982, Essex was severely affected by flooding. The town suffered dramatic flooding with the failure of the Bushy Hill Dam in Deep River which collapsed and sent a wall of water crashing down the Falls River. This caused or contributed to the failure of several other dams downstream and devastated areas of Ivoryton and Centerbrook. Approximately 140 homes were located along the Falls River, housing about 300 people. Factory workers notified people by going door to door. Others were notified by telephone, and one worker used a loud speaker. All of the dams destroyed in Essex were privately owned. In sequence, the destroyed dams were: Bushy Hill Dam, Clark's Pond Dam, Lower Pratt Read Dam, Washburn Dam, Moore, Grove, and Harper Dam on Mill Pond, and the Doane Dam.

c. **Probability of Occurring Again**

A total of eight dams collapsed during the 1982 flood. Although some of these have been removed while others have been repaired, the threat of Dam Failure is still present. 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.

d. **Potential Impacts**

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.

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

The State Department of 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 Environmental Protection (DEP) 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.

DEEP assigns dams to one of five 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 and 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. 83% of dams in Connecticut fall within the negligible to moderate hazardous categories while only 17% fall within the significant and high hazard categories. Map 11 depicts which Hazard Class each dam in Essex is.

DEEP keeps track of which dams have emergency plans but not all of them would be up to date and not all dam owners will want those plans shared publically. Only the larger significant and high hazard dams would typically have an emergency plan with inundation areas but not all do as it is not yet mandated by state statute or regulation.

f. **Mitigation** (ELEMENT C)

See Appendix III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C).

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.

The primary concern in mitigating the damage that might be inflicted by dam failure is that each of the dams is privately owned. Private owners are generally reluctant to repair dams on their property due to the high costs. Mitigation includes prioritizing dams using the DEEP classification systems and inspection. The high hazard dams should be repaired by utilizing state grant funding if available, state bonds if available, low interest loans to the property owners, or other types of incentives. These dams include: Millpond Dam and the Tiffany Pond Dam. The impoundment area for Millpond Dam is similar in size to that of the Bushy Hill Dam. It is a masonry dam approximately 200 feet in length and 15 feet high. The Tiffany Pond Dam (B) is an earthen dam approximately 250 feet in length and 3.5 feet high. This dam is classified as hazard type B. A combined failure of these two dams would potentially have an impact on properties downstream including a business district and industrial area. Also, downstream, there is a wetland area which could serve as a holding area for potential flood waters.

A recommendation is the preservation of this property as a means to mitigating impacts further downstream. An evaluation of this option for the town is recommended.
The town has no authority over any of the dams and therefor the best option available is information. By informing dam owners of their liability should their dam fail, the town may be able to encourage owners to maintain their dam. While DEEP does encourage dam owners to create and register an emergency operation plan for their dam, there is no legal obligation for them to do so. The DEEP conducts dam reviews when necessary and is compiling a list of overall condition for all dams in Connecticut. Flood zone standards within flood zones downstream of dams should mitigate all but the worst case scenario.

Photo 7: **Mill Pond Dam,** privately owned and showing signs of decay.

Photo 8: **Bushy Hill Pond Dam,** along with nearby homes and narrow path of Falls River.

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 Middlesex 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. In 2008, the National Weather Service was asked to determine if a tornado had occurred in Old Saybrook after some residents thought they had seen a funnel cloud; it was inconclusive. Essex-area historical tornado action is near the Connecticut state average, which is 25% smaller than the overall U.S. average. (Source: City Data)

b. **Occurrences**

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 8: **Recorded Tornadoes** in RiverCOG region since 1950.
Source: Tornado History Project

As recently as January 31, 2013, high winds plagued Connecticut. "As of 10:15 a.m. Connecticut Light & Power reported more than 61,000 outages scattered all over the state. The utility reported more than 72,000 outages earlier in the morning." In the RiverCOG region wind gusts were reported of 78 mph in Westbrook, 65mph in Old Saybrook, and 64 mph in Middletown. [New Channel 8, WTNH, January 31, 2013].

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.

c. **Probability of Occurring Again**

Tornados are unlikely to occur in Essex. 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 tornado occurred in Essex between 1950 and 2013.

d. **Potential Impacts**

Tornados and high winds destroy vegetation and structures within the storm's path. For example, on 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.

High wind can lead to extended power outages as was experienced in both Tropical Storm Irene and Hurricane Sandy when downed trees and telephone poles caused power outages of more than a week in Essex.

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

The 2005 Connecticut State Building Code was amended in 2009 and adopted with an effective date of August 1, 2009. The code specifies the design wind speed for construction in all the Connecticut municipalities, with the addition of split zones for some towns. For example, for inland towns such as Haddam and East Haddam, wind speed criteria are different in relation to the distance from the shoreline. Essex uses the state Building Code as its own. The design wind speed for Essex is 110 miles per hour. The Town Building Official enforces the provisions of this article in accordance with the remedies provided in C.G.S. § 8-27.

f. **Mitigation** (ELEMENT C)

See Appendix III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Wind Code Compliance. Ensure that all new structures are built to the state building code requiring a 110 mph resistance. Ensure that the Essex Building Code is in alignment with State Building Code any time there are changes.

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

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 and regulations.

4. Drought & Wildfire

A drought is defined as a period of dry weather: 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.

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

As with all the towns in the region, Essex 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 in the northern areas of town or areas of *Phragmites* along the river. Drought also can exacerbate potential for small wildfires and hinder the ability of the town to control outbreaks.

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

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 9: **Historic Periods of Drought in the Region.** Based on the monthly Palmer Drought Severity Index as computed by the National Climatic Data Center. Period of record: January 1895 through June 2012

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] According to the DEEP, Connecticut traditionally experiences high forest fire danger in the Spring from mid-March through May.

c. **Probability of Occurring Again**

Severe drought and wildfire are both unlikely to occur in Essex. While any dry period brings with it the possibility of brush fires, large wildfires have yet to be experienced in Essex. While summer months tend to be the most likely period when the area could experience drought, autumn months often bring wet weather, ending the drought.

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

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 Essex 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 Essex 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.

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

The current Subdivision Regulations state that the Planning Commission may order for the Fire Department and Fire Marshall to inspect any subdivision. When deemed necessary, storage tanks must be capable of holding at least 30,000 gallons of water. The applicant shall be required to demonstrate that such water supply meets or exceeds the minimum requirements as set forth in National Fire Protection Association (NFPA) Standard 1141 (Standards for Fire Protection in Planned Building Groups) and National Fire Protection Association (NFPA) Standard 1231 (Water Supplies For Suburban and Rural Firefighting).

f. **Mitigation** (ELEMENT C)

See Section III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

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

Wildfire Management Plan. Work with the regional EMDs and neighboring towns to develop a wildfire management plan and protocol to ensure that outside fire-fighting resources, such as the National Guard, are available.

Dry Hydrants. For new development where water supply for fire fighting is inadequate, dry hydrants should continue to be required.

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

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 Connecticut, 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 in higher elevations versus less snow close to the river or in southern parts of town). Connecticut River flooding from nor'easters is also possible as strong winds push water upstream from Long Island Sound.

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

There is a history of powerful winter storms that have affected Essex and the region. The most recent having been February 5, 2013 when nearly 40 inches of snow fell over Connecticut in a 24 hour period. State highways were closed and many towns took days to remove snow from roads. Most schools were closed for the majority of the week. See Figure 6 for a summary of other storms. Some of the more notable storms are listed below.

1888 – Blizzard
1978 – Blizzard
1993 – "Storm of the Century"
1996 – Blizzard
2011 – "Snowstorm Alfred"
2013 – Blizzard

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

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

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

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 provisions 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. Economic losses can occur as people are unable to get to and from work.

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. Only during extreme conditions, such as the Blizzard of 2013 last winter, does the DPW have difficulty keeping roads open.

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

See Section III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Landscaping. Promote landscaping practices through public outreach 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. Continue requiring that all new subdivisions and consider requiring that all 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)

The entire town could be affected by an earthquake in this region; however, impacts could vary locally.

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

While there is no record of damages in Essex 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 10: **Earthquakes** within 50 miles of Essex

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, 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 Essex experienced a 1.3 on the Richter scale tremor.

Earthquakes from distant locations can also be felt in Connecticut, such as the magnitude 5.8 earthquake that shook the Washington DC area on August 23, 2011.

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

The likelihood of an earthquake in Essex is small. The USGS database shows that there is a 1.186% chance of a major earthquake within 50 kilometers of Essex, Connecticut within the next 50 years. [Source: USGS website, 2012] Essex-area historical earthquake action is slightly below the Connecticut state average and is 91% lower than the overall U.S. average. [Source: http://www.city-data.com/city/Essex-Connecticut.html; more information: http://www.city-data.com/city/Essex-Connecticut.html#ixzz1icaDm7tA]

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

In Essex 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 generated using a 100 Year Earthquake Event scenario. This report generates loss estimates based on 2000 U.S. Census Data. This report estimates that no building damage, no economic damage, and no lives will be lost during such an event. For the full report, see Appendix IV HAZUS – MH Earthquake Event Report.

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

See Appendix III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

Insurance. Encourage residents to purchase a low cost earthquake rider for homes and businesses. This would protect

property owners for 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).

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

Hurricanes and tropical storms will affect the entire town; however affects will vary depending on location and proximity to the river. Strong winds and rain will affect the entire town while storm surges and flooding will affect the river shoreline. See Section 1 for a discussion of l flooding and FEMA's flood insurance rate maps that depict the 100-year flood zone and Section 2 for a discussion of high winds.

Maps 12 & 13 below, Hurricane Surge Inundation with Storm Categories, depicts the extent of worst-case coastal flooding that could occur in Essex from category 1 through category 4 hurricanes.

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

See Figures 6 and 11 for a summary of hurricanes that have affected Essex.

Most recently Essex was affected by Hurricane Sandy on October 29, 2012 and Tropical Storm Irene on September 2, 2011 both of which caused significant flooding, property damage, damage to homes and downed power lines resulting in week-long power outages in many cases.

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	Matunk, RI	85
August 30, 1954	Carol	2	Groton, CT	115
September 12, 1960	Donna	1	Old Saybrook, CT	100
September 127, 1985	Gloria	1	Milford, CT	85
August 19, 1991	Bob	1	New Shoreham, RI	105
August 24, 1893	Irene	TS	Brooklyn, NY	65
October 29, 2012	Sandy	1	Brigantine, NJ	80

Figure 11: **Major Hurricanes** and Tropical Storms in New England since 1858.
Source: Ryan Hanrahan, WVIT NBC 30

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

As a Southern Connecticut community, Essex is *likely* to experience hurricanes and tropical storms. The southern boundary of Essex is about four miles from Long Island Sound.

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

In the event of a hurricane or tropical storm, the primary risks in Essex are from high wind, river flooding, and inland flooding on small streams and rivers from heavy rain. See Sections 1 and 2 for a discussion of potential impacts from flooding and high winds, respectively.

Because of the frequency of hurricanes and their potential severity, they are the natural disaster likely to cause the greatest damage. Downed trees from high winds and flooding from rainfall can cause damage to properties.

A HAZUS MH Hurricane Event Report was generated using a 100 Year Flood Event scenario. This report generates loss estimates based on 2000 U.S. Census Data. Below is a chart detailing estimated building damage by the type of building thorughout Essex for such an event. For the full report, see Appendix V HAZUS – MH Hurricane Event Report.

Building	None		Minor		Moderate		Severe		Destruction	
Type	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Concrete	22	88.10	2	9.50	1	2.23	0	0.17	0	0.00
Masonry	149	82.65	21	11.66	10	5.37	1	0.29	0	0.03
MH	2	99.32	0	0.53	0	0.14	0	0.00	0	0.01
Steel	152	88.76	14	8.42	4	2.38	1	0.44	0	0.00
Wood	2,152	85.65	326	12.96	32	1.28	2	0.06	1	0.05

Figure 12: **Building Damage by Type** from 100 Year Hurricane Event
Source: HAZUS MH

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

The greatest threats during a hurricane or tropical storm event come in the form of high wind and the potential for flooding. For these threats, Section 1, Flooding discusses policies regarding Flood Zones throughout Essex. Section 2, High Wind and Tornado discusses Wind Speed Compliance per the state building code.

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

See Section III MITIGATION (Figure 15) for the Comprehensive Mitigation Action Items (ELEMENT C). The following are representative mitigation activities specific to this hazard:

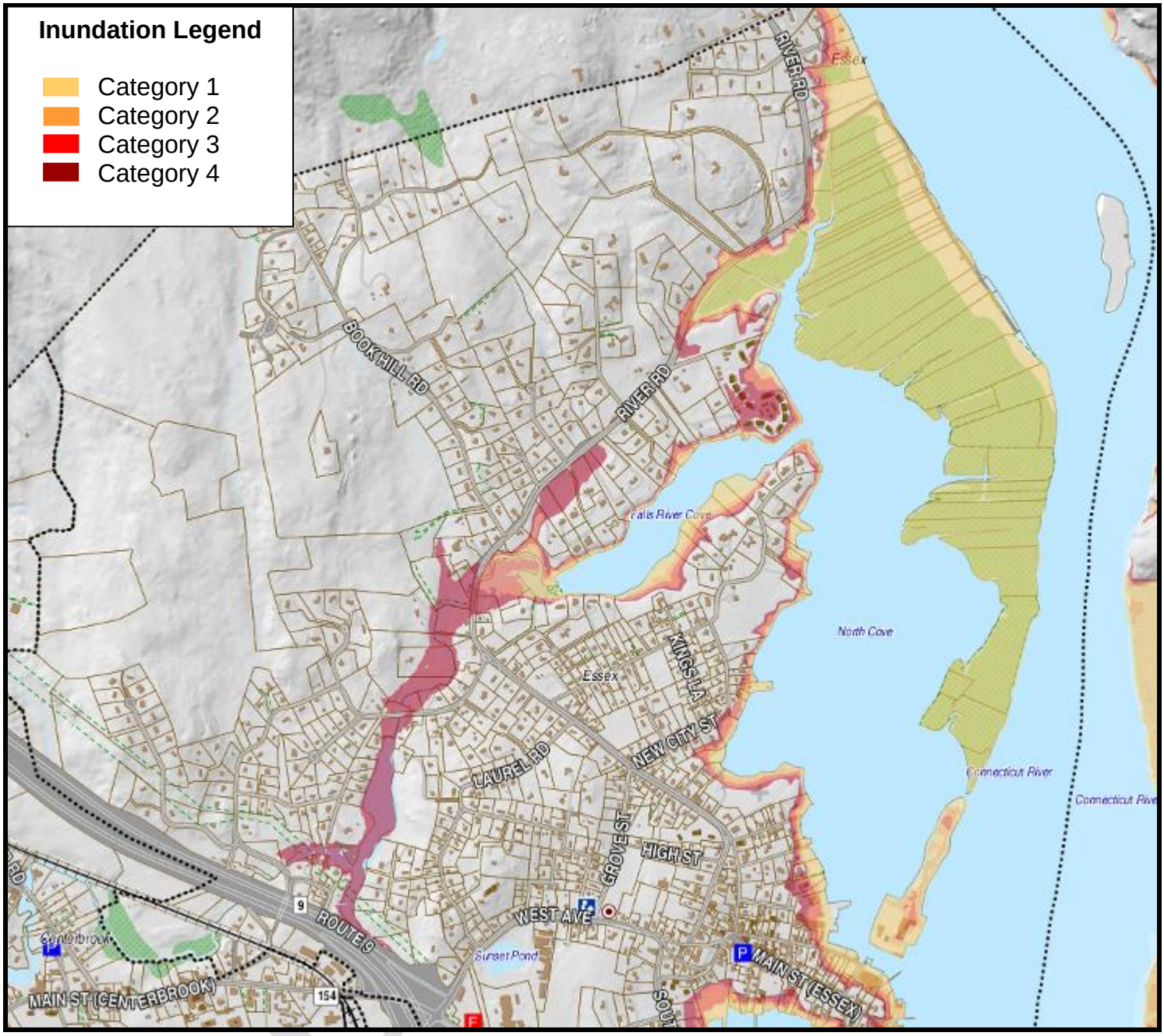
Public Information. Provide information on the town's website about hurricane preparedness and links to town, regional, state and federal sites for information on reducing hurricane damage.

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.

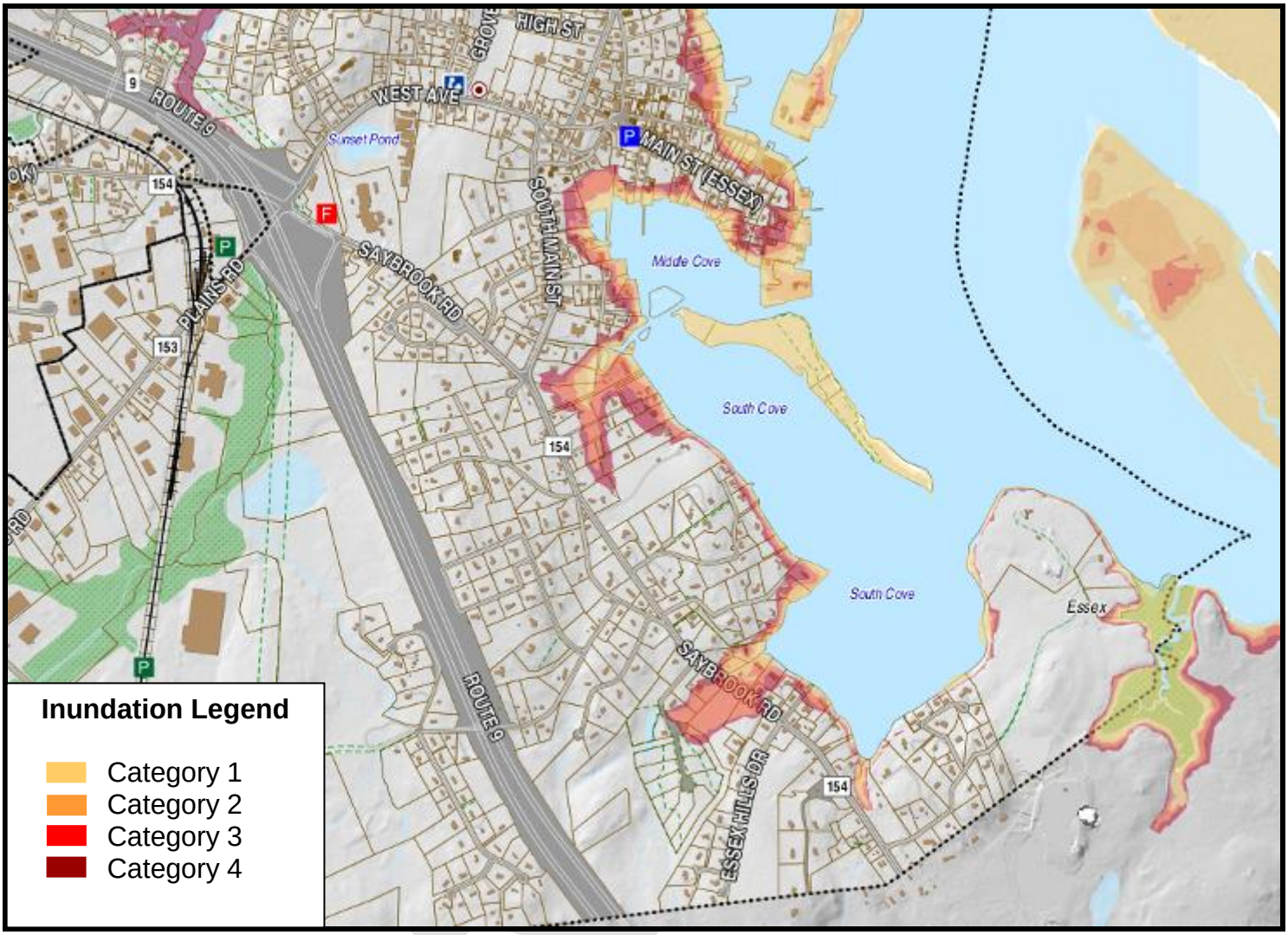
Incident Notification System – Enlist public participation through public workshops to develop methods for notification of hazard events and emergencies.

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 continuing the "rainy day" fund in case Federal assistance is insufficient or delayed. The current fund is about 12% of the overall Town budget.



Map 11: **Hurricane Inundation** in the Northeastern part of town. Visible is the extend of the Falls River that would be affected by a Category 4 Hurricane.

Source: Essex GIS (4/2013)



Map 12: **Hurricane Inundation** in the Southeastern Portion of Essex.

Source: Essex GIS (4/2013)

8. **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. A heat wave in the northeastern United States is defined as a period in which daytime high temperatures reach 90ºF or higher for three days in a row. The term is applied both to routine weather variations and to extraordinary spells of heat which may occur only once a century. 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)

Essex 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. With the elevated summer temperatures comes a risk of extreme heat. With its dense forest coverage and abundant water features, Essex is slightly more protected from extreme heat than some of its neighbors, but heat waves do occur. A heat wave in Connecticut is defined as any period of time in which daytime high temperatures reach more than 90ºF for three consecutive days or longer.

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

Heat waves are a regular summer season event in Connecticut, including Essex. 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 US 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 use air conditioning.

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

Extreme heat and heat waves are highly likely during the summer months in Essex. As global temperatures continue to climb, it seems likely that heat waves will occur more frequently in the future.

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 high event events.

Physical infrastructure can also be impacted negatively by extreme heat. Heat always brings with it the potential for strong thunderstorms which could knock out power due to downed trees. Asphalt, especially in places where there is not a substantial base can buckle or crack significantly under heat. Drought conditions can also become exacerbated by extended periods of significantly high temperatures.

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

The Towns Emergency Management Director has the authority to establish a designated cooling center for those living without air conditioning should the need arise. These places provide a place for people to escape the heat as well as providing water.

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

See Section III Mitigation (Figure 15) for Comprehensive Mitigation Action Items (Element C). The following are representative mitigation activities specific to this hazard:

It is difficult to mitigate the effects of extreme heat on the physical infrastructure. That being said, the best mitigation when it comes to the public is information. Public information, especially for senior citizens should be made available so they know when an extreme heat wave is coming. Reminders about drinking water and staying indoors can help.

The town should designate a cooling center to be used whenever excessive heat warrants it.

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

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

1. **Changes in Development**

New development has been limited since the 2006 Plan. A total of 50 new residential structures were approved along with 10 new commercial structures since 2006 in Essex (see Figure 13 below for detailed building permits). This represents a significant slowing in development as measured in "new start" construction". The following table summarizes by fiscal year the number of building permits issued for new construction of residential and commercial buildings.

New Construction Permits		
Year	**Residential**	**Commercial**
2006	12	1
2007	14	8
2008	7	
2009	3	
2010	6	
2011		1
2012	4	
2013	4	

Figure 13: **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. The figure in this section (Figure 15), 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 STAPLE-E 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 (1-7, 1 being the lowest priority, 7 being the highest priority). For this Plan update, the timeline has been set as *ongoing, 2013-17, 2018-2022,* and *Beyond 2022* while the priority was set using the STAPLEE Method. Prior mitigation action items were reviewed to understand the progress which has been made since the 2006 plan was adopted by the town. Items marked with shading in the spreadsheet are those form the 2006 Plan. The 2006 action list was reviewed, items that have been completed have been marked as such and new items have been added to the original list. A spreadsheet was constructed with all mitigation action items and the STAPLE-E method was used to determine the priority rating of the project. The STAPLEE method is incorporated into Figure 15.

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)

The Town integrates 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. Generally, the Town's:

5-year Capital Improvement Plan addresses *municipal improvements* including: rights-of-way, land, housing, or utilities for public purposes. Mitigation actions form 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 form 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	Regulation or Plan Status Relative to Hazard Mitigation	Responsible Party
Zoning Regulations	Incorporate suggested changes from NHMP into ZR.	Zoning Commission
Subdivision Regulations	Incorporate suggested changes from NHMP into SR.	Planning 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 Commission
Capital Improvement Plan	Consider new projects listed in Figure 15 of this NHMP.	BOS, BOF, PW

Figure 14: **Plans and Regulations to be Potentially Updated**

D. **Comprehensive Mitigation Action Items** (C4.)

Listed below are the supporting actions with the board/ commission or individual responsible for implementation and timeline for consideration and the priority of the action. The schedule is listed as Daily, Monthly, Annually, 2013-2017, 2018-2022, and Beyond 2022 as established by the town during draft review. The priority is based on the STAPLEE method of prioritization and is part of Figure 11. Modifications may be made after public review and adoption. The enabling task for many of these actions will be the application for grants when local sources are unavailable and placement in the budget when Town funding is available.

Figure 15: **Comprehensive Mitigation Action Items**	Natural Hazards							Responsible Party *	Schedule A. Daily B. Monthly C. Annually D. 2013-2017 E. 2018-2022 F. Beyond 2022	Status	Possible Funding Source** (where applicable)	Weighted STAPLEE Criteria Costs (-1)/ Benefits (1)							
	Flooding	High Wind and Tornado	Drought and Wildfire	Winter Storm	Earthquake	Hurricane	Extreme Heat					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		IWC, PC	**D**	New									0
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.	X	X	X	X	X	X	X	BOF, BOS	**C**	Ongoing									0
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.	X	X	X	X	X	X	X	BOS, PW, LUO, BO	**A**	In Place, storm water infrastructure cleaning etc.									0
Business Recovery Plan. Develop business recovery plan cooperatively with other region towns and distribute to town businesses.	X	X	X	X	X	X	X	BOS	**D**										0
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	BOF, BOS, PW	**C**	Ongoing									0
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.	X		X	X		X	X	CC	**D**	New									0
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.	X	X	X	X	X	X	X	BO	**D**	New									0
[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**	New									0
Flood Zone Study. Update flood zone study for the town to incorporate changed conditions upland and within the floodplain.	X							LUO, IWC	**D**	New Maps Adopted 2088	HMPG,PDM								0
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				X	PC, CC	**D**	New									0
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	BOF, BOS, LUO	**C**	Annually									0

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	LUO, ZC	**A**	Ongoing									0
Landlord 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.	X	X	X	X	X	X	X	BOS, LUO	**D**	New									0
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 Essex. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Essex will be affected by natural hazards.	X	X	X	X	X	X	X	BOS, EMD	**D**	New									0
No net runoff from development. Require all new development to be built using techniques to eliminate run-off.	X		X	X		X		ZC, IWC, LUO	**A**	Ongoing									0
Owner Participation. Promote owner participation in mitigation efforts to protect their own properties.	X	X	X	X	X	X	X	LUO, BOS	**C**	Ongoing									0
Possible Open Space Criteria. The Conservation Commission should consider making possible inundation by Hurricane Surge to its considerations for preserving open space .	X			X		X	X	ZC, PC, LUO	**D**	Has not begun	HMPG, PDM, CIP								0
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	PC, BOE	**D**	New									0
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	LUO	**D**	New									0
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	BOS, BOF, LUO	**C**	Ongoing	HMPG, FMA, RFC,SRL								0
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	BOF, BOS	**C**	Ongoing with 9TT	CIP								0
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	LUO, PC	**D**	New	CIP, HMPG								0
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	IWC, PC, ZC, LUO	**D**	Current regulations do not allow new structures in those areas.									0

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.	X	X	X	X	X	X	X	ZC, LUO	**C**	Ongoing									0
Structure and Infrastructure Projects																			
Caches. Consider creating stores of emergency supplies in areas of town that will be cut off during major flooding events.	X			X		X		PW, BOS	**C**	New	CIP,HMPG								0
Construction Standards. Ensure that flood proof construction standards for roads and structures within the flood plain are strictly enforced.	X			X		X		BO	**D**	Ongoing									0
Critical Facilities. Maintain and upgrade as necessary all facility mechanicals, such as generators, in municipal and other critical facilities.	X	X	X	X	X	X	X	PW, BOS, BOF	**C**	Inspected monthly	PDM,HMPG, CIP								0
Data for Plans. Use GIS database to develop better mitigation plans.	X	X	X	X	X	X	X	BOF, LUO	**D**	Ongoing									0
Drinking Water Cache. Install drinking water tanks with a supply of bleach for private well water purification. (Batteries?)	X	X	X	X	X	X	X	PW, BOS	**C**	New	PDM,HMPG, CIP								0
Dry Hydrants. Continue to require dry hydrants or fire ponds in new developments where water supply is inadequate.			X					LUO, BO, ZC	**A**	Ongoing									
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		BOS, BOF	**D**	Ongoing	CIP, HMPG								0
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		BO, LUO	**D**	Ongoing									0
Firefighting Infrastructure Analysis. Evaluate existing firefighting infrastructure to identify needs for improvement to cover gaps in availability.			X					Fire Dept.	**D**	New									0
Geographic Information System. Annually review and update as necessary existing town GIS data.	X	X	X	X	X	X	X	LUO	**D**	Ongoing	HMPG, CIP								0
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	BOS, BOF, LUO	**D**	Ongoing, RiverCOG is currently mapping the entire region.									0
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	**E**	New	HMPG,PDM, CIP								0
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		LUO	**D**	New									0

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		BOS, BOF	**D**	Ongoing									0
Pet Sheltering. Participate in regional program for sheltering pets during hazard events.										Ongoing at DEMHS Region 2 Level									
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		BOS, LUO, BO	**A**	New									0
Public Works Garage & Transfer Station Generator. Install a generator for back-up power.		X		X		X	X	PW, BOF, BOS	**D**	New	HMPG, CIP								0
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	LUO	**E**	New									0
RL and SRL Properties. Encourage property owners of repetitive loss properties to obtain assistance for hazard mitigation funding from DEEP/FEMA for elevation of structures and repairs where applicable.	X	X	X	X	X	X		LUO	**D**	Ongoing									0
Road Evaluation. Evaluate to develop plans, and improve for emergency access and evacuation.	X			X	X	X		PW	**E**	Yearly									0
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		PW	**F**	List on file at DPW	HMPG, FMA, CIP								0
Storm water Infrastructure Inventory. Implement mapping and monitoring of catch basins, storm water outfalls and related infrastructure.	X			X		X		PW	**D**	Inventory on file at DPW	HMPG, FMA, CIP								0
Storm water Infrastructure Maintenance. Provide for annual maintenance of storm water infrastructure, including detention basins.	X			X		X		PW	**C**	Cleaned yearly or as needed	CIP								0
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		BO	**A**	Ongoing									0
Telecommunication Tower Generators (Private). Evaluate whether generators are needed for back-up power at telecommunications facilities.		X		X		X	X	Private	**D**	New									0
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	**F**	New	HMPG,PDM, CIP								0
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	X		BOS, BOF, LUO	**E**	New									0
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		BOS, LUO	**D**	Ongoing	HMPG, PDM, RFC, SRL								0

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		PC, EMD	**D**	New									0
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	**D**	DEEP continues to regulate Dams	HMPG								0
Drought Study. Conduct town-wide study of ground- and surface water capacity as it relates to planning for droughts.			X					LUO	**D**	New	HMPG								0
Fire Warning. During vulnerable periods, a system of warnings about campfires and open fires should be posted in public locations			X					LUO	**A**	DEEP currently does this.									0
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		LUO, PC	**D**	New									0
Flood Enforcement. Enforce through existing zoning, building and flood permitting processes, construction standards to minimize flood risks.	X			X		X		IWC, PC, ZC, LUO	**A**	Ongoing									0
Land Acquisition. Advance an assertive land acquisition plan to reserve vacant land subject to NHs.	X		X	X		X		BOS, BOF, CC	**D**	New	FMA, RFC, SRL								0
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.	X	X	X	X	X	X	X	CC, BOF, BOS	**D**	New									0
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	LUO	**D**	Ongoing									0
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		PW	**D**	Currently in place									0
Water Conservation. Recommendations for future land use patterns including recharge into existing aquifers, including site design to encourage water conservation through such techniques as: strict regulation of vegetative buffers for stream and river corridors, rain gardens for site drainage, and prohibition of wetlands alteration.			X					LUO, BOS	**D**	Ongoing									0
Tree Hazard Management 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	**A**	Ongoing, takes place daily									0
Education and Awareness Programs																			
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.	X	X	X	X	X	X	X	BOS	**C**	Ongoing	HMPG, PDM								0
Drought Education. Coordinate with Connecticut Water Company on public education and public service announcements during droughts.			X				X	BOF, BOS	**C**	New	HMPG, PDM								0

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	LUO	**C**	New	HMPG, PDM									0
Hotline. Publicize emergency "hotline" phone number or website for public information and volunteer support.	X	X	X	X	X	X	X	BOS	**D**	Essex Website has extensive information	HMPG, PDM									0
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	BOS	**D**	Reverse 911 System in place										0
Information. Publish materials on additional hazards and encourage additional insurance.	X	X	X	X	X	X	X	BOS, LUO	**C**	Ongoing – newsletters and emails.										0
Interpretation in Shelters. Request information regarding the need for providing non-English language speakers during natural disasters from the District 4 School administration; and coordinate a shared service for non-emergency and emergency operations.	X	X	X	X	X	X	X	EMD	**D**	New										0
Natural Hazard Training. Continue to train and educate emergency responders about mitigating NHs.	X	X	X	X	X	X	X	LUO	**C**	New	HMPG, PDM									0
Neighborhood Mitigation. Engage neighborhood associations annually to participate in implementing the NH Mitigation Plan.	X	X	X	X	X	X	X	BOS	**D**	New										0
Outreach. Promote owner participation in mitigation efforts to protect their property.	X	X	X	X	X	X	X	LUO	**C**	New	HMPG, PDM									0
Pet Sheltering. Distribute hurricane preparedness information including pet sheltering plans.	X	X	X	X	X	X	X	LUO, PC	**C**	Ongoing	HMPG, PDM									0
Preparedness Webpage. Create a page on the 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	EMD	**D**	Town website has extensive information.										0
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	LUO	**C**	Ongoing, extensive information is available on Town website.	HMPG, PDM									0
Public Participation. Enlist public participation through public workshops to develop methods for notification of emergencies.	X	X	X	X	X	X		PC	**C**	Ongoing										0
Recovery Webpage. Post on town website information about recovery assistance following NH events.	X	X	X	X	X	X	X	BOS	**C**	New	HMPG, PDM									0
Refuges of Last Resort. Identify refuges of last resort for those unable to reach designated shelter.	X	X	X	X	X	X	X	EMD, PC, BOS	**D**											0
Reverse 911. Consider establishing reverse 911 alert system or similar alert system.	X	X	X	X	X	X	X	BOS, EMD	**D**	Complete, Everbridge System										0
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	BOS	**C**	Ongoing	HMPG, PDM									0

Social –Demographic Impacts. Seek grants to provide funding for developing more detailed data to assist in the social – demographic analysis of how Essex will be affected by natural hazards.	X	X	X	X	X	X	X	BOS, LUO	**D**	New									0
Tennant Notification. Develop a mechanism for tenants to register for disaster notification**.**	X	X	X	X	X	X	X	LUO	**C**	New	HMPG, PDM								0
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.	X	X	X	X	X	X	X	BOS	**C**	Ongoing, continual updating of Town website	HMPG, PDM								0
Wildfire Education. Educate the public about potential hazard of wildfire caused by campfires or open burning.			X					Fire Dept.	**C**	Ongoing	HMPG, PDM								0

***Responsible Party Code**

BO = Building Official
BOE = Board of Education
BOF = Board of Finance
BOS = Board of Selectman
CC = Conservation Commission
EMD = Emergency Manager
IWC = Inland Wetlands Commission
LUO = Land Use Office
PC = Planning Commission
PW = Public Works
ZC = Zoning Commission
ZEO = Zoning Enforcement Officer

****Funding Source Code**

CIP = Capital Improvement Plan
FMA = Flood Mitigation Assistance
HMPG = Hazard Mitigation Program Grant
PDM = Pre-Disaster Mitigation
RFC = Repetitive Flood Claim
SRL = Severe Repetitive Loss

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
Clinton, 1986	Essex, 1984
Killingworth, 1981	Lyme, 1978
Westbrook, 1986	

Significant Tornadoes, 1680-1991, *Thomas Grazulis*, *Environmental Fils, September 1993*

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, Essex, ME*

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*

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*

TOPO, Interactive Maps, Connecticut, *Wildflower Productions, 1999*

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*

Mitigation…In Massachusetts, *U.S. Department of Homeland Security, Federal Emergency Management Agency produced in cooperation with the Commonwealth of Massachusetts, circa 2011*

CT-Essex town, 2010 Census Interactive Population Search, *http://2010.census.gov, April 2013*

PICTURES AND NEWS ARTICLES:

New Haven Register, Monday June 7, 1982, Tuesday June 8, 1982
Harford Courant, Monday, June 7, 1982 / Tuesday, June 8, 1982 / July 24, 1982 / July 26, 1982 /
The Gazette, July 28, 1982
Middletown Press, Monday, June 7, 1982 / July 21, 1982

MUNICIPAL DOCUMENTS:

Town of Essex Subdivision Regulations, *Amended to 11/15/11*
Town of Essex Zoning Regulations, *Revised to 4/16/11*
Town of Essex Plan of Conservation and Development, *Effective April, 23, 1990*
Information from current plan update also used.
Essex Inland Wetlands and Watercourses Regulations, *Revised to 8/4/2009*
FEMA Flood Study, Old Saybrook, CT – *January, 1978*
FEMA Flood Insurance Study Supplement – Wave Height Analysis, *January, 1984*

Hartford Courant, "Retreat To High Ground: Hurricane Danger What if Irene had been a major hurricane?", Tuesday, August 30, 2011

Dams in Middlesex County East.jpg / Dams in Middlesex County West.jpg, *Connecticut Department of Energy and Environmental Protection, Inland Water Resources Division, Dam Safety Program, August 4, 2011*

MUNICIPAL DOCUMENTS:

Chapter 128, Floodplain Management, *Adopted 9-19-2002; amended in its entirety 6-17-2008*

Building Permits, Fiscal Year 2004-2005; 2005-2006; 2006-2007; 2007-2008; 2008-2009; 2009-2010, *Prepared by the Essex Building Department, As of December 7, 2011*

OTHER INFORMATION
http://www.city-data.com/city/Essex-Connecticut.html
http://www.homefacts.com/earthquakes/Connecticut/Middlesex-County/Essex.html

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
MPH:	Miles per Hour
MRPA:	Midstate Regional Planning Agency
NFIP:	National Flood Insurance Program
NFIRA:	National Flood Insurance Reform Act of 1994
NOAA:	The National Oceanic and Atmospheric Administration
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
TAC:	Technical Advisory Committee
TNC:	The Nature Conservancy
USGS:	United States Geological Survey

Appendix III - Hazus-MH: Flood Event Report

Region Name: Town of Essex

Flood Scenario: Essex Flood

Print Date: Wednesday, April 17, 2013

Disclaimer:

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

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

Table of Contents

General Description of the Region

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

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

- Connecticut

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

The geographical size of the region is 10 square miles and contains 171 census blocks. The region contains over 3 thousand households and has a total population of 6,505 people (2000 Census Bureau data). The distribution of population by State and County for the study region is provided in Appendix B.

There are an estimated 3,101 buildings in the region with a total building replacement value (excluding contents) of 811 million dollars (2006 dollars). Approximately 86.78% of the buildings (and 65.73% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,101 buildings in the region which have an aggregate total replacement value of 811 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	532,953	65.7%
Commercial	197,775	24.4%
Industrial	51,585	6.4%
Agricultural	4,405	0.5%
Religion	13,327	1.6%
Government	2,912	0.4%
Education	7,804	1.0%
Total	**810,761**	**100.00%**

Table 2
Building Exposure by Occupancy Type for the Scenario

Occupancy	Exposure ($1000)	Percent of Total
Residential	397,998	63.9%
Commercial	158,424	25.5%
Industrial	46,358	7.4%
Agricultural	2,533	0.4%
Religion	6,970	1.1%
Government	2,495	0.4%
Education	7,683	1.2%
Total	**622,461**	**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 1 school, no fire stations, no police stations 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:	Town of Essex
Scenario Name:	Essex Flood
Return Period Analyzed:	100
Analysis Options Analyzed:	No What-Ifs

Building Damage

General Building Stock Damage

Hazus estimates that about 42 buildings will be at least moderately damaged. This is over 15% of the total number of buildings in the scenario. There are an estimated 0 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 5.3 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	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	5	38.46	8	61.54	0	0.00	0	0.00	0	0.00	0	0.00
Education	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Government	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	1	50.00	0	0.00	1	50.00	0	0.00	0	0.00	0	0.00
Religion	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Residential	0	0.00	3	9.09	3	9.09	10	30.30	17	51.52	0	0.00
Total	**8**		**11**		**4**		**10**		**17**		**0**	

Table 4: Expected Building Damage by Building Type

Building	1-10		11-20		21-30		31-40		41-50		Substantially	
Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	1	100.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
ManufHousing	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Masonry	2	40.00	2	40.00	0	0.00	0	0.00	1	20.00	0	0.00
Steel	4	44.44	4	44.44	1	11.11	0	0.00	0	0.00	0	0.00
Wood	1	2.94	4	11.76	3	8.82	10	29.41	16	47.06	0	0.00

Essential Facility Damage

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

Table 5: Expected Damage to Essential Facilities

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

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

(1) None of your facilities were flooded. This can be checked by mapping the inventory data on the depth grid.

(2) The analysis was not run. This can be tested by checking the run box on the Analysis Menu and seeing if a message box asks you to replace the existing results.

Induced Flood Damage

Debris Generation

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

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 302 households will be displaced due to the flood. Displacement includes households evacuated from within or very near to the inundated area. Of these, 540 people (out of a total population of 6,505) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the flood is 47.74 million dollars, which represents 7.67 % 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 47.34 million dollars. 1% of the estimated losses were related to the business interruption of the region. The residential occupancies made up 21.61% 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	6.73	7.53	1.39	0.39	16.04
	Content	3.58	21.99	2.72	2.30	30.58
	Inventory	0.00	0.29	0.39	0.04	0.72
	Subtotal	**10.31**	**29.81**	**4.49**	**2.73**	**47.34**
Business Interruption						
	Income	0.00	0.17	0.00	0.00	0.17
	Relocation	0.01	0.04	0.00	0.00	0.05
	Rental Income	0.00	0.02	0.00	0.00	0.02
	Wage	0.00	0.14	0.00	0.03	0.17
	Subtotal	**0.01**	**0.36**	**0.00**	**0.03**	**0.41**
	Total	**10.32**	**30.17**	**4.49**	**2.76**	**47.74**

ALL

Appendix A: County Listing for the Region

Connecticut

- Middlesex

Appendix B: Regional Population and Building Value Data

		Building Value (thousands of dollars)		
	Population	Residential	Non-Residential	Total
Connecticut				
Middlesex	6,505	532,953	277,808	810,761
Total	**6,505**	**532,953**	**277,808**	**810,761**
Total Study Region	**6,505**	**532,953**	**277,808**	**810,761**

Appendix IV – Hazus-MH: Hurricane Event Report

Region Name: Town of Essex

Hurricane Scenario: Probabilistic 100-year Return Period

Print Date: Monday, April 22, 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 11.80 square miles and contains 1 census tracts. There are over 2 thousand households in the region and has a total population of 6,505 people (2000 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 811 million dollars (2006 dollars). Approximately 87% of the buildings (and 66% of the building value) are associated with residential housing.

Building Inventory

General Building Stock

Hazus estimates that there are 3,101 buildings in the region which have an aggregate total replacement value of 811 million (2006 dollars). Table 1 presents the relative distribution of the value with respect to the general occupancies. Appendix B provides a general distribution of the building value by State and County.

Table 1: Building Exposure by Occupancy Type

Occupancy	Exposure ($1000)	Percent of Tot
Residential	532,953	65.7%
Commercial	197,775	24.4%
Industrial	51,585	6.4%
Agricultural	4,405	0.5%
Religious	13,327	1.6%
Government	2,912	0.4%
Education	7,804	1.0%
Total	**810,761**	**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 1 school, no fire stations, no police stations and no emergency operation facilities.

Hurricane Scenario

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

Scenario Name:	Probabilistic
Type:	Probabilistic

Building Damage

General Building Stock Damage

Hazus estimates that about 66 buildings will be at least moderately damaged. This is over 2% of the total number of buildings in the region. There are an estimated 1 buildings that will be completely destroyed. The definition of the 'damage states' is provided in Volume 1: Chapter 6 of the Hazus Hurricane technical manual. Table 2 below summarizes the expected damage by general occupancy for the buildings in the region. Table 3 summarizes the expected damage by general building type.

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

	None		Minor		Moderate		Severe		Destruction	
Occupancy	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Agriculture	14	86.55	2	10.08	0	2.25	0	1.04	0	0.09
Commercial	232	87.38	26	9.78	7	2.49	1	0.35	0	0.00
Education	7	90.32	1	8.47	0	1.16	0	0.05	0	0.00
Government	5	90.29	0	8.40	0	1.26	0	0.05	0	0.00
Industrial	85	88.96	8	8.63	2	1.95	0	0.43	0	0.03
Religion	17	87.78	2	10.59	0	1.54	0	0.09	0	0.00
Residential	2,283	84.84	353	13.10	52	1.95	1	0.06	1	0.05
Total	**2,643**		**392**		**62**		**3**		**1**	

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

	None		Minor		Moderate		Severe		Destruction	
Building Type	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**	**Count**	**(%)**
Concrete	22	88.10	2	9.50	1	2.23	0	0.17	0	0.00
Masonry	149	82.65	21	11.66	10	5.37	1	0.29	0	0.03
MH	2	99.32	0	0.53	0	0.14	0	0.00	0	0.01
Steel	152	88.76	14	8.42	4	2.38	1	0.44	0	0.00
Wood	2,152	85.65	326	12.96	32	1.28	2	0.06	1	0.05

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**
Schools	1	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 5,748 tons of debris will be generated. Of the total amount, 2,909 tons (51%) is Other Tree Debris. Of the remaining 2,839 tons, Brick/Wood comprises 40% of the total, Reinforced Concrete/Steel comprises of 0% of the total, with the remainder being Eligible Tree Debris. If the building debris tonnage is converted to an estimated number of truckloads, it will require 45 truckloads (@25 tons/truck) to remove the building debris generated by the hurricane. The number of Eligible Tree Debris truckloads will depend on how the 1,709 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 6,505) will seek temporary shelter in public shelters.

Economic Loss

The total economic loss estimated for the hurricane is 10.5 million dollars, which represents 1.29 % 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 10 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 79% 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	6,597.72	898.51	184.5	104.11	7,784.84
	Content	1,267.16	240.11	89.67	21.98	1,618.92
	Inventory	0	6.42	14.83	1.29	22.54
	Subtotal	**7,864.88**	**1,145.04**	**289**	**127.38**	**9,426.30**
Business Interruption Loss						
	Income	0	136.98	2.96	12.63	152.57
	Relocation	296.19	162.15	14.12	16.23	488.69
	Rental	171.96	88.6	2.5	1.43	264.49
	Wage	0	112.02	4.99	36.8	153.81
	Subtotal	**468.14**	**499.76**	**24.57**	**67.09**	**1,059.56**
Total						
	Total	**8,333.03**	**1,644.79**	**313.56**	**194.48**	**10,485.86**

Appendix A: County Listing for the Region

Connecticut
- Middlesex

Appendix B: Regional Population and Building Value Data

	Population	Building Value (thousands of dollars) Residential	Non-Residential	Total
Connecticut				
Middlesex	6,505	532,953	277,808	810,761
Total	**6,505**	**532,953**	**277,808**	**810,761**
Study Region Total	**6,505**	**532,953**	**277,808**	**810,761**

Appendix V - Hazus-MH: Earthquake Event Report

Region Name: Town of Essex

Earthquake Scenario: Essex 100 year probablistic earthquake

Print Date: April 22, 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 11.80 square miles and contains 1 census tracts. There are over 2 thousand households in the region which has a total population of 6,505 people (2002 Census Bureau data). The distribution of population by State and County is provided in Appendix B.

There are an estimated 3 thousand buildings in the region with a total building replacement value (excluding contents) of 810 (millions of dollars). Approximately 87.00 % of the buildings (and 66.00% of the building value) are associated with residential housing.

The replacement value of the transportation and utility lifeline systems is estimated to be 366 and 0 (millions of dollars) , respectively.

Building and Lifeline Inventory

Building Inventory

Hazus estimates that there are 3 thousand buildings in the region which have an aggregate total replacement value of 810 (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 82% 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 1 schools, 0 fire stations, 0 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 366.00 (millions of dollars). This inventory includes over 25 kilometers of highways, 15 bridges, 290 kilometers of pipes.

Table 1: Transportation System Lifeline Inventory

System	Component	# Locations/ # Segments	Replacement value (millions of dollars)
Highway	Bridges	15	181.10
	Segments	8	169.90
	Tunnels	0	0.00
	Subtotal		**351.00**
Railways	Bridges	0	0.00
	Facilities	0	0.00
	Segments	2	13.30
	Tunnels	0	0.00
	Subtotal		**13.30**
Light Rail	Bridges	0	0.00
	Facilities	0	0.00
	Segments	0	0.00
	Tunnels	0	0.00
	Subtotal		**0.00**
Bus	Facilities	0	0.00
	Subtotal		**0.00**
Ferry	Facilities	0	0.00
	Subtotal		**0.00**
Port	Facilities	1	2.00
	Subtotal		**2.00**
Airport	Facilities	0	0.00
	Runways	0	0.00
	Subtotal		**0.00**
	Total		**366.30**

Table 2: Utility System Lifeline Inventory

System	Component	# Locations / Segments	Replacement value (millions of dollars)
Potable Water	Distribution Lines	NA	2.90
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**2.90**
Waste Water	Distribution Lines	NA	1.70
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**1.70**
Natural Gas	Distribution Lines	NA	1.20
	Facilities	0	0.00
	Pipelines	0	0.00
	Subtotal		**1.20**
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		**5.80**

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	Essex 100 year probablistic earthquake
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	16	0.52	0	0.00	0	0.00	0	0.00	0	0.00
Commercial	266	8.58	0	0.00	0	0.00	0	0.00	0	0.00
Education	8	0.26	0	0.00	0	0.00	0	0.00	0	0.00
Government	5	0.16	0	0.00	0	0.00	0	0.00	0	0.00
Industrial	96	3.10	0	0.00	0	0.00	0	0.00	0	0.00
Other Residential	292	9.42	0	0.00	0	0.00	0	0.00	0	0.00
Religion	19	0.61	0	0.00	0	0.00	0	0.00	0	0.00
Single Family	2,399	77.36	0	0.00	0	0.00	0	0.00	0	0.00
Total	**3,101**		**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	2,556	82.41	0	0.00	0	0.00	0	0.00	0	0.00
Steel	194	6.24	0	0.00	0	0.00	0	0.00	0	0.00
Concrete	37	1.19	0	0.00	0	0.00	0	0.00	0	0.00
Precast	13	0.41	0	0.00	0	0.00	0	0.00	0	0.00
RM	58	1.86	0	0.00	0	0.00	0	0.00	0	0.00
URM	239	7.72	0	0.00	0	0.00	0	0.00	0	0.00
MH	5	0.16	0	0.00	0	0.00	0	0.00	0	0.00
Total	**3,101**		**0**		**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	1	0	0	1
EOCs	0	0	0	0
PoliceStations	0	0	0	0
FireStations	0	0	0	0

Transportation and Utility Lifeline Damage

Table 6 provides damage estimates for the transportation system.

Table 6: Expected Damage to the Transportation Systems

System	Component	Number of Locations				
		Locations/ Segments	With at Least Mod. Damage	With Complete Damage	With Functionality > 50 % After Day 1	With Functionality > 50 % After Day 7
Highway	Segments	8	0	0	8	8
	Bridges	15	0	0	15	15
	Tunnels	0	0	0	0	0
Railways	Segments	2	0	0	2	2
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Light Rail	Segments	0	0	0	0	0
	Bridges	0	0	0	0	0
	Tunnels	0	0	0	0	0
	Facilities	0	0	0	0	0
Bus	Facilities	0	0	0	0	0
Ferry	Facilities	0	0	0	0	0
Port	Facilities	1	0	0	1	1
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 Complete Damage	with Functionality > 50 % After Day 1	with Functionality > 50 % 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	145	0	0
Waste Water	87	0	0
Natural Gas	58	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	2,811	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 6,505) 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	169.93	$0.00	0.00
	Bridges	181.08	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Subtotal	**351.00**	**0.00**	
Railways	Segments	13.26	$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	**13.30**	**0.00**	
Light Rail	Segments	0.00	$0.00	0.00
	Bridges	0.00	$0.00	0.00
	Tunnels	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Bus	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Ferry	Facilities	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
Port	Facilities	2.00	$0.00	0.01
	Subtotal	**2.00**	**0.00**	
Airport	Facilities	0.00	$0.00	0.00
	Runways	0.00	$0.00	0.00
	Subtotal	**0.00**	**0.00**	
	Total	**366.30**	**0.00**	

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

System	Component	Inventory Value	Economic Loss	Loss Ratio (%)
Potable Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	2.90	$0.00	0.00
	Subtotal	**2.91**	**$0.00**	
Waste Water	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	1.70	$0.00	0.00
	Subtotal	**1.74**	**$0.00**	
Natural Gas	Pipelines	0.00	$0.00	0.00
	Facilities	0.00	$0.00	0.00
	Distribution Lines	1.20	$0.00	0.00
	Subtotal	**1.16**	**$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	**5.81**	**$0.00**	

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

LOSS	Total	%

Appendix A: County Listing for the Region

Middlesex,CT

Appendix B: Regional Population and Building Value Data

State	County Name	Population	Building Value (millions of dollars)		
			Residential	Non-Residential	Total
Connecticut					
	Middlesex	6,505	532	277	810
Total State		**6,505**	**532**	**277**	**810**
Total Region		**6,505**	**532**	**277**	**810**

Appendix VI - RESOLUTION

TOWN OF ESSEX HAZARD MITIGATION PLAN

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 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 Essex, the Town developed a Natural Hazard Mitigation Plan update to understand local conditions and plan accordingly; and

WHERAS, public information meetings were held to solicit public input and recommendations and to review the plan as required by law;

WHEREAS, the Natural Hazard Mitigation Plan 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 Essex officially adopts the Natural Hazard Mitigation Plan; and

WHEREAS, the Town of Essex shall implement, maintain, and update the Hazard Mitigation Plan through the appropriate municipal departments and commissions;

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

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

Adopted this ___ day of ____ 20__ by the Board of Selectmen of Essex, Connecticut

_____

(Signatures)

Appendix VII – Meeting Minutes, Etc

ESSEX PLANNING COMMISSION

Regular Meeting
February 21, 2013
RiverCOG Office Meeting Room
145 Dennison Road, Centerbrook

MINUTES

1. **Call to Order and Seating of members:**

   Chairman Tom Danyliw called the meeting to order at 7:30 p.m. In attendance was Commissioner Alan Kerr. Seated for Linda Herman was Alternate Neil Nichols. Seated for Ralph Monaco was Alternate Claire Tiernan. Seated for Carla Feroni was Alternate Bob Laundy.

   Also in attendance were Jeremy DeCarli, RiverCOG staff; Bob Doane, PE; property-owners Roberta Bosworth and Mike Peretti, and Town Planner John Guszkowski.

2. **Approval of Minutes:**

   Motion to approve minutes of Regular Meeting of January 10, 2013 by Alan Kerr, Seconded by Claire Tiernan. Motion carried unanimously.

3. **New Business**

   a. Preliminary Discussion – Potential Subdivision, Laurel Road/Grandview Terrace

   Bob Doane, PE of Doane-Collins Engineering presented on behalf of property-owners Roberta Bosworth and Mike Peretti. He described the owners' intention to divide a 2.82 acre property with frontage on Laurel Road and an easement to Grandview Terrace. The current property is the result of a 1993 free-split of 5.6 acres and several lot-line adjustments that brought the resulting lot down to 2.82 acres. There is one house on this 2.82 acres, with a driveway off of Grandview Terrace (via 20' easement). A further split into two parcels of approximately 60,000 square feet (minimum in the VR District) would require Subdivision approval. The existing house would retain the ROW and driveway to Grandview Terrace, and the new lot would have frontage Laurel Road.

   The purpose of the preliminary discussion was to gauge the Commission's receptivity to flexibility on issues of open space and rear lots. While the current lot has frontage on Laurel Road, it functions as a rear lot, using an easement off of Grandview Terrace. This house would continue to use the easement, and the new lot would take over the Laurel Road frontage. This division would technically create one rear and one front lot, which

exceeds the 1/5 rear-lot cap in the Subdivision Regulations. Bob Doane stated that his clients would request a waiver of this provision, and discussed how this would be the only rear lot of the five total lots created from the original parcel since the 1960's. The Commission generally agreed that as there was no new rear-lot access being proposed, the waiver did not seem unreasonable.

The other issue to be discussed was the open space provision. As the 2.82 acre property could not set aside 20% of land for conservation and still accomplish a subdivision, Bob Doane proposed that the applicants would request the payment of a fee in lieu of open space.

Alan Kerr asked questions of clarification on property history and why the easement existed to Grandview Terrace. Bob Laundy sought confirmation that the Laurel Road frontage was accessible and the soils were favorable. Bob Doane confirmed both of these points, though soil testing for septic systems had not been done on this lot yet. Surrounding properties had acceptable soils.

b. Natural Hazard Mitigation Plan Update – Report from RiverCOG

Jeremy DeCarli from RiverCOG provided a summary to the Commission of the Natural Hazards Mitigation Plan that is being undertaken on a town-by-town basis by RiverCOG. He described the purpose of the Plan, which is largely to identify critical properties and resources and secure eligibility for FEMA grants for Hazard Mitigation and pre-disaster planning. Such projects as elevation of roadways, acquiring flood-prone properties, and purchase of emergency equipment were all tied to the presence of a Hazard Mitigation Plan.

Jeremy DeCarli described the process that Old Saybrook is completing and sought guidance from the Commission on their interest in guiding and developing a plan for Essex. He stated that he had started a draft update, based on the 2006 Regional Hazard Mitigation Plan, which contained an Essex appendix. Chairman Danyliw asked who should be involved in this project, and suggested that John Guszkowski be the point person for the Commission. Emergency Management Director Bill Buckridge, Public Works Director Dave Caroline, Town Engineer Bob Doane, and Selectman Stacia Libby were all suggested as key individuals to assist in plan review and development.

Jeremy DeCarli stated that the overall plan needed to be complete by August 2014, but the RiverCOG sought to shorten that deadline. He suggested that he and John Guszkowski would distribute the draft plan to the key individuals and the Commission and would seek comments by mid-April. He thanked the Commission for their interest and help.

Motion to add agenda item 3c to discuss re-naming Earl Street Extension by Neil Nichols, **seconded** by Claire Tiernan. **Motion carried unanimously.**

c. Referral from Traffic Authority – Proposed Change of Name of "Earl Street Extension"

John Guszkowski explained that the Traffic Authority (the Board of Selectmen) had received a request to change the name of Earl Street Extension, which is a short dead-end road south of the Earl Street/View Street intersection, to "Earl Street." The mapping

7. **Adjournment**

Motion to adjourn by Neil Nichols, Seconded by Bob Laundy. Motion carried unanimously. Meeting adjourned at 8:55 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner

Draft Minutes

ESSEX PLANNING COMMISSION

Regular Meeting
March 21, 2013
RiverCOG Office Meeting Room
145 Dennison Road, Centerbrook

MINUTES

4. **Old Business**

   a. **Natural Hazards Mitigation Plan**

   John Guszkowski requested that Commissioners continue to read through the first draft of the Plan prepared by Jeremy DeCarli of RiverCOG and forward any comments to him. Carla Feroni volunteered to help with the draft review and overall process.

7. **Adjournment**

Motion to adjourn by Linda Herman, Seconded by Claire Tiernan. Motion carried unanimously. Meeting adjourned at 9:48 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner

Draft Minutes

ESSEX PLANNING COMMISSION

Regular Meeting
April 18, 2013
RiverCOG Office Meeting Room
145 Dennison Road, Centerbrook

MINUTES

4. **Old Business**

   a. **Natural Hazards Mitigation Plan**

   The Commission reviewed a memo from Jeremy DeCarli of RiverCOG updating the Commission on progress in writing the NHM Plan. John Guszkowski stated that Carla Feroni and he had been working with Jeremy on a revision to the first draft. Jeremy had included a proposed schedule of review and adoption for the Plan, and John Guszkowski encouraged the Planning Commissioners to supply any feedback on the first draft within the next month.

7. **Adjournment**

   Motion to adjourn by Linda Herman, Seconded by Claire Tiernan. Motion carried unanimously. Meeting adjourned at 9:50 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner

Draft Minutes

ESSEX PLANNING COMMISSION

Regular Meeting
May 9, 2013
Essex Town Hall – Room A

MINUTES

4. **Old Business**

   a. **Natural Hazards Mitigation Plan**

   John Guszkowski stated that Carla Feroni and he had been working with Jeremy on a revision to the first draft, and would be meeting later in May to finish the review of the first draft. He anticipated a revision for the June meeting.

7. **Adjournment**

   Motion to adjourn by Linda Herman, **Seconded** by Bob Laundy. **Motion carried unanimously.** Meeting adjourned at 9:04 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner

Draft Minutes

ESSEX PLANNING COMMISSION

Regular Meeting
June 13, 2013
Essex Town Hall – Auditorium

MINUTES

b. **Natural Hazards Mitigation Plan**

John Guszkowski stated that a revision had taken place and noted the list of priorities prepared by RiverCOG, each with proposed primary implementation entity. The Planning Commission will review the action list and provide edits or input to John Guszkowski by the end of June. Ralph Monaco questioned whether "tsunami" was a necessary disaster to consider.

7. **Adjournment**

Motion to adjourn by Linda Herman, **Seconded** by Ralph Monaco. **Motion carried unanimously.** Meeting adjourned at 9:31 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner

Draft Minutes

ESSEX PLANNING COMMISSION

Regular Meeting
July 11, 2013
Essex Town Hall – Room A

MINUTES

4. **Old Business**

a. **Natural Hazards Mitigation Plan**

John Guszkowski stated that the Plan development was ongoing and that he and Jeremy DeCarli of RiverCOG were in the process of interviewing public officials for input, including the Building Official/Fire Marshal, First Selectman, Finance Director, and Public Works Director. Carla Feroni asked for an update on the status of the contract, deadlines, and finances. John Guszkowski will follow up with RiverCOG on those details.

7. **Adjournment**

Motion to adjourn by Linda Herman, **Seconded** by Bob Laundy. **Motion carried unanimously.** Meeting adjourned at 8:42 p.m.

Respectfully submitted,

John Guszkowski
Consulting Town Planner