HAZARD MITIGATION PLAN UPDATE
ANNEX FOR THE TOWN OF GROTON

Southeastern Connecticut Council of Governments
Multi-Jurisdictional Hazard Mitigation Plan Update

DECEMBER 2017

ADOPTED

MMI #3570-09

Prepared for:

TOWN OF GROTON
45 Fort Hill Road
Groton, Connecticut 06340
(860) 441-6630
www.groton-ct.gov

Prepared by:

MILONE & MACBROOM, INC.
99 Realty Drive
Cheshire, Connecticut 06410
(203) 271-1773
www.miloneandmacbroom.com

ACKNOWLEDGEMENTS

This HMP annex update could not have been completed without the time and dedication of the following individuals at the local level:

Jonathan Reiner, AICP — **Director of Planning and Development, Local Coordinator**
134 Groton Long Point Road
Groton, CT 06340
(860) 446-5995
(860) 446-5978 Fax
JReiner@groton-ct.gov

Gary Schneider — **Director of Public Works**
Greg Hanover — **Department of Public Works Supervisor of Technical Services**
Deborah Jones — **Assistant Director, Planning, Zoning and Wetlands**
Matt Allen — **Planning and Development**
Joe Sastre — **Emergency Management Director**

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1.0 INTRODUCTION

1.1 Purpose of Annex

The purpose of this HMP annex is to provide an update to the natural hazard risk assessment and capability assessment provided in the previous HMP, and to evaluate potential natural hazard mitigation measures and prioritize natural hazard mitigation projects specific to mitigating the effects of natural hazards to the Town of Groton. Background information and the regional effects of pertinent natural hazards are discussed in the main body of the Southeastern Connecticut Council of Governments (SCCOG) Multi-Jurisdictional Hazard Mitigation Plan. Thus, this annex is designed to supplement the information presented in the Multi-Jurisdictional HMP with more specific detail for the Town of Groton and is not to be considered a standalone document.

The primary goal of this hazard mitigation plan annex is to identify risks to natural hazards and potential mitigation measures for such natural hazards in order to ***reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources.*** This includes the reduction of public and private damage costs. Limiting losses of and damage to life and property will also reduce the social, emotional, and economic disruption associated with a natural disaster.

1.2 Setting

The Town of Groton is an urbanized municipality located in the south-central portion of the southeastern Connecticut shoreline. The local government of the Town is separate from that of the City of Groton (a political subdivision of the municipality). The Town is bordered by, the Thames River to the west, Ledyard to the north, Stonington to the east, and Fishers Island Sound to the south. The Town of Groton can be accessed by Interstate 95 and the Boston Post Road (Route 1). According to the 2000 U.S. Census, Groton had a year-round population of 39,907 people. The 2010 census data revealed a population of 40,115, an increase of approximately 208 persons since Census 2000.

1.3 Plan Development

The 2012 HMP and its annexes were developed through a series of meetings and the completion of written questionnaires, personal interviews, and workshops as described in the Multi-Jurisdictional HMP update. Since that time, the HMP has been available in local governmental offices and available to emergency personnel. Residents were encouraged to contact the Emergency Management Director with any concerns regarding emergency response and/or the Emergency Management Director or the Director of Planning and Development regarding potential projects related to natural hazard damage.

Based on the 2012 edition of the HMP and the hazards that have occurred since 2012, SCCOG determined that the following data collection program would be sufficient to collect data to update the Multi-Jurisdictional plan and this annex.

- A data collection meeting was held with Town Staff on November 22, 2016 to discuss the scope and process for updating the plan and to collect information. The Director of Planning and Development coordinated the local planning team which included the Director of Public Works, the Department of Public Works Supervisor of Technical Services, the Assistant Director of Planning, Zoning and Wetlands, a Planning and Development staff member, and the Emergency Management Director. The meeting focused on reviewing each section of the existing hazard mitigation plan and annex, critical facilities, and various types of hazards that have affected the Town and that should be addressed in the update.

- The SCCOG issued a press release on November 4th, 2016 announcing two public information meetings on the multi-jurisdictional HMP update. This press release was published in the Norwich Bulletin and The Day, as well as in relevant local "Patch" news websites. This notice was also posted on the SCCOG Facebook page and website. The public information meetings were held on November 28 and December 1, 2016, at the Town of Groton Library and the SCCOG office, respectively.

- A survey soliciting public input was hosted at www.surveymonkey.com/r/SCCOGHazard from October 17, 2016 through March 17, 2017. Topics addressed by the survey included the types of natural hazards that concern participants, the assets, infrastructure, and government services they feel are most at risk, and the types of mitigation measures they support. The survey link was publicized along with the public meetings in The Day, The Norwich Bulletin, and local Patch websites, and at all public meetings.

- The draft that is sent for State review will be posted on the Town website (www.groton-ct.gov) as well as the SCCOG website (http://www.seccog.org) for public review and comment. In addition, a hard copy will be made available in the SCCOG office in Norwich. A press release will announce the availability of the HMP for review. This will provide residents, business owners, and other stakeholders throughout the SCCOG region the opportunity to review and comment on a relatively complete draft with all annexes. Comments received from the public will be incorporated into the final draft where applicable following State and Federal comments.

The adoption of this HMP update by the Town of Groton will be coordinated by SCCOG and the Planning Department. The HMP update must be adopted within one year of conditional approval by FEMA, or the Town will need to update the HMP and resubmit it to FEMA for review. The adoption resolution is located in Appendix A of this annex.

1.4 Progress Monitoring

Following adoption, the Office of Planning and Development Services, with assistance from the Department of Emergency Management, will administer this HMP under the authority of the Mayor and Town Council. The Director of Planning and Development will be the local coordinator of the HMP, and the Emergency Management Director will be the deputy local coordinator. The Office of Planning and Development Services will coordinate with responsible departments as listed in Table 11-1 and ensure that the recommendations of this HMP are considered or enacted. Refer to Section 1.8 of the Multi-Jurisdictional HMP for a description of

how the local coordinator will perform progress monitoring. The majority of recommendations in this annex can be accomplished within or with only a slight increase in the operating budgets of the various departments. Projects that require capital improvements or additional funding will need to be approved by the Town Council.

The HMP will be on file with the Office of Planning and Development Services to assist in guiding growth decisions. See Section 2.5 for recommendations related to integrating the findings of this HMP into other Town planning documents. The Town will encourage residents to contact the Office of Planning and Development Services or Emergency Management Director with concerns related to natural hazards or emergency response via the Town's website. Such announcements will also state that the HMP is available for public review at the Office of Planning and Development Services as well as available on the Town's and the SCCOG's website.

The Town of Groton will review the status of plan recommendations each year. The Office of Planning and Development Services will assist respective departments in the implementation of recommended projects and coordinate an annual meeting with applicable departments (those listed in Table 11-1) and other interested departments. Refer to Section 1.8 of the Multi-Jurisdictional HMP for a list of matters to be discussed at the annual meeting, including a review of each recommendation and progress achieved to date, or reasons for why the recommendation has not been enacted. The Office of Planning and Development Services will keep a written record of meeting minutes and the status of the recommendations. These records of progress monitoring will form the basis for the next HMP update.

The Town of Groton understands that the multi-jurisdictional HMP and this annex will be effective for five years from the date of FEMA approval of the first SCCOG jurisdiction regardless of the date of adoption by the Town. The Office of Planning and Development Services will coordinate with SCCOG for the next HMP update which is expected to occur in 2022.

2.0 COMMUNITY PROFILE

2.1 Physical Setting

The Town of Groton is a coastal community located on the Connecticut shoreline. Elevations range from sea level along the Thames River and Fishers Island Sound to just over 300 feet in the northern portion of the Town.

Geology is important to the occurrence and relative effects of natural hazards such as earthquakes. The Town of Groton lies above four bedrock types which trend northwest to southeast across the area. These are the Potter Hill Granite Gneiss, the Plainfield Formation and the quartzite member of the Plainfield Formation, Rope Ferry Gneiss, and small intrusions of Westerly Granite. Each of these formations consists primarily of gneiss, a relatively hard metamorphic rock except for the hard, igneous granite intrusions. Two faults are mapped within the eastern section of the town, trending north-south. Although they are believed to be inactive, they are associated with the Honey Hill/Lake Char fault system that extends west to east through Salem, Montville, and Preston and has been linked to minor seismic activity in East Haddam.

The Town's surficial geologic formations include glacial till, stratified drift, and coastal formations. Refer to the Multi-Jurisdictional HMP for a generalized view of surficial materials. The majority of the Town is underlain by glacial till. Till contains an unsorted mixture of clay, silt, sand, gravel, and boulders deposited by glaciers as a ground moraine. The exception is a vast area from Poheganut Reservoir and Smith Lake, extending south along the Poquonock River (also spelled "Poquonnock") and west through the airport which is underlain by stratified drift. Other minor stratified drift deposits are found along watercourses.

The amount of stratified drift present is important as areas of stratified materials are generally coincident with floodplains. These materials were deposited at lower elevations by glacial streams, and these valleys were later inherited by the larger of our present day streams and rivers. However, the smaller glacial till watercourses can also cause flooding. The amount of stratified drift also has bearing on the relative intensity of earthquakes and the likelihood of soil subsidence in areas of fill.

2.2 Land Use and Development Trends

SCCOG data on land use collected in 2011 indicates that approximately 56% of town land is developed, 24% has been dedicated to open space, and 20% remains hypothetically open to development. These figures include the City of Groton.

According to the 2016 Town of Groton Plan of Conservation and Development, 57.2% of Groton (11,653 acres) is developed (occupied by residential, commercial, institutional, or transportation uses). 23% (4694 acres) is dedicated open space. 14.5% of the land in Groton (2,946 acres) is vacant. These figures, too, include the City of Groton.

The principal communities of Groton include:

- Burnett's Corner
- Center Groton
- City of Groton (addressed in a separate annex)
- Poquonock Bridge
- Groton Long Point
- Noank
- Long Hill
- West Mystic (the village of Mystic spans eastern Groton and western Stonington)
- Old Mystic (Old Mystic also spans eastern Groton and western Stonington)
- Submarine Base area

The Town of Groton has an extensive coastline which includes several peninsulas (such as Groton Long Point and Noank) as well as the west bank of the Mystic River and its shoreline. A large tract of land called Bluff Point, a State coastal preserve, lies along the shoreline between the Poquonock River estuary and Mumford Cove. Groton-New London Airport is located within the south-central portion of Groton. The U.S. Naval Submarine Base is situated along the Thames River spanning into the Towns of Groton and Ledyard. A large number of residents living in the Town of Groton are employed by or stationed at the submarine base. Other notable employers in the area include the Pfizer Corporation, Electric Boat, and the University of Connecticut at Avery Point (all three located in the City of Groton).

Developable land is present in Groton, and a number of new developments have been completed within the last few years:

- The Fairview Senior Living Community constructed a number of new homes, including congregate units, assisted living units, and active senior units, behind the existing Oddfellows facility.
- A development by Mystic Active Adult LLC named "Four Winds at Mystic" is expected to include 247 units on Noank-Ledyard Road. Construction was to start in March 2016 and is to be completed by March 2020.
- A 144-unit apartment development at the corner of Gungywamp Road and Route 12 (which has been mostly completed).
- A new middle school is being constructed.
- The Caldor Plaza Shopping Center at the junction of route 12 and Interstate 95 has been converted to Electric Boat offices.

For the most part, these projects are located outside of flood hazard areas and away from steep slopes, within areas of public water service and fire protection. Therefore disaster resilience is expected to remain high for new projects.

2.3 Drainage Basins and Hydrology

Groton is divided among six sub-regional watersheds: Great Brook (including the Poquonock River, Haleys Brook, Mystic River, Southeast Shoreline, Thames River, and Whitford Brook. All of the drainage basins directly or indirectly drain to Long Island Sound.

Streams in the extreme western part of Town drain to the Thames River. Streams in the north-central region of the Town drain to Great Brook, which discharges to the Poquonock River. Streams in the northeast part of Town drain to Red Brook, Haleys Brook, and Blindloss Brook, flowing eastward towards the Mystic River. Streams in the central and southern portion of the Town drain southward to Birch Plain Creek eventually discharging to the sound in Baker Cover; Fort Hill Brook eventually discharging to the sound in Mumford Cove; and Eccleston Brook or Fishtown Brook eventually discharging to the sound in Palmer Cove.

In addition, the town contains a number of large reservoirs, namely Ledyard Reservoir, Groton Reservoir (extending both north and south of I-95), Poheganut Reservoir, and Smith Lake. These are public water supply reservoirs owned by Groton Utilities.

2.4 Governmental Structure

Groton is governed by a Council-Manager form of government. The Town Council is the legislative body of the Town. The Town Manager is appointed by and is directly responsible to the Council and serves for no definite term. The Town Manager plans, organizes, coordinates, and administers the day-to-day functions of the Town government. The Manager is responsible for the preparation of the general government budget. Before approving the budget, the Council must hold public hearings.

The Town of Groton is responsible for education, public works and police services throughout its municipal boundaries. The City of Groton is responsible for most services within its own boundaries and maintains its own HMP annex. Groton has three additional political subdivisions or jurisdictions. These are Noank, Groton Long Point, and the Navy Base. Although all three are covered in the subject HMP annex, they maintain separate governmental or organizational structures. In particular, Groton Long Point and Noank maintain their own zoning regulations. The following graphic depicts the relationships between Groton Town, Groton City, Noank, Groton Long Point, and the Navy Base. For clarification, some of the Groton villages such as Center Groton are listed in the chart.

	Geographic Area								
	Poquonnock Bridge	Center Groton	Mystic	Old Mystic	West Pleasant Valley	Noank	Groton Long Point	City of Groton	Navy Base
Overall Government	Town of Groton					Town & Noank	Town & Assoc.	Town & City	Navy
Education	Town of Groton								
Public Works	Town of Groton							City of Groton	Navy
Police	Town of Groton						Town & GLP.	City of Groton	Navy
Wetlands	Town of Groton						GLP Assoc.	City of Groton	Navy
Land Use Planning	**Town of Groton**						GLP Assoc.	City of Groton	Navy
Zoning	**Town of Groton**					Noank	GLP Assoc.	City of Groton	Exempt
Recreation	Town of Groton					Town & Noank	Town & GLP.	Town & City	Town & Navy
Fire	Poquonnock Bridge	Center Groton	Mystic	Old Mystic	City of Groton	Noank	GLP Assoc.	City of Groton	Navy
Ambulance, Rescue & Paramedic	Groton Ambulance Association (GAA)		Mystic River Ambulance Association		GAA	Mystic River Ambulance Association		GAA	Navy & GAA

Graphic originally from Town of Groton Plan of Conservation and Development, 2002 (with modification)

The Town of Groton has several departments that provide municipal services. Departments pertinent to natural hazard mitigation include the Office of Emergency Management, Office of Planning and Development Services, Police, and Public Works. In addition, the fire districts (described in Section 2.6) and several boards and commissions that can take an active role in hazard mitigation, including the Conservation, Harbor Management, Planning, Zoning, and Economic Development Commissions. The general roles of most of these departments and commissions are common to most municipalities in SCCOG and were described in Section 2.8 of the Multi-Jurisdictional HMP. More specific information for certain departments and commissions of the Town of Groton is noted below:

- The Office of Emergency Management is separate from the fire districts and oversees emergency management, EOC operations, and the Town of Groton's Emergency Communications Center (ECC).

- The Office of Planning and Development Services merges the duties and responsibilities of the former Planning Department, Building Inspection Office, Office of Community Development, and Economic Development staff. The agency acts as a liaison with State and local agencies, carries out development activities on behalf of the Town and provides planning and staff assistance to the Town Manager's Office, land use and other boards and commissions, and other Town departments and political subdivisions. The office carries out its mission through four divisions: Planning and Environmental Protection, Inspection Services; Community Development; and Economic Development.

- The Building Official has a unique responsibility when it comes to hazard mitigation as he or she is responsible for overseeing a number of codes such as those related to wind damage

prevention as well as those related to inland and coastal flood damage prevention. Many important types of pre-disaster mitigation are funneled through and enforced by the Building Department. For example, the Inspection Services Division enforces A- and V-zone standards for floodproof construction and building elevations, maintains elevation certificates, and enforces building codes that protect against wind and fire damage.

- Day-to-day duties of the Police Department include crime prevention, criminal investigations, traffic enforcement, motor vehicle accident investigations, and patrols. Duties related to natural hazard mitigation include planning and coordination of personnel, equipment, shelters, and other resources necessary during an emergency. The types of mitigation that are directly administered by the Police Department include mainly emergency services and public education.

- The Public Works Department maintains the infrastructure of roads, bridges, and stormwater management. The Public Works Department also conducts snow removal and deicing on roads; tree and tree limb removal in rights-of-way; and maintains and upgrades storm drainage systems to prevent flooding caused by rainfall. As is common throughout Connecticut, the Public Works Department is often charged with implementing numerous structural projects that are related to hazard mitigation. Specifically, roadway/infrastructure maintenance and complaint logging/tracking are the two primary duties of the Public Work Department. For example, the Public Works Department tracks, plans, prepares for, and responds to flooding, inundation, and/or erosion of roads and infrastructure such as the sewer pumping station and the wastewater treatment plants.

- The Inland Wetlands Agency enforces the Inland Wetland Regulations and reviews development projects in wetlands and the adjacent review areas.

- The Conservation Commission maintains an index of all open areas and recommends to the planning commission plans and programs for the development and use of such areas. The Commission may acquire land and easements in the name of the town and promulgate rules and regulations, including charges for the use of the land and easements. It may supervise and manage town-owned open space or park property upon delegation by the entity which has responsibility for such property.

- The Harbor Management Commission oversees the development and use of the coastal waters in and around the Town of Groton. The commission maintains the Town's Harbor Management Plan; proposes ordinances and regulations to implement the plan and specifies fines for violation; assists the harbormaster in the assignment of mooring and anchorage areas and the collection of mooring fees; prepares an operating budget; assists in the coordination of all agencies which provide service based upon the harbor; reviews any application for a state or federal permit within its jurisdiction and responds with recommendations; and conducts studies of the conditions and operations in and out of town waters and presents proposals.

- The Planning Commission and Zoning Commission oversees orderly and appropriate use and development of residential, commercial, and industrial land and the conservation of natural

resources. They review and approve a wide range of land use applications, zoning regulation amendments, planning and development projects, and grant opportunities to ensure that development and growth in the Town is consistent with existing land use, environmental policy, and the objectives of the Plan of Conservation and Development. They are assisted by the professional staff of the Office of Planning and Development Services who administer the Town's Zoning and Subdivision regulations, administer the Coastal Management Program, perform planning studies, and provide technical assistance to developers and the public.

- The Economic Development Commission conducts research into the economic conditions and trends, makes recommendations regarding action to improve the economic condition and development, and seeks to coordinate the activities of and cooperate with unofficial bodies.

- Groton Utilities provides electricity and potable water to portions of the Town. They maintain and test fire hydrants utilized by the Fire Department. Eversource, Aquarion Water Company, and Comcast are the other utility providers in the area.

Town staff report that budget cuts have forced staffing reductions since the time of the previous HMP; nevertheless, the roles of Town departments have not significantly changed. Practically this has resulted in fewer staff members performing the same duties as were previously accomplished with a larger staff. Despite this, the Town of Groton continues to be technically, financially, and legally capable of implementing mitigation projects for natural hazards.

2.5 Review of Existing Plans and Regulations

The Town has several Plans and regulations that suggest or create policies related to hazard mitigation. These policies and regulations are outlined in the Emergency Operations Plan, Plan of Conservation and Development, Zoning Regulations, Subdivision Regulations, and Inland Wetland Regulations.

Emergency Operations Plan

The Town has an Emergency Operations Plan (EOP) that is updated annually. This document provides general procedures to be instituted by the Town Manager and/or designee, Police Department, and Fire Department in case of an emergency. Emergencies can include but are not limited to natural hazard events such as hurricanes and nor'easters. The EOP is directly related to providing emergency services prior to, during, and following a natural hazard event. A physical copy of the EOP is housed at the Police Department.

Plan of Conservation and Development (2016)

The Plan of Conservation and Development was adopted in 2016 with contributions from local boards and commissions, citizens, and citizen groups. The purpose of the plan is to balance

growth with maintaining the quality of life that citizens within the Town embrace. A major goal of the most recent update was to incorporate the themes of energy and sustainability into each planning area.

In addition to acting as a standalone planning document, the POCD explicitly integrates other planning documents. Included in this are the Municipal Coastal Program and the 2012 edition of the Hazard Mitigation Plan.

Recommendations of the POCD include several related to hazard mitigation throughout the plan, including:

- ❑ Develop Low Impact Development Regulations
- ❑ Review and retrofit town-owned stormwater basins and drainage structures to improve water quality
- ❑ Update regulations to conserve important natural resources
- ❑ Fund open space acquisition annually in the Capital Improvement Program
- ❑ Revise the Zoning and Subdivision regulations to increase open space and recreation requirements and to provide standards for improvements
- ❑ Develop an action plan to establish, expand, and connect greenbelts and State Greenways both within Groton and with adjacent towns.
- ❑ Complete a Harbor Management Plan for Groton
- ❑ Develop a program to prioritize and implement the selected strategies outlined in the Municipal Coastal Program, including development of plans to restore eroded tidal marshes, to acquire land for marsh advancement, and to reduce the direct discharge of stormwater to coastal waters.
- ❑ Create a coastal overlay zone to manage coastal development.
- ❑ Include historic assets and historic districts as critical features that merit protection and/or planning when considering Disaster Mitigation Plans, especially with regards to flooding, storm surge, sea level rise, and coastal erosion.

The Groton POCD is considered completely consistent with the current goals and actions of the hazard mitigation plan, as it directly references the 2012 Hazard Mitigation Plan. The next update to the POCD (scheduled for 2026, outside the life of the current hazard mitigation plan) should continue to incorporate the elements of the hazard mitigation plan.

Municipal Coastal Program (2016)

The Municipal Coastal Program (MCP) exists as a stand-alone document, and its recommendations are included within the POCD. It was updated concurrently with the POCD. The document includes identification and description of the major coastal-related issues and problems such as erosion, flooding, recreational facilities, and utilization of port facilities. It includes a description of the municipal boards, commissions and officials responsible for implementing and enforcing the coastal program and review of coastal site plan reviews. Most significantly, the MCP serves as the Town's coastal resilience plan, since it reviewed sea level rise and future flood risks to help inform objectives and specific actions.

Zoning Regulations (2016)

In Groton, the Planning and Zoning Commission is charged with administering the Zoning Regulations. Current Zoning Regulations are effective November 2, 1987 and have been revised through May 16, 2016. Updates since the previous HMP include incorporation of the DFIRMS adopted in 2013, and changes to the Waterfront Design District, Open Space Subdivisions, and Erosion and Sediment Control Plan. Additional changes to Flood Protection Regulations were made in 2015.

Flood protection regulations are found in Section 6.6 and Coastal Resource Setbacks are found in Section 6.8. Section 6.6 is essentially the local articulation of the NFIP regulations. Groton identifies Coastal AE zones (seaward of the Limit of Moderate Wave Action) as having a higher risk than other AE zones, and requires that new or substantially improved residential structures have one-foot of freeboard in Coastal AE zones. One foot of freeboard is also required for all new construction and substantial improvement in V zones. Substantial Improvement is defined as cumulative over a one-year period.

The Coastal Resources Setback section prohibits new building construction, including minor additions to or modifications of existing buildings or detached accessory buildings, such as garages, utility sheds, pools, tennis courts, or parking lots within 50 feet of any of the following Coastal Resource Areas: coastal waters, tidal wetlands, coastal bluffs, escarpments, beaches or dunes. This section is believed appropriate for facilitating disaster-resistant construction. The section does not apply to water-dependent uses.

The City is in the process of rewriting the entire Zoning and Stormwater Regulations.

Subdivision Regulations (2006)

The Groton Subdivision Regulations have been amended through November 1, 2006. In Groton, the Planning Commission is charged with administering Subdivision Regulations. Components of the regulations that directly or indirectly address hazard mitigation (flooding, public safety, etc.) are found in Section 4.4 - Drainage, Storm Sewer, and Flood Prevention. The regulations also require fire protection by extension of the public water system and installation of hydrants, where feasible.

Inland Wetland and Watercourses Regulations (2011)

In Groton, the Inland Wetlands Commission is charged with administering the Inland Wetland and Watercourses Regulations. The Groton Inland Wetlands and Watercourses Regulations have been amended through July 1, 2011. In Connecticut, wetlands are identified as related to flood hazard mitigation within the state enabling regulations, and this is often stated as such in the title section of local regulations. Review areas in Groton are variable as follows:

- Within 150 feet measured horizontally from Eccleston Brook, Bindloss Brook, Fort Hill Brook and Birch Plain Creek;

- Within 200 feet measured horizontally from Great Brook, Beaver Dam Brook, Hatching House Brook, Hempstead Brook, and Haley Brook; and
- Within 100 feet measured horizontally from the boundary of any other wetland or watercourse.

The variable regulated area is believed to moderately assist with review of flood-related issues when considering land development applications.

Climate Change Planning

The Town of Groton has participated in an EPA-funded climate change planning process in 2010 and 2011. The process resulted in the report "Preparing for Climate Change in Groton, Connecticut: A Model Process for Communities in the Northeast" (April 2011). During the workshops held in Groton, workshop participants identified the following as climate related impacts likely to affect Groton:

- More frequent river and coastal flooding;
- Increased coastal erosion;
- Increased precipitation, flooding, drought, and erosion;
- More frequent flooding that could prevent access to and reduce function of Groton-New London Airport;
- Access to state parks such as Bluff Point and Haley Farm could be hampered by flooding;
- Docks and marina facilities could be damaged by flooding and sea level rise;
- Increased economic impacts related to infrastructure replacements, loss of employment hours, additional emergency service personnel, and others arising from no action scenarios;
- Sections of Amtrak railroad could flood under certain sea level rise and storm flooding scenarios;
- Mystic River bridge may experience additional openings for smaller boats as bridge clearance diminishes with sea level rise;
- Overall quality of life, aesthetics, and enjoyment of citizens may be reduced.

Specific locations were also identified by workshop participants as vulnerable to climate change impacts such as sea level rise, increased storm frequency, and increased storm intensities:

Transportation

- Poquonnock Road
- Fort Hill Road
- Groton Long Point Road
- Route 649 Amtrak railroad underpass
- Route 117 at Route 1
- Route 1 at Fishtown Road
- Route 1 at Poquonnock Bridge
- Route 27 at Mystic River Bridge
- Mystic River Bridge

Other Town/City Infrastructure

- ❑ Reservoir and Water Treatment Plant
- ❑ Wastewater Treatment Plant and Pump Stations – 30% of pump stations are along the coastline
- ❑ Claude Chester Elementary School
- ❑ Cutler Middle School

Residential Locations

- ❑ Mumford Cove
- ❑ Groton Long Point
- ❑ Noank
- ❑ Eastern Point
- ❑ Mystic

Commercial Locations

- ❑ Downtown Mystic
- ❑ Poquonnock Bridge
- ❑ Airport Industrial Park

Ecological Resources

- ❑ Birch Plain Creek – Baker Cove
- ❑ Fort Hill Brook – Mumford Cove
- ❑ Eccleston Brook – Palmer Cove
- ❑ Groton Long Point Marshes

Emergency Services

- ❑ Police and Fire Operations
- ❑ Emergency Medical Services

Numerous adaptation strategies were developed by workshop participants:

1. Relocate/Elevate vulnerable roads and infrastructure – ensure emergency access and preservation of public safety during extreme events;
2. Develop Memorandums of Understanding with state personnel regarding funding of local police costs incurred to protect safety along vulnerable state owned road infrastructure during and after storm, so that police can also monitor other hazardous areas;
3. Stormwater runoff reduction program designed to control peak discharges and to require post- development rates of runoff to be no greater than pre-development conditions in most circumstances;
4. Flood-proofing of existing buildings;
5. Conversion of land upriver to wetlands in order to accommodate increased sea level rise;

6. Creation of incentives for retreat zoning and/or zoning and redevelopment restrictions and building code changes or enforcement to prevent building in the most vulnerable locations;
7. Educational programs that alert residents about climate change and vulnerable areas of the Town;
8. Purchase of vulnerable land or land that will act as a buffer by Groton;
9. More stringent building and engineering design standards that anticipate future climate conditions, as opposed to just existing conditions;
10. Beach nourishment;
11. Installation of flood/tide gates at locations such as Groton Long Point and Mumford Cove;
12. Creation of a comprehensive watershed management plan for debris and culverts, in partnership with Amtrak and CTDOT;
13. Improved road condition reports during extreme events, in order to help the school district and other agencies to identify the safest transportation routes;
14. Identification of Town, State, and Federal funding available to make the improvements to infrastructure that is deemed highly vulnerable;
15. Integrate climate preparedness into the Capital Planning process, Master Plan of Conservation and Development update process, the zoning regulations revision, and streetscape project; and
16. Investigate the logistical challenges of incorporating climate change, adaptation, and preparedness into school curriculum.

Many of the above strategies and actions were incorporated directly into the 2012 HMP, the 2016 Plan of Conservation and Development, and the Municipal Coastal Program. Specifically, strategies 1, 3-5, 7-11, and 16 were incorporated into the 2012 HMP annex as specific recommendations.

2.6 Critical Facilities, Sheltering Capacity, and Evacuation

The Town of Groton considers numerous facilities to be critical to ensure that emergencies are addressed while day-to-day management of the Town continues. In addition, locations with populations that may be at additional risk during an emergency are also considered to be critical. Critical facilities are presented on figures throughout this annex, summarized in Table 2-1, and described below.

Fire and Emergencies Services

The Town of Groton has nine separate fire districts, ten station houses (all critical facilities), over 30 fire-fighting vehicles, and over 200 paid and volunteer firefighters. In addition, Groton has two ambulance service companies. The nine fire districts in Groton include:

- Center Groton Fire District
- Groton Long Point Fire Department
- Noank Fire District
- Mystic Fire District (shared with Town of Stonington)
- Old Mystic Fire District (shared with Town of Stonington)
- Poquonnock Bridge Fire District

- Mumford Cove Association (contracts fire services through the Noank Fire District)
- West Pleasant Valley Fire District (contracts fire services from the City of Groton Fire District)
- City of Groton Fire District (separate HMP annex; not listed in Table 2-1 above)

As noted in the above list, two of the fire districts extend into the Town of Stonington; these are the Mystic and Old Mystic fire districts. In most cases, there is one fire station in each district. However, the Mystic and Old Mystic fire districts each have two fire stations, with one each in the Town of Stonington. The City of Groton district has two stations, as well.

Fire services are also provided by the Groton-New London airport fire service and the U.S. Navy Base Fire Department.

Municipal Buildings

The Town Hall houses land records and is the town's IT hub, and is therefore a critical facility. The Town Hall Annex on Groton Long Point Road is not considered a critical facility. The adjacent Town Garage on Groton Long Point Road is a critical facility. It has a generator. Since the previous HMP, the Town Garage installed new shutters to protect against high wind and debris damage. These shutters came from an HMGP grant.

Emergency Operations Center / Emergency Communications Center

The Town of Groton's EOC and ECC is located within the Town's Public Safety Building at 68 Groton Long Point Road. The center is a regional 9-1-1 emergency communications center and Public Safety Answering Point (PSAP) serving the Town of Groton, all of its political subdivisions, part of Stonington, and all of North Stonington. The Center is operated 24/7 by emergency dispatchers. The center receives all 9-1-1 calls originating in Groton or North Stonington and distributes the incidents to four police departments, ten fire agencies and four emergency medical services.

The Center acts as an after-hours point of contact for the community, maintaining contact telephone lists for local businesses, public works, Groton schools and Ledgelight Health District for emergency services. The center's personnel monitor a variety of weather and emergency warning and alert systems. Any warnings or alerts received are immediately distributed to emergency services, public officials and the public if necessary.

The Groton Emergency Communications Center operates a regional Central Emergency Medical Dispatch (C-MED) radio system. This radio system allows the emergency medical technician (EMT) or paramedic at the scene of an emergency or in the ambulance to communicate with medical personnel at local hospital emergency rooms. Through this system, the EMT or paramedic can receive treatment instructions and authorizations from the emergency physician while keeping the hospital advised of the patient's condition. If needed, any ambulance passing through the region can be connected with a local emergency room physician at any time.

In addition, there are three Police stations in the town: at Groton Long Point (in the same building as the Groton Long Point fire district), at the EOC, and in the City of Groton.

TABLE 2-1
Critical Facilities

Facility	Address or Location	Emergency Power Supply?	Shelter?	In Floodplain or Coastal Flood Hazard Area?	In Surge Zones?
Emergency Services					
Emergency Operations Center/Public Safety/Emergency Call Center (ECC)	68 Groton Long Point Rd	✓			
Groton Ambulance	217 Newtown Road				
Mystic River Ambulance	237 Sandy Hollow Rd, Mystic				
Center Groton Fire District	163 Candlewood Road, Groton				
Groton Long Point Association (Police & Fire)	5 Atlantic Avenue, Groton Long Point			✓ (1%)	Cat. 1
Mystic Fire District	34 Broadway, Mystic			✓ (1%)	Cat. 1
Noank Fire District	Ward Avenue, Noank				
Old Mystic Fire District	295 Cow Hill Road, Mystic				
Poquonnock Bridge Fire District	373 Long Hill Road, Groton				
West Pleasant Valley Fire District	140 Broad Street, Groton City				
Municipal Facilities					
Town Hall	45 Fort Hill Road, Groton	✓			
Town Garage	134 Groton Long Point Road	✓			
Shelter: Groton Senior Center	102 Newtown Road	Limited	✓		
Shelter: Fitch High School	101 Groton Long Point Road	Limited	✓		
Health Care and Senior Living Facilities					
Fairview (nursing home)	235 Lestertown Road				
Mystic River Healthcare (nursing home)	475 High Street				
Groton Regency (nursing home)	1145 Poquonnock Road				
Academy Point (senior living)	20 Academy Lane				
Grasso Gardens (senior living)	217 Newtown Road				
Pequot Village (senior living)	11 Village Lane				
AHEPA (senior living)	251 Drozdyk Drive				
Windham Falls (senior living)	425 Drozdyk Drive				
Haley Brook (senior living)	2590 Gold Star Highway				
Mystic River Homes (senior living)	201 Elm Street			✓	Cat. 3
Other Infrastructure and Facilities					
Groton-New London Airport	155 Tower Avenue	✓		✓	Cat. 1-4
Sewer pumping stations	Various	Most		Some	Some
Groton Utilities Water Treatment Plant	Filter Plant Road			✓ (0.2%)	Cat. 3
Groton Wastewater Treatment Plant	170 Gary Court			✓ (0.2%)	Cat. 3
U.S. Navy Base	Northwest Groton			✓	Cat. 1-4

SCCOG completed an assessment of critical facilities in the region in 2017, fulfilling an action listed in the 2012 edition of the multi-jurisdiction hazard mitigation plan. The Town Hall on Fort Hill Road and the Groton Long Point Police/Fire complex were addressed in this study. The assessment determined that the Town Hall was not at current risk to flooding, but risk would

increase over time and could be addressed with a low berm or flood wall structure; and that the Groton Long Point Police/Fire complex was at high risk to flooding that should be addressed in the short term with additional floodproofing and in the long term through relocation of the facility. Recommendations are incorporated into the list of actions in Chapter 11 of this annex.

Shelters

Emergency shelters are considered to be an important subset of critical facilities as they are needed in emergency situations. Fitch High School and the Senior Center are both shelters and are staffed by the American Red Cross. Either one can serve as the primary shelter.

Both shelters have insufficient emergency power. The generator at the Senior Center can only power about one-third of the building. Neither shelter has sufficient air-conditioning to cool the space during a summertime emergency.

During Tropical Storm Irene, the high school was opened as a shelter for two nights and ran on a generator. Then it was closed, and the Senior Center was opened as a respite/meal center because it had power from the utility lines. This is an example of how both facilities can be used. During the school year, the Senior Center may be preferable as a shelter because the high school cannot serve as a shelter as easily.

A new middle school is currently being constructed. The Town is interested in ensuring it is equipped with a sufficiently effective backup generator, and having it serve as an additional shelter space.

Water and Wastewater

The Groton Utilities Water Treatment Plant (WTP) is a critical facility as the town of Groton must respond to emergencies there. Also, much of the town receives water from the system. One WPCF and 23 pumping stations are critical facilities.

The effluent pumping station at the Wastewater Treatment Plant (WWTP) is being redone to make it resilient to coastal flooding and sea level rise. Flood gates are being installed and electrical panels are being moved out of the basement. Funding for this project is local.

Health Care, Assisted Living, Ambulance, etc.

Groton Ambulance and Mystic River Ambulance are considered critical facilities. Pequot Health is a critical facility, as it receives overflow critical care and ER patients from Lawrence & Memorial Hospital. Pequot Health remained open and staffed during Tropical Storm Irene.

The following nursing homes and senior housing facilities were identified by the Town to be critical facilities. The three nursing homes (Fairview, Mystic River Healthcare, and Groton Regency) are all located outside any FEMA flood zones or hurricane surge areas. Six of the seven active adult, assisted living and Alzheimer's care facilities are also located outside flood or hurricane surge zones (Academy Point, Grasso Gardens, Pequot Village, AHEPA, Windham Falls,

and Haley Brook). Mystic River Homes is located within both a flood zone and a Category 3 hurricane surge zone. An alternate access route to Mystic River Homes has been developed to allow for dry access during flood events.

Health care, assisted living and senior living facilities that are located in flood zones should be considered for floodproofing. In addition, the facilities in flood zones and those that may be cut off from flooding should develop site-specific evacuation plans that are understood by Groton's Emergency Management Agency and upgrade their modes of egress as necessary.

Other Facilities

The Navy base is a critical facility. Although the Town is not responsible for responding to emergencies involving the base, the Town regularly supplies mutual aid emergency services to the Base when needed to supplement emergency services at the Base. In addition, the Town is responsible for handling the effect of 5,000 to 6,000 cars leaving the facility in the event of an emergency.

Groton-New London Airport is a critical facility. It offers daily flights for people traveling to or from Electric Boat, Pfizer, the National Guard, and the Navy, among others.

Evacuation Routes

The Town has an evacuation plan on file that considers an evacuation required because of an emergency at the Millstone Nuclear Power Plant in Waterford, a coastal flooding emergency, or a hurricane. In general, evacuation routes should not include roads that can become submerged during coastal storms and riverine flooding. Any changes in shelter status or shelter locations will necessarily require modifications to the evacuation map.

3.0 INLAND FLOODING

3.1 Setting / Historic Record

Flooding is the primary hazard that impacts the town each year as documented in the previous HMP. While riverine flooding is a concern, nuisance flooding and poor drainage have also created flooding challenges at several locations in the town. Flooding is typically caused by heavy rainstorms, but can also be caused by relatively light rains falling on frozen ground. Flooding of roadways is more common than damage to structures, although both occur.

Sustained heavy rainfall in late March 2010 caused a 1% annual chance flood throughout southeastern Connecticut. The March 2010 storms continue to be considered the event that caused the most widespread flooding in Groton since the town began participating in the multi-jurisdiction hazard mitigation plan. According to the planning team, more homes were damaged in Groton than in any other town in Connecticut during that event. The March 2010 flood was notable for washing out the Route 184 Bridge at Whitford Brook and the River Road Bridge at Haleys Brook. The River Road crossing was closed for a year. The entire neighborhood at the Whitford Brook/Haleys Brook confluence was submerged, and people along River Road had to be rescued by boat.

On June 7, 2013, the remnants of Tropical Storm Andrea tracked up the eastern seaboard in early June resulting in a prolonged period of heavy rain, which caused flash flooding in portions of Fairfield and New London Counties. In Groton, South Road was closed at the railroad underpass due to flooding. Total reported rainfall amounts in New London County ranged from 4.12 inches in Yantic to 6.64 inches in Gales Ferry.

On September 2, 2013, several upper level shortwave troughs interacting with a warm, moist air mass and a surface trough produced scattered thunderstorms across the area. Precipitable waters ranged between 2 and 2 1/2 inches, which resulted in heavy rain and flash flooding in Fairfield and New London Counties. There were six to eight inches of flowing water on portions of Route 12 from the U.S. Naval Submarine Base south to Groton, and South Road at the railroad underpass in Groton was closed due to flooding.

3.2 Existing Capabilities

The Town attempts to mitigate inland flood damage and flood hazards by utilizing a wide range of measures including restricting activities in floodprone areas, replacing bridges and culverts, promoting flood insurance, acquiring floodprone structures, maintaining drainage systems, through education and outreach, and by utilizing warning systems. Many mitigation measures are common to all hazards and therefore were listed in Section 2.5 and Section 2.6. No major inland flood control structural projects are in place within or upstream of Groton.

Bridge Replacements, Drainage, and Maintenance

The Department of Public Works cleans and inspects catch basins and culverts at least annually or more often if problems are noted. The Town fields phone calls related to drainage

complaints. Roadway drainage complaints are directed to the Director of Public Works. When flooding occurs, the Public Works department may handle complaints. For example, Public Works would inspect bridges and culverts and erect barricades to close roads.

Regulations, Codes, and Ordinances

The Town of Groton has planning and zoning tools in place that incorporate floodplain management. The Town has recently updated its flood protection regulations in its Zoning Regulations in 2015 as noted in Section 2.5. The Town utilizes the 1% annual chance floodplain as defined by FEMA to regulate floodplain and floodway activities and requires 100 percent compensatory storage for any encroachment in the floodplain.

The Town's Subdivision Regulations require that adequate drainage be provided to reduce exposure to flood hazards and that buildings and utilities are located to minimize the effects of flood damage. Regulations covering development in or within a certain distance of inland wetland or watercourse areas are enforced by the Town's Inland Wetlands Agency.

The Town is implementing new stormwater management requirements in accordance with the State's MS4 General Permit update. Over time this should help reduce flooding caused by stormwater, but it is also having major impacts on the municipal budget.

Acquisitions, Elevations, and Property Protection

To date, the Town of Groton has not performed acquisitions or elevations of floodprone property. Property protection has focused instead on preventive measures and maintaining and upgrading drainage systems. The Town is not opposed to performing acquisitions, elevations, or relocations if property owners were willing and grant funding was available. Many coastal residents have elevated homes at their own expense, as noted in Section 4.0.

Flood Watches and Warnings

The Emergency Management Director and the Emergency Communications Center receives weather reports from the National Weather Service and local media and disburses this information as required. Weather alerts are distributed to residents via the Connecticut Alerts Community Notification system when storms are imminent. The Emergency Management Office is responsible for operating the system as part of the Town's warning capabilities.

Summary

In general, municipal capabilities to mitigate flood damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is likely because the Town increased its capabilities in response to flooding of 2011 and 2012 associated with Tropical Storm Irene and Hurricane Sandy, which are discussed in later chapters. Town personnel have participated in events of the Connecticut Association of Flood Managers in recent years, and should continue to do so when time allows.

3.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to inland flooding within the Town. Areas at risk from coastal flooding are discussed in Section 4 of this annex. Note that *HAZUS-MH*, FEMA's hazard loss estimation software, was utilized to calculate the potential damages to the Town of Groton from a combined 1% annual chance riverine and coastal flood. Results were presented in Section 3.5.2 of the Multi-Jurisdictional HMP.

3.3.1 Vulnerability Analysis of Areas along Watercourses

Major inland watercourses and water bodies in Groton have the 1% annual chance floodplain defined by FEMA on a Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS). The FIRM delineates areas within Groton that are vulnerable to flooding and was most recently published on July 18, 2011 with the remainder of New London County. Many of the inland watercourses and water bodies in Groton are mapped as Zone AE. Hempsted Brook, Beaver Dam Brook, Great Brook, Haleys Brook, and Beebe Pond are mapped as Zone A. Refer to Figure 3-1 for the location of the 1% annual chance floodplains related to inland flooding within Groton.

As noted in the previous HMP annex, there are many roadways throughout the Town of Groton that are in flood zones, such as Buddington Road near Hempstead Brook and Rhonda Drive and Farmstead Avenue near Fishtown Brook.

Based on the information in the previous HMP and that provided by Town officials at the January 2012 planning meeting, numerous areas along watercourses and roads are vulnerable to flooding. A map entitled "Town of Groton March 2010 Flood Damage Locations" depicts damage to the following roadways:

- Lambtown Road at tributary of Haleys Brook.
- River Road, Cold Spring Road, and two locations on Packer Road at Haleys Brook.
- Pumpkin Hill Road at West Branch Red Brook.
- Welles Road at Red Brook.
- Gungywamp Road at Great Brook.
- Candlewood Road at Hatching House Brook.
- Bindloss Road at Bindloss Brook.
- Drozdyk Road at unnamed stream.
- Poquonnock Road at unnamed stream.
- Brook Street at Eccleston Brook.
- Fishtown Road and Farmstead Avenue at Fishtown Brook.

As noted in Section 3.1, the March 2010 flood was notable for washing out the Route 184 Bridge at Whitford Brook and the River Road Bridge at Haleys Brook. The River Road crossing was closed for a year. The entire neighborhood at the Whitford Brook/Haleys Brook confluence was submerged, and people along River Road had to be rescued by boat.

Insert Figure 3-1

3.3.2 Vulnerability Analysis of Private Properties

As noted in Table 3-4 of the Multi-Jurisdictional HMP, a total of 1,043 structures in Groton appear to be located in the 1% annual chance floodplain. A total of 17 are located in Zone A, none are located in the Zone AE floodway, 925 are located within Zone AE, and 101 are in zone VE. Of all the communities in the SCCOG planning area, Groton has the second-highest number of structures in the AE zone (after Stonington).

Most of the structures located in Zone AE are vulnerable to inland flooding, with the remainder being vulnerable to coastal flooding (although some may be susceptible to both types of flooding). The Town of Groton should make an effort to identify properties within the 1% annual chance floodplain and distribute information regarding floodproofing and home elevation to the owners of these properties.

The map described above ("Town of Groton March 2010 Flood Damage Locations") depicts the following areas of residential flood damage from the March 2010 flood:

- River Road neighborhood in Old Mystic (Haleys Brook/Whitford Brook)
- Deerfield Ridge/Heather Glen neighborhood
- Midway Oval neighborhood
- Parts of Noank
- Parts of Mystic
- Ocean View Avenue neighborhood
- Farmstead Avenue/Judson Avenue neighborhood
- Lamphere Road neighborhood
- The Wayne Road/Woodland Drive neighborhood suffered basement damage from drainage –related flooding and high groundwater.
- The Virgo Drive/Pegasus Drive neighborhood in Bailey Hill was flooded from runoff coming down the hill. Inches of water flowing over foundations and into basements.
- On the north side of Route 1/Fort Hill Road, homes near Fort Hill Brook experienced at least a foot of inundation.
- The High Rock Road trailer park experienced flooding from a tributary of Baker Cove.

The numerous instances of residential flood damage are not surprising, given the high number of structures in A, AE, and VE zones.

As of November 2011, four repetitive loss properties were reported in Groton. One was not linked to an address and could not be located. The remaining three were related to inland flooding. These properties were along Haleys Brook, Whitford Brook, and an area of internal drainage in the Poquonock Bridge neighborhood that is not associated with a watercourse. One of the structures is located within a 100-year floodplain but two appear to be in 0.2% annual chance areas. The most recent claim-related damage events are listed in Table 3-1.

TABLE 3-1
Recent Inland Repetitive Loss Damage Claims in Groton

Repetitive Loss Property	Flood Zone	Most Recent NFIP Losses
"Haleys Brook"	0.2% annual chance	March 2010, Oct. 2005
"Whitford Brook"	1% annual chance	March 1984
"Internal Drainage"	0.2% annual chance	August 1991

The dates of the recent losses for the property along Haleys Brook confirm that the March 2010 and October 2005 floods (both presidentially-declared disasters in Connecticut) were likewise damaging in Groton. The other two properties had not reported damage in quite some time, and it is possible that the owners are repairing flood damage on their own.

As of 2017, five repetitive loss properties are located in Groton. The single new entry on the list is located in Noank, and is believed to be affected by coastal flooding.

3.3.3 Vulnerability Analysis of Critical Facilities

Critical facilities in the Town do not normally suffer from inland flooding, although several fire stations are located in moderate risk zones. The risk of inland flooding to critical facilities is therefore considered to be low. Floodproofing of critical facilities can help lower risks further.

3.4 Potential Mitigation Strategies and Actions

Potential mitigation measures for reducing or eliminating the impact of inland flooding fall into the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects. General potential mitigation measures that can be taken to reduce the effects of inland flooding were discussed in Section 3.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the town are listed in Section 11 of this annex, as are specific measures pertinent to reducing inland flooding in the Town of Groton.

4.0 COASTAL FLOODING & SHORELINE CHANGE

4.1 Setting / Historic Record

The shorefront of the Town of Groton contains developed shorefront along the Thames River; areas of rocky shorefront at Bushy Point, Bluff Point, and Groton Long Point; coastal bluffs and escarpments at Bluff Point; modified bluffs and escarpments at Groton Long Point, Noank, and West Mystic; and beaches and dunes at Bluff Point Beach, Bluff Point, and Groton Long Point. Portions of Baker Cove, Poquonock River, Mumford Cove, Palmer Cove, Beebe Cove, and Mystic Harbor are estuarine embayments. The coastal resources found in Connecticut and described by DEEP can be found in the Multi-Jurisdictional HMP.

Homes, businesses, and industry are located in close proximity to the coastline along the Thames River and Fishers Island Sound. Structures and infrastructure in the southern section of the Town are closer to sea level than in northern areas and are therefore more susceptible to coastal flooding. Hurricanes and tropical storms have the potential to induce coastal flooding and storm surge that can impact structures. Many coastal roads have been closed during prior flood events, and many coastal structures in Groton have been flooded.

- On August 28, 2011, the region was impacted by Hurricane Irene, which had since weakened to a tropical storm.

- On October 29, 2012, Coastal communities along Southern New London County experienced two successive tidal cycles with at least moderate coastal flooding on Monday October 29th. The peak of this surge occurred Monday Night as Sandy made landfall in Southern New Jersey, with widespread major coastal flooding occurring along the Southern New London coast. Peak storm tides surpassed water levels from Hurricane Irene in 2011, only being topped by Hurricane Carol in 1954 and the 1938 Hurricane. The record storm tide levels along Eastern Long Island Sound resulted from a peak storm surge of about 5 to 7 feet that coincided with normal high tides. These storm tides resulted in up to 2 to 3 feet of inundation a few blocks inland along low lying portions of Long Island Sound, with one to two feet of inundation working north of I-95 in several low spots along waterways such as the Niantic River in Niantic, Mystic River in Mystic, and almost 15 miles inland along the Thames River.

The Town is very concerned with the potential long-term effects of sea level rise and its potential to exacerbate flooding conditions in the future, and has been planning for adaptation as described elsewhere in this annex. Even during lesser storm events and high tides, coastal flooding occurs in Groton. For example, a king tide occurring on a sunny day (October 28, 2015; refer to the picture on the right) caused water to flow onto, and

inundate, many sections of roads in the Groton side of Mystic.

4.2 Existing Capabilities

The Town primarily attempts to mitigate coastal flood damage and flood hazards by controlling and restricting activities in floodprone areas, encouraging the elevation of homes and roadways, maintaining hard structures in good condition, and providing signage and warning systems. Many of the Existing Capabilities utilized in the Town for inland flood mitigation (Section 3.2) are also applicable to coastal flood mitigation.

Coastal sewer pumping stations in Groton are designed to be floodproofed to a 14-foot elevation. This minimizes risk of coastal and storm surge flooding.

As noted in Section 3.2 and Section 2.5, the Town utilizes the 1% annual chance floodplains delineated by FEMA. These consist of the 1% annual chance floodplain with elevations (Zone AE), and the 1% annual chance floodplain subject to wave velocity (Zone VE) for coastal flooding areas. As noted by the Zoning Regulations and the Subdivision Regulations, building activities in these areas are restricted and new construction or substantial redevelopment must prove that the lowest horizontal member of the new construction will be more than one foot above the base flood elevation (freeboard). The Planning Commission and the Building Official are required to review and approve portions of applications that involve structures within FEMA Special Flood Hazard Areas.

As explained elsewhere in this HMP, the National Weather Service issues a flood watch or a flash flood watch for an area when conditions in or near the area are favorable for a flood or flash flood, respectively. A flash flood watch or flood watch does not necessarily mean that flooding will occur. The National Weather Service issues a flood warning or a flash flood warning for an area when parts of the area are either currently flooding, highly likely to flood, or when flooding is imminent. The Town of Groton utilizes these warnings and forecasts to prepare emergency responders for flooding events.

The shoreline of Groton contains many coastal flood control structures. Small, private seawalls and bulkheads can be found in many of the residentially developed coastal neighborhoods. Groins and jetties are also common in beach areas. Most of these structures were designed to retain land as well as protect against wave action, but have the secondary effect of reducing coastal erosion. Many coastal homes have been elevated at the owners' expense. A number of private homeowners in Groton Long Point have elevated their homes since the previous HMP; Groton Long Point requires buildings be elevated or floodproofed to one foot above the Base Flood Elevation. Elevation is a very important type of mitigation that has proven to be successful in reducing flood damage.

The Town of Groton has actively pursued coastal resiliency planning and climate change planning in its update to the POCD and MCP as explained in Chapter 2. These efforts built on

prior efforts that were undertaken in 2011-2012. Even more recently, the Town participated in a resiliency planning initiative with SCCOG and TNC in 2016-2017[1].

Together, the policies of the POCD and MCP and the existing regulations and codes will build a foundation for addressing coastal resilience and adaptation.

As explained in Section 2.13 of the regional part of this multi-jurisdiction hazard mitigation plan, the State Historic Preservation Office (SHPO) embarked on a resiliency planning study for historic and cultural resources beginning in 2016. During winter 2016-2017, individual meetings were held with the shoreline SCCOG communities. Reports were issued to these communities in DECEMBER 2017. The Town of Groton report outlines eight strategies that can be employed to make historic and cultural resources more resilient:

- Identify Historic Resources
- Revisit Historic District Zoning Regulations
- Strengthen Recovery Planning
- Incorporate Historic Preservation into Planning Documents
- Revisit Floodplain Regulations and Ordinances
- Coordinate Regionally and with the State
- Structural Adaptation Measures
- Educate

Subsequently, a best practices guide for planning techniques to make historic resources more resilient was distributed in September 2017.

Summary

Municipal capabilities to mitigate coastal flood damage have increased sharply since the 2012 edition of the hazard mitigation plan was adopted. This is because the Town updated its POCD and MCP, participated in the historic resources resiliency planning, and generally increased its capabilities in response to the flooding associated with storms Irene and Sandy in 2011 and 2012, respectively.

4.3 Vulnerabilities and Risk Assessment

This section discusses specific areas at risk to coastal flooding within the Town. This flooding can be the result of astronomical high tides, hurricanes, nor'easters, or storm surge. As shown by the historic record, coastal flooding can impact many roads and neighborhoods, potentially cause severe damage, and impede transportation in the Town. Refer to Figure 3-1 for a depiction of areas susceptible to coastal flooding, and Figure 4-1 for areas susceptible to storm surge from hurricanes.

[1] https://tnc.app.box.com/s/8nne60yjk2g3m1mgzkfa86rndxyjiawf

Note that *HAZUS-MH*, FEMA's hazard loss estimation software, was utilized to calculate the potential damages to the Town of Groton from a combined 1% annual chance riverine and coastal flood. Results were presented in Section 3.5.2 of the Multi-Jurisdictional HMP.

4.3.1 Vulnerability Analysis of Areas along Coastal Waters

As noted in the previous HMP annex, the entire coastline of Groton is subject to flooding and coastal storm damage, as are the peninsula areas of Noank and Groton Long Point, which are entirely exposed. Most of Groton's velocity zones are located along the immediate shoreline. The beachfront properties in the velocity zone are very susceptible to damage.

Residences are heavily concentrated along the coastline and they are subject to damage from tidal flooding with wave action. Many residential and commercial structures are located in low-lying areas further inland and though not subject to damage from waves, they are subject to tidal flooding. The southern portion of Groton Long Point, in the Shore Avenue area, is exposed to the wave action from Fishers Island Sound. This location has been exposed to the most flood damage in the past. The shoreline structures along Mumford and Palmer Coves have also experienced wave damage, but to a lesser degree.

Groton Long Point is a highly populated section of the Town of Groton. There are approximately 1,200-1,300 persons living in Groton Long Point during the winter months and 3,000 to 4,000 residents in the summer months. It is a low-lying peninsula surrounded by Fishers Island Sound on three sides. The entire area of Groton Long Point except for a few roads including Duryea Drive, Burrows Street, Smith Street, and several other elevated areas, are in the flood zone.

Groton Long Point's entire shoreline is a velocity zone and many structures have the potential to be damaged by waves and storm surges. The Groton Long Point Road Bridge is the only access/egress to the area and utilities pass along the bridge to the Groton Long Point residents. Town officials have expressed concern because of the sole access/egress as well as the fact that gradual shifting of rip-rap along the bridge could be catastrophic during a major storm.

Another highly populated section of Groton is Noank. Noank is a peninsula that is surrounded by Fishers Island Sound; however, most of the land is elevated above the flood zone. A few of the roads with structures located in the flood zone include Morgan Point, Marsh Road, Noble Avenue, and sections of Elm Street, Front Street, and Brook Street. There are numerous cul-de-sacs along Noank's shoreline which are also affected by tidal flooding. The entire shoreline of Noank is in a velocity zone and structures may be damaged by waves and storm surge during severe storms. The adjacent areas of Beebe Cove and Spencer Point are protected by old walls and riprap. Due to the relatively large number of residences, the potential for heavy flood damage exists along the shores of Palmer, West, and Beebe Coves. The shores of Noank have long been the site of boat yards and other facilities such as the Noank Shipyard, Abbott's Lobsters, and the Morgan Point Lighthouse.

Insert Figure 4-1 (Coastal surge zones)

Groton has several major transportation facilities such as Interstate 95, Route 1, Route 12, Route 184, Route 117, and the Amtrak and Providence/Worcester rail lines. The embankments for railroad tracks act as dikes in limiting the encroachment of tidal floods. A series of crossings of the railroad and the highway have been constructed to allow passage of roadways under and over the highway and railroad. Town officials are concerned with Amtrak underpasses such as Poquonnock Road and South Road. These low bridges make passage of emergency vehicles difficult under normal conditions. When these areas are flooded out they are not passable and emergency services are forced to take a longer route. Town officials are concerned that problems could also arise with the evacuation of people and getting materials to residents.

The Town of Groton shoreline has several flooding sources which include Mumford Cove, Palmer Cove, Fishtown Brook, and Fishers Island Sound. There are many residential structures located in flood zones in these areas around the shoreline. Roads in the flood hazard area include Midway Oval, Hartford Court, and sections of Joliet Court, Birmingham Court, and Concord Court, which are flooded by Mumford Cove. Palmer Cove floods Haley Farm Road and Beebe Cove affects a flood zone on Route 215.

The Mystic River affects many roadways and structures in the flood zone from the mouth of the river to the end of River Road, which is the eastern corporate limit of Groton. Along the Mystic River many of the roads in the flood zones include Cedar Road and the roads around Spencer Point and Willow Point, and Water Street.

Town officials are concerned with Willow Point due to its low-lying areas and the potential for the area to be isolated during flooding.

In general, it is assumed that as sea level rises, the frequency and magnitude of coastal flooding in the Town will increase, with structures and roadways closest to existing sea level being affected more quickly. In addition, tidal marshes will either migrate inland or be eroded by constant inundation.

Coastal erosion is a serious concern where beaches are present in the Town of Groton although parts of the shorefront is either rocky shorefronts or modified bluffs and escarpments consisting of seawalls, bulkheads, or revetments. As sea level rises, the effectiveness of hard structures such as groins, jetties, bulkheads, and seawalls will be undermined such that erosion will be able to occur landward of the walls necessitating expansion of the structures.

4.3.2 Vulnerability Analysis of Private Properties

The coastal areas of the Town of Groton have many properties that are inhabited year-round. This intensifies risk to life and property in coastal areas. Waterfront properties are very susceptible to damage, not only as a result of flooding but also due to the velocity zones located along the shoreline. Shoreline erosion is a relatively minor concern for private property owners at this point in time since most have seawalls or rocky shorefront protecting their structures.

Buildings located in flood hazard areas are primarily residential. Most of the structures that are threatened by flooding are located within the 1% annual chance floodplain, but some are also in

the coastal velocity zone. Location in the velocity zone poses an increased threat to structures due to high wind and potential wave damage, as well as inundation by flood waters. Other areas located more inland or behind protective seawalls are only subject to coastal flooding without wave action. Drainage systems in low-lying areas can also backup during coastal storms, resulting in flooding along roadways.

Floodprone residences are located throughout the coastal areas of Groton. Areas located in the coastal velocity zone are believed to be particularly at risk. As noted in Table 3-4 of the Multi-Jurisdictional HMP, 101 properties are in zone VE.

As of November 2011, four repetitive loss properties were reported in Groton but none were believed related to coastal flood zones. Since then, one property has been added to the list, and it is believed affected by coastal flooding. The Town recognizes that many private properties may suffer coastal flood damage that is not reported because the structures are not insured under the NFIP, or because they choose to not report the damage. These residents and business owners are likely repairing structures on their own. Coastal flood mitigation as recommended in this HMP will likely assist many of these property owners.

The Town of Groton is interested in all forms of flood mitigation, including acquisitions, elevations, drainage upgrades, and other structural projects provided property owners are interested and funding is available.

The Town of Groton has no formalized program currently in place to identify the location or the number of structures that are susceptible to flooding. Such information would be valuable in directing hazard mitigation efforts to locations with the greatest risk. Town planning staff should use the recently released DFIRM to identify the approximately 925 structures in the town that are located in the AE zone (with or without wave velocity). This could provide a list of areas to inspect following a storm event and allow for the town to track building permits from repairs following a natural hazard. This information, in turn, would provide supporting data for future grant applications.

4.3.3 Vulnerability Analysis of Critical Facilities

A review of the Town of Groton's critical facilities indicates most of the facilities are not in coastal flood hazard areas. One facility of concern is the Groton-New London Airport. The entire Groton-New London Airport is located in a flood zone, potentially limiting its use during coastal flood events. Several fire stations are located in moderate risk zones, and Mystic River Homes senior living is in a surge zone. Floodproofing of critical facilities can help lower risks further, and developing a site-specific evacuation plan for Mystic River Homes can help reduce risks to residents.

As noted in Chapter 2, SCCOG completed an assessment of critical facilities in the region in 2017, fulfilling an action listed in the 2012 edition of the multi-jurisdiction hazard mitigation plan. The Town Hall on Fort Hill Road and the Groton Long Point Police/Fire complex were addressed in this study. The assessment determined that the Town Hall was not at current risk to flooding, but risk would increase over time and could be addressed with a low berm or flood wall

structure; and that the Groton Long Point Police/Fire complex was at high risk to flooding that should be addressed in the short term with additional floodproofing and in the long term through relocation of the facility. Recommendations are incorporated into the list of actions in Chapter 11 of this annex.

4.4 Potential Mitigation Strategies and Actions

Potential mitigation measures for reducing or eliminating the impact of coastal flooding and sea level rise fall into the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects. General potential mitigation measures that can be taken to reduce the effects of coastal flooding were discussed in Section 4.7 and in Section 11.2.2 of the Multi-Jurisdictional HMP. General recommendations pertinent to all natural hazards that could affect the town are listed in Section 11 of this annex, as are specific measures pertinent to reducing inland flooding in Groton.

5.0 HURRICANES AND TROPICAL STORMS

5.1 Setting / Historic Record

Several types of hazards may be associated with tropical storms and hurricanes including heavy or tornado winds, heavy rains, and flooding. Flooding and storm surge hazards are discussed in Section 3 and Section 4 of this annex. Wind hazards are widespread and can affect any part of the Town. However, some buildings in the Town are more susceptible to wind damage than others.

Tropical Storm Irene heavily impacted the region in August 2011. Following the storm, power outages topped 90% of the town's population. The power outage was up to six days in CL&P's utility territory. Groton Utilities was able to restore power to customers more quickly in its territory.

Hurricane Sandy struck the region in October of 2012. The storm caused damage to some structures in town, such as Fitch High School, and caused flooding. There were power outages and tree damage from the 60+ mile per hour wind gusts.

5.2 Existing Capabilities

Wind loading requirements are addressed through the state building code. The Connecticut State Building Code was most recently adopted with an effective date of October 1, 2016. The code specifies the design wind speed for construction in all the Connecticut municipalities. The ultimate design wind speed for the Town of Groton ranges from 125 to 145 miles per hour depending on the building use (for example, hospitals must be designed to the higher wind speed). Note that changes in design wind speed figures since the previous HMP are largely the result of a shift from "nominal" to "ultimate" wind speeds, for compatibility purposes; see the Connecticut Building Code or the American Society of Civil Engineers website for more information. The Town of Groton has adopted the Connecticut Building Code as its building code.

Parts of trees (limbs) or entire tall and older trees may fall during heavy wind events, potentially damaging structures, utility lines, and vehicles. Utility lines are located underground in only a few areas of the Town. The Town of Groton receives utility service from Groton Utilities and Eversource (which acquired the previous regional utility provider, Connecticut Light and Power (CL&P)). Groton Utilities and Eversource have active tree pruning programs, and Eversource specifically, in response to widespread outages after Tropical Storm Irene, Hurricane Sandy, and Winter Storm Nemo, has implemented a more aggressive trimming regime than what was previously performed under CL&P. Eversource has also replaced a lot of wires to strengthen the regional grid.

In addition, Groton has a full time Tree Warden operating as part of the Public Works Department. The Tree Warden can post and remove trees in rights of way or town land.

The Town's tree trimming program has been affected by budget cuts, with trimming decreased from one day per week at the time of the previous HMP to one day every two weeks. A contractor is utilized for this program.

All new subdivisions are required to install utilities underground. This requirement has been in place for about 25 years. The Mystic streetscape project completed in 2012 resulted in the placement of utilities underground.

Warning is one of the best ways to prevent damage from hurricanes and tropical storms, as these storms often are tracked well in advance of reaching Connecticut. The Town accesses National Weather Service forecasts via the internet as well as local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the Town to activate its EOP and encourage residents to take protective or evacuation measures if appropriate.

Prior to severe storm events, the Town ensures that warning/notification systems and communication equipment are working properly and prepares for the possible evacuation of impacted areas. The statewide CT Alerts Community Emergency Notification System can be utilized to warn coastal residents of an impending evacuation. Although hurricanes that have impacted Groton have historically passed in a day's time, additional shelters can be outfitted following a storm with the assistance of the American Red Cross on an as-need basis for long-term evacuees.

In the case of an extended power outage, residents would be directed to shelter at Fitch High School or the Senior Center, depending on the specific locations of the outages in the town. During Tropical Storm Irene, the high school was opened as a shelter for two nights and ran on a generator. Then it was closed, and the Senior Center was opened as a respite/meal center because it had power from the utility lines. This is an example of how both facilities can be used.

Since the previous HMP, the Town has worked successfully to lower the number of outages experienced by the Town Hall Annex.

Summary

In general, municipal capabilities to mitigate hurricane damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is likely because the Town increased its capabilities slightly in response to the damage from Tropical Storm Irene in 2011 and Hurricane Sandy in 2012.

5.3 Vulnerabilities and Risk Assessment

The entire town is vulnerable to hurricane and tropical storm wind damage and from any tornadoes (Section 6) accompanying the storm, as well as inland flooding (Section 3) and coastal flooding and storm surge (Section 4). Of particular concern are the blockage of roads and the damage to the electrical power supply from falling trees and tree limbs. The

town is also susceptible to damage occurring in other communities cutting off the electrical supply as occurred following Tropical Storm Irene.

As noted above, CL&P trims trees along power lines. After Tropical Storm Irene, the Town participated in meetings with CL&P. During these meetings, CL&P stated that its personnel needed to spend time opening roads. However, the Town believes that this is not the responsibility of CL&P. The Town favors using local forces to clear roads. Public Works personnel cleared trees and debris from roads after Irene. Within nine hours of the safe start time for clearing, every blockage was cleared that did not involve downed wires. Comparing Irene to previous events, the Town noted that the Public Works crews could open roads more quickly after Hurricane Gloria (in 1985) because there was better information about live wires back then. Therefore, utility lines in Groton will remain vulnerable until better communication with CL&P is developed.

Direct wind damage to newer buildings from hurricane or tropical storm-level winds is rare in the town since the new buildings were constructed to meet or exceed current building codes. Many buildings in the town are greater than 50 years old and do not meet current building codes. Older buildings in the town are particularly susceptible to roof and window damage from high wind events, although this risk will be reduced with time as these buildings are remodeled or replaced with buildings that meet current codes. For example, many homes have been renovated recently and some property owners have installed shutters and other wind mitigation measures.

Groton has a diverse housing stock including rental properties and trailer parks. These areas are also at particular risk of damage during a hurricane or tropical storm because rental properties are not owner-occupied and therefore may not be properly maintained, and because trailer parks contain manufactured homes that are not as structurally sound as permanent buildings. Fortunately, the usually long lead time prior to a hurricane or tropical storm event allows for timely evacuation of such areas prior to a natural hazard event.

The strength of a large hurricane could cause a significant economic impact to the town. The potential economic effect of wind damage to SCCOG was evaluated in the Multi-Jurisdictional HMP. A separate analysis was not performed specifically for the Town of Groton.

5.4 Potential Mitigation Strategies and Actions

Potential mitigation measures for reducing or eliminating the impact of wind damage fall into the categories of prevention, property protection, emergency services, public education and awareness, natural resource protection, and structural projects. General potential mitigation measures that can be taken to reduce the effects of wind damage from hurricanes and tropical storms were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. General recommendations pertinent to all hazards that could affect the town are listed in Section 11 of this annex, as are specific measures pertinent to reducing wind damage to the Town of Groton.

6.0 SUMMER STORMS AND TORNADOES

6.1 Setting / Historic Record

Similar to hurricanes and winter storms, wind damage associated with summer storms and tornadoes has the potential to affect any area of the town. Furthermore, because these types of storms and the hazards that result (flash flooding, wind, hail, and lightning) might have limited geographic extent, it is possible for a summer storm to harm one area within the town without harming another. Such storms occur in the town each year, although hail and direct lightning strikes to the town are rarer.

- No tornadoes have occurred in the Town of Groton since the last HMP, although a funnel cloud was spotted on August 5, 2010 near Electric Boat in the nearby City of Groton as reported to the NCDC. The NCDC also reported that strong straight-line thunderstorm winds overturned a boat at Eastern Point on July 31, 2009 causing minor damage.

- On June 23, 2015 a passing cold front triggered multiple severe thunderstorms across the entirety of Southern Connecticut. Tree damage was reported in the area, including on Military Highway.

6.2 Existing Capabilities

Warning is the most viable and therefore the primary method of existing mitigation for tornadoes and thunderstorm-related hazards. The NOAA National Weather Service issues watches and warnings when severe weather is likely to develop or has developed, respectively. The Town has access to National Weather Service forecasts via the internet as well as local media outlets (television, radio) to receive information about the relative strength of the approaching storm. This information allows the Town to activate its EOP and encourage residents to take protective measures if appropriate.

Aside from warnings, several other methods of mitigation for wind damage are employed by the Town as explained in Section 5.2 within the context of hurricanes and tropical storms. In addition, the Connecticut Building Code includes guidelines for the proper grounding of buildings and electrical boxes to protect against lightning damage.

Summary

In general, municipal capabilities to mitigate thunderstorm and tornado damage have not increased significantly since the 2012 edition of the hazard mitigation plan was adopted.

6.3 Vulnerabilities and Risk Assessment

Summer storms are expected to occur each year and are expected to at times produce heavy winds, heavy rainfall, lightning, and hail. All areas of the town are equally likely to experience the effects of summer storms. The density of damage is expected to be greater near the more densely populated sections of the town.

Most thunderstorm damage is caused by straight-line winds exceeding 100 mph. Experience has generally shown that wind in excess of 50 miles per hour (mph) will cause significant tree damage during the summer season as the effects of wind on trees is exacerbated when the trees are in full leaf. The damage to buildings and overhead utilities due to downed trees has historically been the biggest problem associated with wind storms. Heavy winds can take down trees near power lines, leading to the start and spread of fires. Such fires can be extremely dangerous during the summer months during dry and drought conditions. Fortunately, most fires are quickly extinguished due to the Town's strong fire response.

Lightning and hail are generally associated with severe thunderstorms and can produce damaging effects. All areas of the town are equally susceptible to damage from lightning and hail, although lightning damage is typically mitigated by warnings and proper grounding of buildings and equipment. Hail is primarily mitigated by warning, although vehicles and watercraft can often not be secured prior to the relatively sudden onset of a hailstorm. Lightning and hail are considered likely events each year, but typically cause limited damage in the town. Older buildings are most susceptible to lightning and hail damage since they were constructed prior to current building codes.

Although tornadoes pose a threat to all areas of Connecticut, their occurrence is least frequent in New London County as compared with the rest of the State. Thus, while the possibility of a tornado striking the town exists, it is considered to be an event with a very low probability of occurrence.

6.4 Potential Mitigation Strategies and Actions

General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP. No additional recommendations are available specific to reducing damage from summer storms and tornadoes. Refer to Section 11 of this annex for recommendations related to wind damage and general recommendations related to emergency services.

7.0 WINTER STORMS AND NOR'EASTERS

7.1 Setting / Historic Record

Similar to hurricanes and summer storms, winter storms have the potential to affect any area of the town. However, unlike summer storms, winter storms and the hazards that result (wind, snow, and ice) have more widespread geographic extent. In general, winter storms are considered highly likely to occur each year (major storms are less frequent), and the hazards that result (nor'easter winds, snow, and blizzard conditions) can potentially have a significant effect over a large area of the town.

- The heavy snow storms during the winter of 2010-2011 caused damage to structures across Connecticut. No roofs or buildings collapsed in January 2011. However, the Town was concerned with the Public Works garage and monitored snow load conditions. The Groton Walmart removed snow from its roof.
- Winter Storm Alfred in October 2011 did not significantly affect Groton.
- A low pressure system rapidly intensified while moving northeast to a position east of Cape Cod on the morning of Saturday, February 9, 2013, producing blizzard conditions and very heavy snowfall across southern Connecticut on February 8th and 9th. Groton Airport ASOS (KGON) reported at least three consecutive hours of blizzard conditions. Snowfall began at 7:40 am on February 8. Spotters reported an average snowfall of 6 inches by 7:50 pm. Total snowfall ranged from 15 inches in Stonington to as much as 22 inches in Ledyard Center.
- On January 26, 2015, a large snowstorm dropped nearly two feet of snow throughout the region, including Groton. The town received over $125,000 in federal assistance to aid in the cleanup.

7.2 Existing Capabilities

Existing programs applicable to winter storm winds are the same as those discussed in Sections 5.2 and 6.2. Programs that are specific to winter storms are generally those related to preparing plows and sand and salt trucks; tree trimming and maintenance to protect power lines, roads, and structures; and other associated snow removal and response preparations.

As it is almost guaranteed that winter storms will occur annually in Connecticut, it is important to locally budget fiscal resources toward snow management. Snow is the most common natural hazard requiring additional overtime effort from Town staff, as parking lots and roadways need constant maintenance during storms.

The Public Works Department oversees snow removal in the town and along town roads. Since the previous HMP, the Town has relinquished the responsibility for plowing the roads of private associations to those associations, allowing the Town to focus on important public ways. Treated salt is used for de-icing. The Town has established plowing routes that prioritize access to and from critical facilities. Main roads are plowed before secondary roads. Plows are diverted to address emergency service needs whenever necessary. The Connecticut Department of Transportation plows the State roads in the town.

Groton's plowing fleet has not changed since the previous HMP, and has been sufficient for the Town's needs. An area for dumping excess snow has been designated and permitted.

The Connecticut Building Code specifies that a pressure of 30 pounds per square foot be used as the base "ground snow load" for computing snow loading for roofs. The Town performed visual assessments of many buildings during the winter of 2010-2011 as noted above and cleared several town-owned roofs. Many residents also shoveled their own roofs or hired contractors to clear their roofs of excessive snow.

Summary

In general, municipal capabilities to mitigate snowstorm damage have increased slightly since the 2012 edition of the hazard mitigation plan was adopted. This is because the Town continues to experience heavy snow each winter.

7.3 Vulnerabilities and Risk Assessment

Severe winter storms can produce an array of hazardous weather conditions, including heavy snow, blizzards, freezing rain and ice pellets, flooding, heavy winds, and extreme cold. Further "flood" damage could be caused by flooding from frozen water pipes. Often, tree limbs on roadways are not suited to withstand high wind and snow or ice loads.

This section focuses on those effects commonly associated with winter storms, including those from blizzards, ice storms, heavy snow, freezing rain, and extreme cold. Warning and education can prevent most injuries from winter storms. This is particularly important as the town includes many residents who are elderly and additional elderly developments are proposed. Most deaths from winter storms are indirectly related to the storm, such as from traffic accidents on icy roads and hypothermia from prolonged exposure to cold. Damage to trees and tree limbs and the resultant downing of utility cables are a common effect of these types of events. Secondary effects can include loss of power and heat.

Many buildings in the town that are recently constructed are not susceptible to damage from heavy snow. While some Town buildings could be susceptible to heavy snow loads, they will be cleared quickly if safety is a concern. Some buildings in the town have flat roofs which are more susceptible to damage from heavy snow than sloped roofs. A more detailed response plan is necessary to ensure that town buildings, including schools, are properly inspected and cleared if excessive snow is an issue in the future.

Icing is not a significant issue in the town. In general, there are few steep slopes such that extra salting of the roadways in necessary locations alleviates any trouble spots.

7.4 Potential Mitigation Strategies and Actions

Potential mitigation measures for flooding caused by nor'easters include those appropriate for flooding that were discussed in Section 3.7 and Section 4.7 of the Multi-Jurisdictional HMP and Section 11 of this annex. General potential mitigation measures that can be taken to reduce the effects of wind damage were discussed in Section 5.7 and in Section 11.2.3 of the Multi-Jurisdictional HMP and Section 11 of this annex. However, winter storm mitigation measures must also address blizzards, snow, and ice hazards. These were discussed in Section 7.7 and Section 11.2.4 of the Multi-Jurisdictional HMP and Section 11 of this annex.

8.0 EARTHQUAKES

8.1 Setting / Historic Record

An earthquake is a sudden rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric, and telephone lines; and often cause landslides, flash floods, fires, avalanches, and tsunamis. Earthquakes can occur at any time and often without warning. Detailed descriptions of earthquakes, scales, and effects can be found in Section 8 of the Multi-Jurisdictional HMP. Despite the low probability of an earthquake occurrence, earthquake damage presents a potentially catastrophic hazard to the town. However, it is very unlikely that the town would be at the epicenter of such a damaging earthquake. No major earthquakes have affected the town since the last HMP.

8.2 Existing Capabilities

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

Due to the infrequent nature of damaging earthquakes, Town land use policies do not directly address earthquake hazards. However, the potential for an earthquake and emergency response procedures is addressed in the Town's EOP.

In general, municipal capabilities to mitigate earthquake damage have not increased since the 2012 edition of the hazard mitigation plan was adopted. This is because the hazard continues to pose a low risk of damage to the Town.

8.3 Vulnerabilities and Risk Assessment

Surficial earth materials behave differently in response to seismic activity. Unconsolidated materials such as sand and artificial fill can amplify the shaking associated with an earthquake. As noted in Section 2.1, a several areas of the town (particularly near watercourses and underlying the entire Groton-New London airport) are underlain by stratified drift. These areas are potentially more at risk for earthquake damage than the areas of the town underlain by glacial till. The best mitigation for future development in areas of sandy material is the application of the most stringent standards in the Connecticut Building Code, exceeding the building code requirements, or, if the Town deems necessary, the possible prohibition of new construction. The areas that are not at increased risk during an earthquake due to unstable soils are the areas underlain by glacial till.

Two faults are mapped within the eastern section of the town, trending north-south. Although they are believed to be inactive, they are associated with the Honey Hill/Lake Char fault system that extends west to east through Salem, Montville, and Preston. The west-east portion of the fault system is considered moderately active by the Connecticut Department of Emergency

Services and Public Protection and has been linked with recent small earthquake activity in East Haddam, on the order of 1 to 2 on the Richter scale. Towns that are intersected by this fault zone are considered at moderate risk for very low-intensity earthquakes such as those experienced in East Haddam. Groton may have slightly lower risk due to its position to the south of the main fault zone.

Unlike seismic activity in California, earthquakes in Connecticut are not associated with specific known active faults. However, bedrock in Connecticut and New England in general is typically formed from relatively hard metamorphic rock that is highly capable of transmitting seismic energy over great distances. For example, the relatively strong earthquake that occurred recently in Virginia was felt in Connecticut because the energy was transmitted over a great distance through such hard bedrock.

The built environment in the town primarily includes some more recent construction that is seismically designed. However, most buildings were built before the 1980s and therefore are not built to current building codes. Thus, it is believed that most buildings would be at least moderately damaged by a significant earthquake. Those residents who live or work in older, non-reinforced masonry buildings are at the highest risk for experiencing earthquake damage.

Areas of steep slopes can collapse during an earthquake, creating landslides. The town has several areas with steep slopes greater than 15% located throughout the town and these areas have already prevented significant development. While landslides are not a particular concern in the town, areas beneath steep slopes could be vulnerable to landslide damage during a major earthquake.

Seismic activity can also break utility lines such as water mains, gas mains, electric and telephone lines, and stormwater management systems. Damage to utility lines can lead to fires, especially in electric and gas mains. Dam failure can also pose a significant threat to developed areas during an earthquake. For this HMP, dam failure has been addressed separately in Section 10.0. As noted previously, most utility infrastructure in the town is located above ground. A quick and coordinated response with CL&P, Groton Utilities, and other providers will be necessary to inspect damaged utilities following an earthquake, to isolate damaged areas, and to bring backup systems online. This is covered in the EOPs for these entities.

A *HAZUS-MH* analysis of the potential economic and societal impacts to the SCCOG region from earthquake damage is detailed in the Multi-Jurisdictional HMP. The analysis addresses a range of potential impacts from any earthquake scenario, estimated damage to buildings by building type, potential damage to utilities and infrastructure, predicted sheltering requirements , estimated casualties, and total estimated losses and direct economic impact that may result from various earthquake scenarios.

8.4 Potential Mitigation Strategies and Actions

Due to the low probability of occurrence, potential mitigation measures related to earthquake damage primarily include adherence to building codes and emergency response services. Both of these are mitigation measures common to all hazards as noted in Section 11 of this annex.

The Multi-Jurisdictional HMP also includes additional recommendations for mitigating the effects of earthquakes that are also listed in Section 11.

9.0 WILDFIRES

9.1 Setting / Historic Record

Wildfires are considered to be highly destructive, uncontrollable fires. The most common causes of wildfires are arson, lightning strikes, and fires started from downed trees hitting electrical lines. Thus, wildfires have the potential to occur anywhere and at any time in both undeveloped and lightly developed areas of the town.

Four acres of forested land burned off Route 184 near Center Groton about three years ago. An additional four acres of land burned near Bluff Point and the airport a few years ago. These are the only notable wildfires since the preparation of the last HMP.

9.2 Existing Capabilities

Monitoring of potential fire conditions is an important part of mitigation. The Connecticut DEEP Forestry Division uses the rainfall data recorded by the Automated Flood Warning system to compile forest fire probability forecasts. This allows the DEEP to monitor drier areas to be prepared for forest fire conditions. The Town can access this information over the internet. The Town also receives "Red Flag" warnings via local media outlets.

Existing mitigation for wildland fire control is typically focused on building codes, public education, Fire Company training, and maintaining an adequate supply of equipment. The Fire companies go to fires as quickly as possible in the Town. Groton Utilities provides fire protection water. Fire pumps are tested and are considered to provide excellent pressure. Each hydrant is banded such that the Fire Company knows how much pressure is available. The Town has few dry hydrants since public water service is available throughout the town. Installation of dry hydrants and cisterns is not required by regulations.

The level of fire protection afforded by the existing public water service and other water sources in outlying areas is considered to be good for the development level of the Town. The Fire Companies will continue to evaluate the level of risk and the need for additional public water system hydrants or other water sources in the future.

The Connecticut DEEP has recently changed its Open Burning Program. It now requires individuals to be nominated and designated by the Chief Executive Officer in each municipality that allows open burning and to take an online training course and exam to become certified as an "Open Burning Official." Permit template forms were also revised that provide permit requirements so that the applicant/permittee is made aware of the requirements prior to, during, and after burn activity. The regulated activity is then overseen by the Town.

Summary

In general, municipal capabilities to mitigate wildfire damage have remained consistent since the 2012 edition of the hazard mitigation plan was adopted.

9.3 Vulnerabilities and Risk Assessment

The risk for wildlife in the Town is low for several reasons. First, with the exception of Groton Utilities watershed land, the Town is largely developed such that there are few outlying areas where a wildfire could advance undetected. Secondly, developed areas of the Town have public water service provided by Groton Utilities. This public water service provides sufficient water volume and pressure to fight nearly any fire. Third, the Thames River and Fishers Island Sound are nearby if additional firefighting water was necessary. Fourth, there are few notable dead ends or one-way roads that are difficult to access in the Town. Finally, the Town has very extensive coverage from its many Fire Companies. Thus, if a wildfire did occur, it would likely be contained to within only a few acres. This was true of the two recent four-acre fires noted above.

9.4 Potential Mitigation Strategies and Actions

The Town of Groton is a low-risk area for wildfires. Potential mitigation measures for wildfires include a combination of prevention, education, and emergency planning measures as presented in Section 11.

10.0 DAM FAILURE

10.1 Setting / Historic Record

Dam failures can be triggered suddenly with little or no warning and often in connection with natural disasters such as floods and earthquakes. Dam failures can occur during flooding when the dam breaks under the additional force of floodwaters. In addition, a dam failure can cause a chain reaction where the sudden release of floodwaters causes the next dam downstream to fail. While flooding from a dam failure generally has a limited geographic extent, the effects are potentially catastrophic depending on the downstream population. A dam failure affecting Groton is considered a possible event each year with potentially significant effects. No dam failures have impacted the town since the previous HMP.

10.2 Existing Capabilities

The Connecticut DEEP administers the Dam Safety Section and designates a classification to each state-registered dam based on its potential hazard as detailed in the regional plan. According to the 2016 updated list of registered dams with the DEEP Dam Safety Division, there are three DEEP-registered high or significant hazard dams within Groton. Dams in Groton are listed in Table 10-1.

TABLE 10-1
Dams Registered With the DEEP in the Town of Groton

Number	Name	Owner	Class
5902	Ledyard Reservoir	Groton Utilities	B
5904	Poquonock Dam	Groton Utilities	C
5905	Poheganut Reservoir	Groton Utilities	B

Failure of a Class C dam would result in any of the following: loss of life; major damage to habitable structures, residences, hospitals, convalescent homes, schools, and main highways; and a significant economic loss. Failure of a Class B dam failure would result in any of the following: possible loss of life; minor damage to habitable structures, residences, hospitals, convalescent homes, and schools; damage or interruption of the use of service of utilities; damage to primary roadways and railroads; and a significant economic loss. Both hazard classes of dams are regarded as significant in the state of Connecticut.

Dams in the region whose failure could impact Groton are under the jurisdiction of the Connecticut DEEP. The dam safety statutes are codified in Section 22a-401 through 22a-411 inclusive of the Connecticut General Statutes. Sections 22a-409-1 and 22a-409-2 of the Regulations of Connecticut State Agencies have been enacted, which govern the registration, classification, and inspection of dams. Dams must be registered by the owner with the DEEP according to Connecticut Public Act 83-38.

Owners of high and significant hazard dams are required to maintain EAPs for such dams. EAPs are not on file for the three dams listed in Table 10-1, although it is presumed that they could be obtained from Groton Utilities. The Town has reached out to Groton Utilities to obtain these documents.

Summary

In general, municipal capabilities to mitigate dam failure damage have not increased since the 2012 edition of the hazard mitigation plan was adopted. However, changes in the State's regulation of dams have increased Statewide capabilities.

10.3 Vulnerabilities and Risk Assessment

The impacts related to the Class C and Class B dams in Town are described below. The description below is based on information available at the Connecticut DEEP Dam Safety Section.

- *Ledyard Reservoir* has a Class B dam located in north-central Groton off Gales Ferry Road. Failure of this dam would inundate the Great Brook corridor and damage commercial and residential properties along Route 184 before floodwaters reached the Poquonock Reservoir, described below.

- *Poquonock Reservoir* has a Class C dam located 1,500 feet north of Route 1 at the Poquonock River estuary, adjacent to the water treatment plant. The impoundment is the terminal reservoir of the Groton water supply system. The dam is considered intermediate in size, has a watershed of 15.9 square miles, and impounds 1,000 acre-feet. The structure was built in 1901 and was incorporated into an earlier dam. In 1968, the stonefill structure was surfaced with flat stones placed against the spillway. In 1974, Metcalf & Eddy developed preliminary designs to enlarge the spillway and raise the dam. This study included a DFA and is on file at the CT DEEP. According to the 1980 Phase II report by Lenard & Dilaj Engineering, the dam is a masonry earthfill structure with a length of 290 feet and a maximum height of 12 feet. The 90-foot long spillway is a masonry wall, sloped stonefill. The downstream face is surfaced with flat stones. The impoundment has an irregular shape, but is generally oriented in a north-south direction and is approachable on all sides by roads. The reservoir is bisected by Interstate 95. .

  An Operations, Inspection and Maintenance Plan for the dam was reportedly written in 1980. Failure of this dam would damage commercial and residential properties along Route 1 in the Poquonock Bridge area before floodwaters reached the Poquonock River estuary. Failure of the Ledyard Reservoir Dam could lead to failure of the Poquonock Reservoir dam.

- *Poheganut Reservoir* has a Class B dam located near I-95. Although located very near the Poquonock Reservoir, the level of Poheganut Reservoir is some 12 feet higher. Failure of the Poheganut Reservoir Dam could lead to failure of the Poquonock Reservoir dam and thus flooding of Route 1 and associated commercial and residential properties.

Groton Utilities owns another reservoir and dam located upstream of the Ledyard Reservoir and Poquonock Reservoir. This is the Morgan Pond Dam, located in central Ledyard. The Morgan Pond Dam is a Class B dam whose failure would impact the Town of Groton. Morgan Pond is the most upstream of the Groton Utilities water supply reservoirs. Water passing over the Morgan Pond Dam spillway flows into Ledyard Reservoir, eventually discharging to Great Brook into the Poquonock Reservoir. Morgan Pond receives water from the Billings Avery diversion. According to a 1987 inspection by Lenard Engineering, the Morgan Pond dam is an earthen embankment with concrete spillway having a length of 1,500 feet and a maximum height of 45 feet. The spillway is located 600 feet from the right embankment contact area, and is 40 feet long with an ogee crest. Installation of crest gates was completed in March 1992, which effectively raised the pond elevation by three feet. A Dam Failure Analysis (DFA) was completed as part of the 1987 inspection, and utilized a ½ PMF of 1,726 cfs.

While dams upstream in the Thames River basin could potentially cause a rise in water levels in the Thames River if they failed, their failure is expected to have a minimal effect on the Town of Groton due to the distance involved and the significant ability of Long Island Sound and the Thames River to absorb flood waters.

Hyde Pond Dam on Whitford Brook at Route 184 / the new London Turnpike was removed in 2016, thereby removing any low risks associated with this dam.

10.4 Potential Mitigation Strategies and Actions

Groton is considered a generally low-risk area for dam failure. The Class B and C dams are owned by Groton Utilities and well-maintained in close coordination with Connecticut DEEP to ensure that these public water supply sources remain intact and viable. While EOPs and dam failure inundation mapping was not found for all of the dams in the Connecticut DEEP Dam Safety files, this information could exist elsewhere.

Recommendations are presented in this HMP with the goal of reducing Groton's long-term risk of experiencing a dam failure. Potential mitigation measures for dam failure include a combination of prevention, education, and emergency planning, as well as dam removal projects as discussed in Section 11.

11.0 MITIGATION STRATEGIES AND ACTIONS

11.1 Status of Mitigation Strategies and Actions

The previous edition of the SCCOG Multi-Jurisdictional HMP and Town of Groton annex listed a suite of hazard mitigation actions applicable both locally and region-wide. These actions, along with commentary regarding the status of each, are listed in the tables in this section. Additionally, new actions were developed in the process of developing this HMP update. These are listed at the end of each hazard section below.

11.1.1 Actions Applicable to All Hazards

Actions Applicable to All Hazards		
Action	**Status**	**Status**
Regional Coordination		
Continue to promote inter-jurisdictional coordination efforts for emergency response	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continue to promote local and regional planning exercises that increase readiness to respond to disasters	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continue to evaluate communication capabilities and pursue upgrades to communication and ensure redundant equipment is available	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continue to promote regional transportation planning through SCCOG	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Work with the SCCOG to perform a regional study of the vulnerability of critical facilities to natural hazard damage	*Complete*	*This action is the responsibility of, and was performed by, SCCOG in 2017. The Town Hall and Groton Long Point Police/Fire facility were included in the study due to their positions near or in flood zones. Recommendations from the study are incorporated into this HMP.*
Work with the SCCOG to develop regional evacuation scenarios that include but build upon the Millstone evacuation plan	*Capability*	*The Town participates in regional hazard mitigation projects. Completion of this action is the responsibility of, and is being performed by, SCCOG. This action is redefined as a regional capability, and is dropped.*
Local Emergency Response & Public Information		
Continue to review and update the Town EOP at least once annually	*Capability*	*In lieu of revising the EOP into the State's new format, the Town has notified the State that the EOP is sufficient and will revise it in the next few years. This action is reclassified as a capability.*
Continue to maintain emergency response training and equipment and upgrade equipment when possible	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Encourage Town officials to attend FEMA-sponsored training seminars at EMI	*Capability*	*This action is reclassified as a capability and can be removed from this list. Town staff have also participated in events of the Connecticut Association of Flood Managers.*
Continue to evaluate emergency shelters, update supplies, and check communication equipment	*Capability*	*This action is reclassified as a capability and can be removed from this list.*

Actions Applicable to All Hazards		
Action	**Status**	**Status**
Continue to promote dissemination of public information regarding natural hazard effects into Government buildings, with additions	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Utilize the CT Alerts Reverse 9-1-1 system during emergencies	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Expand the availability of standby power in the Town's critical facilities particularly the Senior Center	*Carry Forward*	*The Town has not had the resources for this, but it is a priority.* *Carry forward.*
Prevention		
Integrate elements of this HMP and the Climate Change Project into the next POCD and MCP updates	*Complete*	*This action is complete.*
Continue reviewing building plans to ensure proper access for emergency vehicles	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Consider expanding street tree planting programs while recommending appropriate street-side trees and encouraging maintenance	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Require the underground installation of utilities for all new development	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continue to enforce the appropriate building code for new building projects	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Encourage residents to install and maintain lightning rods on their structures	*Delisted*	*This has not been necessary.* *This action is dropped.*
Natural Resource Protection & Open Space		
Work with the City of Groton to create an open space corridor along Birch Plain Creek	*Complete/ Carry Forward*	*The Sparkle Lake Open Space (acquired 2013) is part of this area. Additional progress is desired. This action is carried forward.*
Continue to regulate development in protected and sensitive areas including steep slopes, wetlands, and floodplains	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continue requiring the deduction of sensitive areas when determining residential density for new developments	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Fund open space acquisitions so land can be purchased when it becomes available	*Complete/ Capability*	*Examples include the Sparkle Lake Open Space (2013) and lands acquired by the Groton Open Space Association (GOSA acquired the 91-acre Candlewood Ridge in June 2013). This is a strong capability and can be removed from the list of actions.*
Ensure that any open space acquired be preserved appropriately	*Capability*	*This action is reclassified as a capability and can be removed from this list.*

Other actions or strategies completed since the previous HMP include:

- The Sparkle Lake Conservation Area was developed as dedicated open space
- The Groton Open Space Association has successfully acquired a number of properties in the past five years

New actions or strategies developed during the HMP update include:

- Equip the new middle school with a standby generator that is sufficiently powerful to serve

the entire building, and designate this building as an emergency shelter

- ❑ Upgrade the standby generator at the Senior Center so that it is capable of powering the entire building
- ❑ Install air-conditioning units in emergency shelters so that they can be used safely during summertime emergencies
- ❑ Upgrade the standby generator at the High School so that it is capable of powering the entire building
- ❑ Pursue the acquisition of the Tilcon land, which is traversed by Fort Hill Brook.
- ❑ From the Critical Facilities Assessment completed by SCCOG in 2017:
  - o Groton Town Hall: Nothing in the lifespan of this HMP (long-term actions are recommended).
  - o Groton Long Point Police/Fire Facility: Complete additional utility room dry floodproofing and expanded wet floodproofing.

11.1.2 Actions Applicable to Inland and Coastal Flooding

Actions Applicable to Inland and Coastal Flooding		
Action	**Status**	**Status**
	Prevention	
Continue to regulate new development activities within SFHAs to the greatest extent possible within the local land use regulations.	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Continually review regulations affecting coastal areas to ensure that siting of development within coastal flood hazard areas (A- and V-zones) is discouraged, and hazards to life and property are minimized.	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Require developers to demonstrate whether detention or retention of stormwater is the best option for reducing peak flows downstream.	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Review local Zoning Regulations and evaluate the possibility of incorporating changes to place further limitations on areas of impermeable surfaces in new residential subdivision developments in flood prone areas. If warranted, make necessary changes.	*Complete*	*A Zoning Regulation re-write was completed in 2016-2017. This action is complete.*
Conduct an annual inspection of floodprone areas that are accessible to Town officials. Determine if potential flood damage is stormwater facility related and make recommendations as appropriate.	*Delisted*	*The Town does not have the resources for annual inspections. Instead, they monitor known problems and respond to complaints and address issues on a case by case basis.* *This has been sufficient to monitor and manage drainage issues.* *This action is dropped.*
Limit development activities within potential storm surge areas as mapped by FEMA.	*Capability*	*The Town does this through the regulation of SFHAs.* *This action is reclassified as a capability and can be removed from this list.*
Consider flexible yard requirements and regulatory incentives to allow for and encourage larger separations of buildings from coastal high hazard areas and encourage or require property owners to build as far back from eroding shorelines and vulnerable beach areas as possible.	*Carry Forward*	*The Town developed a Municipal Coastal Program to advance resilience concepts, and it discusses setbacks.* *The next step will be to revisit this action.* *This action is carried forward.*

Actions Applicable to Inland and Coastal Flooding		
Action	**Status**	**Status**
Work with State and Federal agencies to ensure that flood protection regulations reflect current thinking and standards especially with regard to long-term rise in sea levels.	*Complete*	*The Town developed a Municipal Coastal Program to advance resilience concepts and has adopted freeboard. This action is complete.*
Utilize the recently released DFIRM to compile a list of addresses with structures within the 1% annual chance floodplain. Track the cost of repairs to these properties following major storm events through outreach or building permits to develop a database of information for potential future grant funding.	*Complete*	*The Town keeps track of repairs and improvements in the SFHA. However, the Town does not promote the use of grant funds for private property mitigation. This action is considered complete.*
Consider a study to determine if improvements are necessary to control flooding on Birch Plain Creek near Poquonnock Road since the former Electric Boat Dam has been removed.	*Carry Forward*	*The Town has not had sufficient resources for this type of study. Carry forward.*
Property Protection		
Incorporate information on the availability of flood insurance into all hazard-related public education workshops.	*Delisted*	*The Town does not have the resources to do this. This action is dropped.*
Make available FEMA-provided flood insurance brochures at public accessible places such as the local government buildings. Encourage residents to purchase flood insurance if they are located within a FEMA SFHA.	*Capability*	*This action is reclassified as a capability and can be removed from this list.*
Provide technical assistance to owners of non-residential structures that suffer flood damage regarding floodproofing techniques such as wet and dry floodproofing.	*Carry Forward*	*This has not been necessary in the last five years. Carry forward.*
When property owners become interested, pursue elevations or acquisitions of residential properties that suffer flood damage.	*Capability*	*Numerous property owners have elevated their structures. The Town does not promote the use of grant funds for private property mitigation. This action is reclassified as a capability.*
Upon completion of the pending update to Groton's Municipal Coastal Program, consider strategic application of freeboard standards of one foot or greater when requiring structure elevations for renovations and new construction in coastal A and V zones.	*Complete*	*Freeboard is required This action is complete.*
Remind residents that their flood insurance rates will not increase if they make a claim since the insurance is federally subsidized and encourage them to submit claims following damage events.	*Delisted*	*The Town does not have the resources to do this, nor has it been necessary. This action is dropped.*
Work with the fire districts to pursue floodproofing for the fire stations in flood hazard areas and hurricane surge zones.	*Complete/ New*	*The Poquonnock Bridge fire house located in the SFHA has been retired from service and the fire district utilizes a building located outside the SFHA. The SCCOG Critical Facility study included the Groton Long Point Police/Fire facilities. A new mitigation action has been developed for this facility.*
Emergency Services		
Develop a site-specific evacuation plan for residents of the Mystic River Homes senior living complex, as it is located in a flood zone.	*Delisted*	*This is no longer necessary because dry land access has been established. This action is dropped.*
Develop a protocol to address redevelopment of buildings severely damaged or destroyed after a major coastal storm.	*Carry Forward*	*This has not been necessary. This action is carried forward.*

Actions Applicable to Inland and Coastal Flooding		
Action	**Status**	**Status**
Ensure that the EOP provides up-to-date, detailed instructions regarding the timing of evacuations from the southern part of the Town, since these roads will be significantly flooded or washed out by a major hurricane.	*Delisted*	*The Town has found that its EOP is sufficient and this has not been necessary.* *This action is dropped.*
Investigate locations and necessary labor involvement for the pre-event stockpiling of sand bags for use in floodprone areas.	*Complete*	*Supplies are maintained and the Town can access three bagging devices as well as labor for bagging.* *This action is complete.*
Pursue mutual aid agreements with such organizations as the American Red Cross and the Boy Scouts of America to provide volunteer labor prior to or during flood events to fill sand bags and assist with other response activities.	*Complete*	*Supplies are maintained and the Town can access three bagging devices as well as labor for bagging.* *This action is complete.*
Incorporate the 1% annual chance and the 0.2% annual chance inland and coastal floodplains based on the recent DFIRM into the Reverse 9-1-1 system.	*Complete*	*This action is complete.*
Implement a roadway-specific warning system to alert motorists to the dangers present during times of flooding. Warning may take the form of dedicated signage or traffic control lights.	*Complete*	*Evacuation signs are affixed to staff gauges and are located at many intersections in the SFHAs.* *This action is complete.*
Public Education and Awareness		
Consider having a local Natural Hazards Awareness Week each year. As part of this week, conduct an annual "Flood Fair" so that residents, business owners, insurance and real estate agents, and all interested parties can familiarize themselves with functions of a floodplain, the laws governing development in a floodplain and the associated hazards, mitigation alternatives, and precautions necessary for living in flood prone areas. Climate change and sea level rise concepts should be included. Invite local insurance agents and the NFIP representatives from FEMA's insurance contractors to educate the public on the program.	*Delisted*	*The Town does not have the resources to do this. However, the new POCD and MCP address climate change and sea level rise.* *This action is dropped.*
Visit schools (as is currently done under fire prevention) and educate children about the risks of floods (and other natural hazards) and how to prepare for them. Climate change and sea level rise concepts should be included.	*Delisted*	*The Town does not have the resources to do this. However, the new POCD and MCP address climate change and sea level rise.* *This action is dropped.*
Expand the annual public outreach projects to include a brochure which will outline the risks of flood prone areas and mitigation and preparedness strategies and contacts. The brochure would be handed out annually.	*Delisted*	*The Town does not have the resources to do this.* *This action is dropped.*
Encourage builders, developers, and architects to become familiar with the NFIP land use and building standards by attending annual workshops.	*Delisted*	*The Town does not have the resources to do this.* *This action is dropped.*
Natural Resource Protection		
Conduct beach nourishment and vegetation as needed to keep up with erosion.	*Carry Forward*	*The Town has not had the resources to do this, but is interested in pursuing these actions.* *Carry forward.*

Actions Applicable to Inland and Coastal Flooding		
Action	**Status**	**Status**
Acquire properties adjacent to tidal wetlands and set aside for advancement of tidal marshes.	*Complete/ Capability*	*The Sparkle Lake area in the coastal SFHA was acquired in 2013 and is now Town-owned open space. This prevented the siting of a new school on the land. Other areas will be acquired as they become available. This action is reclassified as a capability.*
Structural Projects		
Encourage the use of floodplain storage, diversions, berms, dikes, and other flood control methods in new developments and at existing properties where appropriate.	*Delisted*	*The Town's preference is to avoid new development in SFHAs. This action is dropped.*
Utilize recently available extreme rainfall data to determine existing sizing of culverts. Encourage bridge replacements and culvert replacements in areas found to be undersized.	*Carry Forward*	*The Town has not had an opportunity to use this data yet, but plans to use it. Carry Forward*
Continue to require that post- development rates of runoff to be no greater than pre-development conditions in most circumstances; utilize recently available extreme rainfall data as noted above when designing controls.	*Carry Forward*	*The Town has not had an opportunity to use this data yet, but plans to use it. Carry Forward*
Continue to perform catch basin and culvert surveys to perform maintenance and cleaning and to identify and prioritize structures in need of replacement.	*Capability*	*This is a capability and can be removed from the list of actions.*
Investigate funding sources and feasibility of improvements to mitigate frequent and repeated flooding problems. Improvements could include elevation of roads and replacement of storm drainage systems. Work with CT DOT to facilitate these actions if State roads are involved.	*Carry Forward / Modify*	*The Town has not had the resources for this yet. The new MCP discusses this issue appropriately Carry Forward with a modification to focus on study and prioritization.*
Upgrade stormwater collection and discharge systems to keep up with rising sea level.	*Carry Forward*	*The Town has not had the resources for this yet. The new MCP discusses this issue appropriately Carry Forward with a modification to focus on study and prioritization.*
Install appropriately designed flood/tide gates at locations such as Groton Long Point and Mumford Cove, with considerations for sea level rise built into the designed.	*Carry Forward / Modify*	*The Town has not had the resources for this yet. Carry Forward with a modification to focus on study and prioritization.*
Maintain existing hard structures along the coast in good condition.	*Capability*	*The Town has been allocating funds to repair a 130' bulkhead in Noank. The new MCP discusses this issue appropriately. These will be addressed on a case by case basis.*
Encourage or require use of "non-structural" erosion control measures (such as vegetated slopes and elevated foundations) when and where appropriate.	*Carry Forward / Modify*	*The Town has not had the resources to do this, but is interested in pursuing living shorelines and bioengineered erosion mitigation. The new MCP discusses this issue appropriately. Carry Forward with a modification to focus on study and prioritization.*
Strive to ensure that structural measures will not cause secondary or cumulative shoreline impacts.	*Delisted*	*The Town's preference is to avoid new development in coastal SFHAs. This action is dropped.*
Ensure that the Groton WPCF is adequately protected from coastal flooding and storm surge, and perform improvements if necessary.	*Complete*	*In connection with general upgrades, resiliency measures are being incorporated. Electrical panels and equipment are being removed from the basement, and flood gates are being installed.*

Actions Applicable to Inland and Coastal Flooding		
Action	**Status**	**Status**
Complete the ongoing engineering study of Groton Long Point Road Bridge and determine appropriate means of protecting this important mode of egress to keep up with rising sea level and withstand coastal storms.	*Carry Forward / Modify*	*The Town has not had the resources to do this. The current tentative plan is to harden and upgrade the causeway and bridge without elevating it.* *Carry Forward with a modification to focus on study and design.*
Evaluate potential roadway elevation and structural protections at Groton-New London Airport, as it lies in the coastal flood hazard area.	*Carry Forward / Modify*	*The Town has not had the resources to do this, but is interested in pursuing these actions. The new MCP discusses this issue appropriately.* *Carry Forward with a modification to focus on study and prioritization.*
Work with Amtrak to prioritize bridge replacements at the Poquonnock Road and South Road underpasses to facilitate enhanced emergency transportation. Conduct drainage Improvements at the South Road and Poquonnock Road underpasses to reduce flooding.	*Carry Forward / Modify*	*The Town has not had the resources to do this, but is interested in pursuing these actions. The new MCP discusses this issue appropriately.* *Carry Forward with a modification to focus on study.*

New actions or strategies developed during the HMP update include:

- ❑ Work with The Nature Conservancy to identify redevelopment options for the Fort Hill homes area, which is partly located in a SFHA.
- ❑ In accordance with the recommendations of the historic and cultural resources resiliency planning effort in 2016-2017:
  - o Determine if any at-risk structures that are not yet eligible for historic designation will be eligible in the future. This may take the form of a historic resources survey.
  - o Conduct a pilot study in Mystic to determine how a small number of historic structures may be mitigated without loss of historicity that is connected to their location near or over water.

11.1.3 Actions Applicable to Wind Damage from Hurricanes, Tropical Storms, Summer Storms, Tornadoes, and Winter Storms

Action	**Status**	**Status**
Prevention		
Work with the State to locate NOAA weather radios in commercial buildings with large population clusters	*Delisted*	*With advances in warning systems, this has not been necessary.* *This action is dropped.*
Work with marinas to ensure personal watercraft can be removed in a timely manner prior to a hurricane or tropical storm event	*Delisted*	*This has not been necessary.* *This action is dropped.*
Work with SCCOG to implement a regional Marina Management Plan for wind damage, and encourage local clubs to develop plans	*Capability*	*The Town participates in regional hazard mitigation projects. Completion of this action is the responsibility of, and is being performed by, SCCOG. This action is redefined as a regional capability.*
Property Protection		
Promote use of functional shutters for older buildings, particularly at the Senior Center	*Delisted*	*This has not been necessary.* *This action is dropped*
Make information on wind-resistant construction techniques available to all building permit applicants	*Capability*	*This is a capability and can be removed from the list of actions.*

Action	Status	Status
Encourage commercial building owners or managers of large population clusters to develop response plans and mitigation opportunities	*Carry Forward*	*The Town has not had the resources to do this, but is interested in pursuing these actions. The new MCP discusses this issue appropriately.* *Carry Forward*
Upgrade shelters and critical facilities to resist stronger winds when possible	*Carry Forward*	*The Town has not had the resources to do this.* *This action is carried forward.*
Emergency Services		
Consider surveying all Town-owned buildings to determine ability to withstand wind load	*Delisted*	*The Town does not have the resources to do this.* *This action is dropped. Note that the SCCOG Critical Facilities Assessment included wind risk evaluation for Town Hall and Groton Long Point Police/Fire.*
Develop agreements with landowners and companies to chop/chip to ensure backup plans are in place for debris removal	*Delisted*	*This has not been necessary. Adequate space and procedures are in place.* *This action is dropped.*
Public Education and Awareness		
Consider an annual "Wind Fair" to familiarize the public with wind hazards and potential mitigation measures	*Delisted*	*The Town does not have the resources to do this.* *This action is dropped.*
Visit schools & educate children about risks of wind events and how to prepare for them	*Delisted*	*The Town does not have the resources to do this.* *This action is dropped.*
Post and maintain signs signifying evacuation routes from coastal areas	*Complete*	*Evacuation signs are affixed to staff gauges and are located at many intersections in the SFHAs.* *This action is complete.*
Develop working relationships with local community organizations and encourage them to promote wise landscaping techniques	*Carry Forward*	*The Town has not had the resources to do this.* *This action is carried forward.*

11.1.4 Actions Exclusively Applicable to Winter Storms

Action	Status	Status
Consider drafting a written plan for inspecting and prioritizing the removal of snow from Town-owned structures	*Capability*	*The Town has not found this necessary, as buildings are addressed case-by-case.* *This action is dropped.*
Continue making funding available to the Public Works Department each year for clearing snow from roads and parking lots	*Capability*	*This is a capability and can be removed from the list of actions.*
Provide information for protecting Town residents during cold weather and for mitigating icing and insulating pipes at residences	*Carry Forward*	*The Town has not had the resources to do this.* *Carry forward.*
Continue to identify areas that are difficult to access during winter storm events and develop contingency plans to access such areas	*Capability*	*This is a capability and can be removed from the list of actions.*

11.1.5 Actions Applicable to Earthquakes

Action	Status	Status
Ensure Town departments have adequate backup supplies & facilities for continued functionality following an earthquake	*Delisted*	*Groton does not have a backup EOC, but in general there are sufficient redundancies.* *This action is considered unnecessary and is dropped.*
Consider preventing residential development in areas prone to collapse such as below steep slopes or areas prone to liquefaction	*Delisted*	*This has not been necessary. Adequate protections are believed in place, and there are few sites for new development in these areas.*

		This action is dropped.
Carefully guide development near the airport as it is located above extensive sand deposits susceptible to shaking or liquefaction	*Delisted*	*This has not been necessary. Adequate protections are believed in place via the State Building Code, and there are few remaining sites for new development near the airport. This action is dropped.*

11.1.6 Actions Applicable to Wildfires

Action	Status	Status
Continue to evaluate fire flows, available water supply, & areas at risk of wildfire in town	*Capability*	*This is a capability and can be removed from the list of actions. In the last five years, Groton Utilities and Aquarion Water Company interconnected the Groton and Mystic systems, which has improved fire protection water availability. Aquarion is constructing a new tank, which will improve pressures.*
Continue to support public outreach programs to increase awareness of forest fire danger, equipment usage, and protecting homes	*Capability*	*This is a capability and can be removed from the list of actions.*
Ensure provisions of Town regulations regarding fire protection facilities & infrastructure are being enforced	*Capability*	*This is a capability and can be removed from the list of actions.*

11.1.7 Actions Applicable to Dam Failure

Action	Status	Status
Ensure that copies of EOPs for all the Groton Utilities dams are on file with the Town of Groton Office of Emergency Management.	*Carry Forward*	*The Town is waiting to receive the new EAPs. Carry Forward.*
Work with Groton Utilities to conduct a tabletop exercise (drill) that simulates a potential dam failure, as Norwich Public Utilities has done with the City of Norwich.	*Carry Forward*	*The Town will pursue this after the new EAPs are ready. Carry Forward.*

11.2 Prioritization of Specific Actions

As explained in Section 11.3 of the Multi-Jurisdictional HMP, the STAPLEE method was utilized in this annex to prioritize actions. Table 11-1 presents the STAPLEE matrix for the Town of Groton. Each action includes the Town department responsible for implementing the action, a proposed schedule, and whether or not the action is new or originally from the previous HMP. Refer to Section 2.7 for the list of previous plan actions and whether or not each action was carried forward into this HMP.

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Insert Table 11-1 STAPLEE

Table 11-1: Mitigation Actions and Strategies for Town of Groton 2016 - 2021

Action or Strategy #		Status	Responsible Department[1]	Fiscal Year					Cost	Potential Funding Sources[2]	Weighted STAPLEE Criteria[3]															Total STAPLEE Score	Priority for Community
											Benefits								*Costs*								
				7/2018-6/2019	7/2019-6/2020	7/2020-6/2021	7/2021-6/2022	7/2022-6/2023	Minimal <$1,000 Low < $10,000 Mod. < $100,000 High > $100,000		Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	**STAPLEE Subtotal**	Social	Technical (x2)	Administrative	Political	Legal	Economic (x2)	Environmental	**STAPLEE Subtotal**	
1	Expand the availability of standby power in the Town's critical facilities particularly the Senior Center	Carried Forward	EM	x					Mod. each; High overall	CIB, EOC	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-1	0	**-2.0**	**4.0**	Low
2	Work with the City of Groton to create an open space corridor along Birch Plain Creek	Carried Forward	OPDS	x	x	x	x	x	High	CIB	1	1	1	1	1	1	1	**9.0**	0	0	0	0	0	-1	0	**-2.0**	**7.0**	High
3	Equip the new middle school with a standby generator that is sufficiently powerful to serve the entire building, and designate this building as an emergency shelter	New	EM			x			Moderate	CIB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
4	Install air-conditioning units in emergency shelters so that they can be used safely during summertime emergencies	New	EM				x		High	CIB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-1	0	**-2.0**	**4.0**	Low
5	Upgrade the standby generator at the High School so that it is capable of powering the entire building	New	EM		x				Moderate	CIB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
6	Pursue the acquisition of the Tilcon land, which is traversed by Fort Hill Brook.	New	OPDS	x	x	x	x	x	High	CIB	1	1	1	1	1	1	0.5	**8.5**	0	0	0	0	0	-1	0	**-2.0**	**6.5**	High
7	Groton Long Point Police/Fire Facility: Complete additional utility room dry floodproofing and expanded wet floodproofing.	New	EM	x					Moderate	CIB, HMA	0.5	1	1	1	0.5	0.5	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
8	Consider flexible yard requirements and regulatory incentives to allow for and encourage larger separations of buildings from coastal high hazard areas and encourage or require property owners to build as far back from eroding shorelines and vulnerable beach areas as possible.	Carried Forward	OPDS	x					Low	OB	1	1	1	1	1	0.5	0.5	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**	High
9	Consider a study to determine if improvements are necessary to control flooding on Birch Plain Creek near Poquonnock Road since the former Electric Boat Dam has been removed.	Carried Forward	OPDS		x				Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
10	Provide technical assistance to owners of non-residential structures that suffer flood damage regarding floodproofing techniques such as wet and dry floodproofing.	Carried Forward	OPDS	x	x	x	x	x	Minimal	OB	1	1	1	1	1	0.5	0.5	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**	High
11	Develop a protocol to address redevelopment of buildings severely damaged or destroyed after a major coastal storm.	Carried Forward	OPDS			x			Low	OB	1	1	1	1	1	0.5	0	**7.0**	0	0	0	0	0	0	0	**0.0**	**7.0**	High
12	Conduct beach nourishment and vegetation as needed to keep up with erosion.	Carried Forward	DPW	x	x	x	x	x	High	CIB	1	1	1	1	1	0	0.5	**6.5**	0	0	0	0	0	-1	0	**-2.0**	**4.5**	Low
13	Utilize recently available extreme rainfall data to determine existing sizing of culverts. Encourage bridge replacements and culvert replacements in areas found to be undersized.	Carried Forward	DPW	x					Moderate	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
14	Continue to require that post- development rates of runoff to be no greater than pre-development conditions in most circumstances; utilize recently available extreme rainfall data as noted above when designing controls.	Carried Forward	OPDS		x				Minimal	OB	1	1	1	1	1	0.5	0	**7.0**	0	0	0	0	0	0	0	**0.0**	**7.0**	High
15	Investigate funding sources and feasibility and prioritization of improvements to mitigate frequent and repeated flooding problems. Improvements could include elevation of roads and replacement of storm drainage systems. Work with CT DOT to facilitate these actions if State roads are involved.	Carried Forward	OPDS	x	x	x	x	x	Moderate	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
16	Study and prioritize upgrades to stormwater collection and discharge systems to keep up with rising sea level.	Carried Forward	DPW	x	x	x	x	x	Moderate	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
17	Study and prioritize installation of appropriately designed flood/tide gates at locations such as Groton Long Point and Mumford Cove, with considerations for sea level rise built into the design.	Carried Forward	DPW			x			Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
18	Study and prioritize locations for use of "non-structural" erosion control measures (such as vegetated slopes and elevated foundations)	Carried Forward	OPDS		x				Low	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	0	0	**0.0**	**6.0**	Medium
19	Complete the ongoing engineering study of Groton Long Point Road Bridge and design appropriate means of protecting this important mode of egress to keep up with rising sea level and withstand coastal storms.	Carried Forward	DPW	x	x				Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
20	Evaluate and prioritize potential roadway elevation and structural protections at Groton-New London Airport, as it lies in the coastal flood hazard area.	Carried Forward	DPW			x			Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
21	Work with Amtrak to study potential bridge replacements at the Poquonnock Road and South Road underpasses to facilitate enhanced emergency transportation. Evaluate potential drainage Improvements at the South Road and Poquonnock Road underpasses to reduce flooding.	Carried Forward	DPW				x		Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
22	Work with The Nature Conservancy to identify redevelopment options for the Fort Hill homes area, which is partly located in a SFHA.	New	OPDS			x			Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
23	Determine if any at-risk structures that are not yet eligible for historic designation will be eligible in the future. This may take the form of a historic resources survey.	New	OPDS				x		Moderate	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	-0.5	0	**-1.0**	**5.0**	Medium
24	Conduct a pilot study in Mystic to determine how a small number of historic structures may be mitigated without loss of historicity that is connected to their location near or over water.	New	OPDS					x	Moderate	OB	0.5	1	1	1	1	0	0	**5.5**	0	0	0	0	0	-0.5	0	**-1.0**	**4.5**	Low
25	Encourage commercial building owners or managers of large population clusters to develop response plans and mitigation opportunities	Carried Forward	EM	x					Low	OB	1	1	1	1	1	0.5	0.5	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**	High
26	Upgrade shelters and critical facilities to resist stronger winds when possible	Carried Forward	EM	x	x	x	x	x	Moderate	CIB	1	1	1	1	1	0.5	0	**7.0**	0	0	0	0	0	-0.5	0	**-1.0**	**6.0**	Medium
27	Develop working relationships with local community organizations and encourage them to promote wise landscaping techniques	Carried Forward	OPDS	x	x	x	x	x	Low	OB	1	1	1	1	1	0.5	0.5	**7.5**	0	0	0	0	0	0	0	**0.0**	**7.5**	High
28	Provide information for protecting Town residents during cold weather and for mitigating icing and insulating pipes at residences	Carried Forward	OPDS	x					Low	OB	1	1	1	1	1	0.5	0	**7.0**	0	0	0	0	0	0	0	**0.0**	**7.0**	High
29	Ensure that copies of EOPs for all the Groton Utilities dams are on file with the Town of Groton Office of Emergency Management.	Carried Forward	EM	x	x	x	x	x	Minimal	OB	0.5	1	1	1	1	0.5	0	**6.5**	0	0	0	0	0	0	0	**0.0**	**6.5**	High
30	Work with Groton Utilities to conduct a tabletop exercise (drill) that simulates a potential dam failure, as Norwich Public Utilities has done with the City of Norwich.	Carried Forward	EM			x			Low	OB	1	1	1	1	1	0	0	**6.0**	0	0	0	0	0	0	0	**0.0**	**6.0**	Medium

[1]Notes
DPW = Department of Public Works & Engineering
EM = Emergency Management
OPDS = Office of Planning & Development Services

[2]Notes
CIB = Capital Improvement Budget
EOC = EOC Grants
HMA = FEMA Grant Programs
OB = Operating Budget

[3]Notes
Beneficial or favorable ranking = 1
Neutral or Not Applicable ranking = 0
Unfavorable ranking = -1

Technical and Economic Factors have twice the weight of the remaining categories
(i.e. their values are counted twice in each subtotal).

APPENDIX A

ADOPTION RESOLUTION

CERTIFICATE OF ADOPTION
TOWN OF GROTON TOWN COUNCIL

A RESOLUTION ADOPTING THE HAZARD MITIGATION PLAN UPDATE, 2017

WHEREAS, the Town of Groton has historically experienced severe damage from natural hazards and it continues to be vulnerable to the effects of those natural hazards profiled in the plan (e.g. *flooding, high wind, thunderstorms, winter storms, earthquakes, dam failure, and wildfires)*, resulting in loss of property and life, economic hardship, and threats to public health and safety; and

WHEREAS, the Groton Town Council approved the previous version of the Plan in 2012; and

WHEREAS, the Southeastern Connecticut Council of Governments, of whom the Town of Groton is a member, has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its Hazard Mitigation Plan Update, 2017 under the requirements of 44 CFR 201.6; and

WHEREAS, committee meetings were held and public input was sought in 2016 and 2017 regarding the development and review of the Hazard Mitigation Plan Update, 2017; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies and Plan maintenance procedures for the Town of Groton; and

WHEREAS, the Plan recommends several hazard mitigation actions that will provide mitigation for specific natural hazards that impact the Town of Groton, with the effect of protecting people and property from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the Town of Groton eligible for funding to alleviate the impacts of future hazards; now therefore be it

RESOLVED by the Town Council:

1. The Plan is hereby adopted as an official plan of the Town of Groton;
2. The respective officials identified in the mitigation strategy of the Plan are hereby directed to pursue implementation of the recommended actions assigned to them;
3. Future revisions and Plan maintenance required by 44 CFR 201.6 and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of this resolution.
4. An annual report on the progress of the implementation elements of the Plan shall be presented to the Town Council.

Adopted this _____ day of _____, 201_ by the Town Council of Groton, Connecticut

_____
Mayor

IN WITNESS WHEREOF, the undersigned has affixed his/her signature and the corporate seal of the Town of Groton this _____ day of _____, 201_.

_____
Town Clerk