Strategy for Reducing Risks From Natural Hazards in North Kingstown, Rhode Island

A Multi-Hazard Mitigation Strategy 2013

5-Year Update

Purpose: This plan will replace the adopted 2005 Hazard Mitigation Plan and recommends updated actions and policies for the Town of North Kingstown to minimize the social and economic loss and disruption associated with natural hazard events. This plan will address the capability of North Kingstown to reduce the vulnerability of our community to these natural hazards and will provide comprehensive guidance for hazard mitigation in the town of North Kingstown. Hazard mitigation is an ongoing process that requires continued implementation, evaluation, and revision. This plan identifies goals, objectives and recommended actions for both short-term and long-term hazard mitigation with an intention to preserve and enhance the safety, quality of life, and natural resources of North Kingstown.

This document should be referenced as:

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This document is available electronically at www.state.ri.us/riema and www.northkingstown.org.

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A Multi-Hazard Mitigation Strategy 2013
5-Year Update

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1.0 – Introduction

Hazard mitigation is a set of actions and policies designed to reduce the long-term risk of naturally occurring disasters on people and property. It focuses on reducing repetitive loss and the vulnerability of communities in an attempt to break the disaster cycle. The following are essential steps in the Hazard Mitigation process:

1. Planning process, inclusive of stakeholder activity
2. Hazard identification and risk analysis
3. Vulnerability analysis
4. Preparation of a hazard mitigation strategy
5. Plan Review and evaluation
6. Implementation of hazard mitigation actions
7. Plan adoption

It is a requirement for local governments to develop a hazard mitigation plan as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects. The adoption and implementation of this plan will allow North Kingstown to access credits under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS), which offers discounts on National Flood Insurance Program (NFIP) premiums for property owners in communities that choose to participate.

Advances in the ability to predict the occurrence and effects of natural disasters, from severe storms to earthquakes, have provided government bodies with an opportunity to better prepare for them. In preparing this Mutli- Hazard Mitigation Plan, the Town of North Kingstown utilized both internal and external staff to obtain resources, to include GIS data, mapping, changing sea conditions, development patterns and climate shifts to identify and understand the risks facing the town.

The town was also able to incorporate the recent pilot project for sea level rise into this plan as it has formed a source of invaluable research in identifying areas of the town which are most at risk to increased flooding, erosion, infrastructure and property damage and displacement of coastal residents in coming decades.

Benefits of Hazard Mitigation

The most immediate benefit of natural hazard mitigation planning is the reduction and elimination of the negative impacts of natural disasters in terms of lost life and property. With adequate preparation the town can significantly reduce the economic and social disruptions caused by natural disasters and reduce the costs of recovery for

the town, local businesses, and residents. Another important benefit of hazard mitigation is that money spent today on preventative measures can significantly reduce the impact of disasters in the future, including the cost of emergency response and post-disaster cleanup.

The Federal Emergency Management Agency (FEMA) offers three distinct incentives for the adoption of local hazard mitigation plans. Firstly FEMA's Pre-Disaster Mitigation (PDM) grant program and Flood Mitigation Assistance (FMA) program provide grants for activities designed to mitigate the effects of floods and other disasters in a community. Funds from these grants can go to acquisition, relocation, and retrofitting of structures but are only available if an approved hazard mitigation plan is in place. Secondly, a hazard mitigation plan can expedite the approval process for receiving money after a federally declared disaster through the FEMA Post-Disaster Hazard Mitigation Grant Program (HMGP). Finally, a mitigation plan can be counted towards credit points in FEMA's Community Rating System (CRS). Points are awarded for having the plan, as well as for going through the various steps involved in creating the plan, including having community involvement and coordinating with other agencies. The better a community's CRS score, the greater the discounts provided on individual property owner's National Flood Insurance Program (NFIP) premiums. Currently, North Kingstown has a CRS rating of 9, which entitles property owners to a 5% discount on flood insurance.

Goal Statement

The goal of this hazard mitigation plan is to identify areas at risk from natural hazards and develop policies and plans of action that could be implemented to reduce the impacts of natural hazards on the residents, properties, and natural resources of North Kingstown. A high priority is placed on protecting the safety of residents and visitors alike. The town's many historic buildings and coastal resources are of special concern. This hazard mitigation plan update has also taken steps to incorporate climate change into planning analyses as a first step in considering its impact on North Kingstown, including how they may exacerbate natural hazards such as floods, hurricanes, and drought. It is a Goal of North Kingstown through recent works and the preparation of this updated plan to achieve a CRS rating of 8, which would entitle property owners to a 10 % discount on flood insurance.

Hazard Mitigation Planning Process

The North Kingstown Hazard Mitigation Committee was initially re-convened on December 8th, 2010 for the purpose of updating the plan. The committee includes the Town Manager, town safety officials, Department of Public Works, the Building Official, town planners, a Quonset Development Corporation (QDC) representative, community members, and representatives from the North Kingstown Chamber of Commerce. The committee was supervised by the Director of Planning, Jonathon Reiner.

There were several meetings of the Hazard Mitigation Committee (HMC) that featured discussions of the goals of hazard mitigation, the risks North Kingstown faces from natural hazards, the town's vulnerabilities, and steps the town could take to reduce its vulnerabilities to those hazards. Technical aid, research, and meeting facilitation were provided by the North Kingstown Department of Planning and Development. Planning Staff developed maps using Geographic Information System data detailing hazard risks, critical facilities, known flood hazards and vulnerabilities. These maps were reviewed by the committee and used as a guide to further develop discussions (Maps 1, 2 & 3). This allowed for re-assessment of required updates and action plans needed in this HMP.

Additionally, information has been incorporated from the town's pilot project with Rhode Island Sea Grant College Program (RISG) to map assets of the town vulnerable to sea level rise. Maps 6 and 7 illustrate sample products from that project. This pilot project has been extended to a secondary phase and has engaged the public from the initial stages of phase II. Project meetings commenced for this second stage on 11/14/2012 which was the first Technical Review Committee (TRC) meeting and the most recent was held on 09/19/2013 which was a public presentation held in the community center in North Kingstown. The meetings and public presentations to date for phase II have included roundtable discussions, public presentations and a sea level rise informational booth during the September 2013 Harbor Fest. Questionnaire boards were present at the Harbor Fest to obtain public views and knowledge on Sea Level Rise (SLR) and future consequences. This provided a good discussion forum with members of the public and informational session.

Constant liaising throughout phase I and now phase II has been maintained with the URI department head for Sea Level Rise/Grant and has allowed North Kingstown to utilize their expertise and to help inform board members and review committees within the town of the current and future hazards that face the town as a result of seal level rise. A list of SLR meetings that have been undertaken with the Town of North Kingstown members and public has been attached in Appendix D.

In the data gathering stages and throughout the planning process, public input was achieved through additional committee members including representatives from the QDC, South County Nursing and Rehabilitation Center, RI Air National Guard, Army Guard. To ensure neighbor involvement, the plan will be distributed to the surrounding communities of South Kingstown, East Greenwich, Exeter, Warwick, Narragansett and Jamestown for their review and consideration in December 2013. This draft plan will also be sent to agencies at that time for their comments. The plan will also be made available on the town's website (www.northkingstown.org) for public review and to receive further public input. Sea Level Rise was discussed in depth at Planning

Commission meeting on November 19, 2013 and this forms an element of the HMP. Initial discussions of the draft HMP also took place on this Planning Commission Agenda in November with a view to it being placed on a later agenda for more detail discussion. Additional opportunities for public input will take place during the Planning Commission and Town Council review of the plan following review from FEMA and REIMA. This action requires a public meeting before the Planning Commission for a recommendation on the plan and a public hearing before the Town Council for the plans adoption. It is anticipated that the plan will be presented to both the Planning Commission and the Town Council in January of 2014.

This update provides a foundation for improved mitigation opportunities as the town initiates its update of the local comprehensive plan, consistent with General Laws in Chapter 45-22.2 entitled "Rhode Island Comprehensive Planning and Land Use Regulation Act" to incorporate a Natural Hazards element. " The plan must include an identification of areas that could be vulnerable to the effects of sea-level rise, flooding, storm damage, drought, or other natural hazards..." Specifically, the update of the North Kingstown Hazard Mitigation Plan reinforces Action NC.1.18.1 of the Town's 2008 Comprehensive Plan, which states, "Implement the recommendations of the Hazard Mitigation Plan." The Comprehensive Plan includes a series of objectives and goals which require the facilitation, Implementation, evaluation and periodic revision of the Hazard Mitigation Plan as appropriate (CS.17) and for the development of strategies to protect the community from the impacts of natural hazards (Objective NC.1.18). After approval by RIEMA and FEMA, the Hazard Mitigation Plan will be incorporated as an addendum to the town's comprehensive plan.

2.0 – Hazard Risk and Vulnerability Assessment

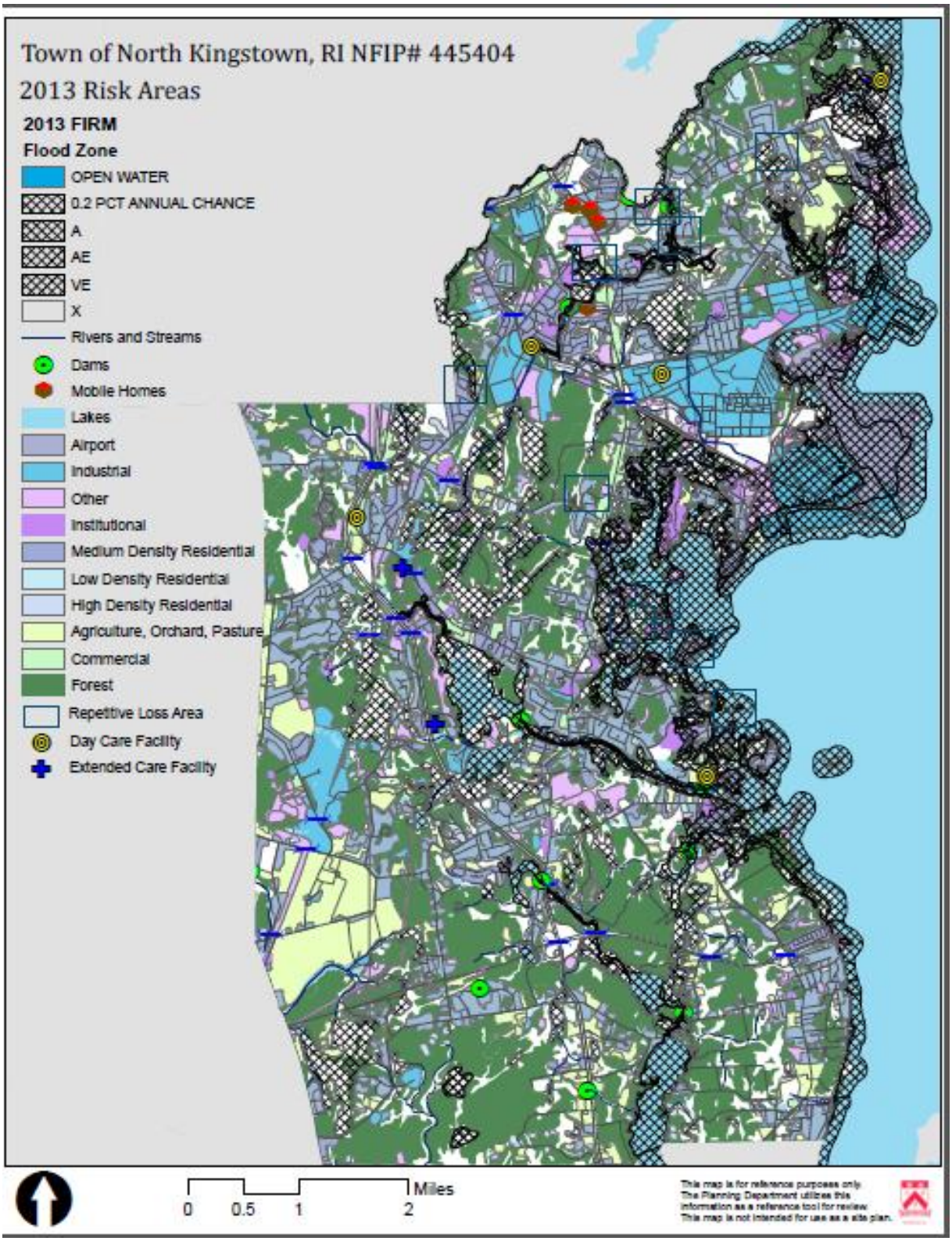
The hazard identification process for North Kingstown consisted of reviewing the town's previous plan (2005hhj), the RI State Hazard Mitigation Plan (2011) and plans from other coastal communities in Rhode Island. Past newspaper articles of natural hazard events that have occurred in the town were researched and websites to include the National Climatic Data Center and National Weather Service were also viewed. The Town of North Kingston's Hazard Mitigation Committee identified natural hazards which possessed the highest level of potential impact to the town.

Table 1. Historic Natural Hazard Events in North Kingstown

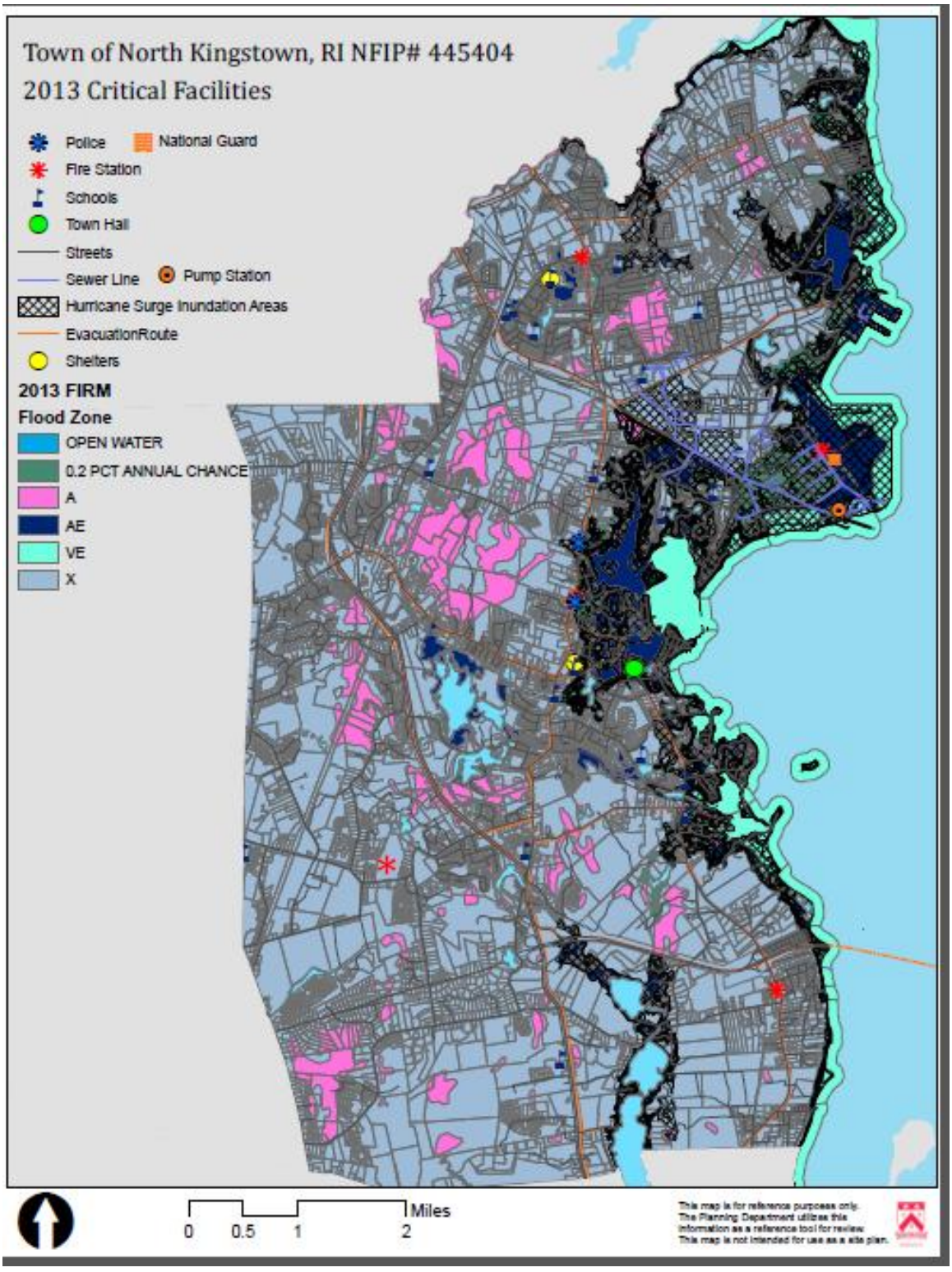
Name/Date of Storm	Damaged Areas

Hurricane of 1938	Historical marker in the Gregory Building in Wickford village shows the high water mark from this storm. One hundred small cottage homes on Quonset Point were destroyed and nine people were killed there. Homes in Wickford were flooded, some destroyed. Many boats from the harbor were destroyed including the fishing fleet.
Earthquake - 1951	Epicenter in Kingston, measured 4.6 on the Richter Scale
Hurricane Carol - 1954	Historic Marker on the West Main Street Highway Garage in Wickford village shows the high water mark from this storm. Homes stripped from their foundations and upended at Poplar Point. Military facilities at Quonset Point flooded.
Wildfire - 1968	500 acres in the Slocum area
Wildfire - 1974	300 acres in the Slocum area
Blizzard - 1978	Town Services shut down for a week.
Hurricane Gloria - 1985	Boathouse at Town Beach was blown down and much of the sand was washed away. Salt spray led to extensive defoliation of trees.
Hurricane Bob - 1991	Boats washed ashore and piled on lawns fronting Wickford Harbor. Docks damaged.
Flooding - 2010	Five to ten inches of rain fell across Washington County resulting in rises in rivers and streams in North Kingstown. Numerous roads were flooded. A mudslide washed onto two rail tracks near Routes 403 and 4, disrupting rail service throughout Rhode Island on the Amtrack Northeast Corridor Line.
Tropical Storm Irene - 2011	Many power lines were damaged and many streets were not passable due to fallen debris and trees. Thousands of residents throughout Rhode Island were left without power as a result of high winds from the storm. Minimal coastal flooding except for Wickford.
Hurricane/ Superstorm Sandy - 2012	Many power lines were damaged and many streets were not passable due to fallen debris and trees. Thousands of residents throughout Rhode Island were left without power as a result of high winds from the storm. There was minimal coastal flooding except for Wickford Village.

Blizzard (NEMO) -2013	Many power lines were damaged and many streets were not passable due to fallen debris and trees. This storm affected 28 per cent of the states population. Thousands of residents throughout Rhode Island were left without power as a result of high winds and snow from the storm. Cold temperatures and lack of power made heating homes difficult during the period of below freezing weather.



Map 1: Risk Areas in North Kingstown



Map 2: Critical Facilities in North Kingstown

2.1 Risk Assessment

Flooding, Hurricanes and Coastal Storms

"Floods are among the worst frequent and costly natural disasters in terms of human hardship and economic loss. Seventy –five percent of federal disaster declarations are related to flooding. "(www.riema.ri) It is oftentimes the direct result of other weather events such as snow melt combined with heavy rains, nor'easters, tropical rainstorms or hurricanes. The State Hazard Mitigation Plan, 2011 categorizes flood events into six categories. These include: riverine, coastal, flash, storm surge, urban storm water and dam breeches.

North Kingstown is a coastal community in the northeastern portion of the United States situated on the Narragansett Bay in the State of Rhode Island. The town is landlocked on three sides with the Bay forming its eastern boundary. The Hunt River forms the northern border of the town while the Annaquatucket and Pettaquamscutt (Narrow) Rivers both run through the southern portions of the town. Significant coastal features along the town's approximately 30 mile coast include Allen Harbor, Quonset Point, Wickford Harbor, and Bissel Cove. There are approximately 6,343 acres of wetlands (22.6%) and 14,085 acres of forest (49.8%) in the town. North Kingstown's coastal location and low lying areas, makes the town susceptible to coastal flooding, river flooding and flash flooding and more recently storm surges as witnessed in Hurricane Sandy in 2012.

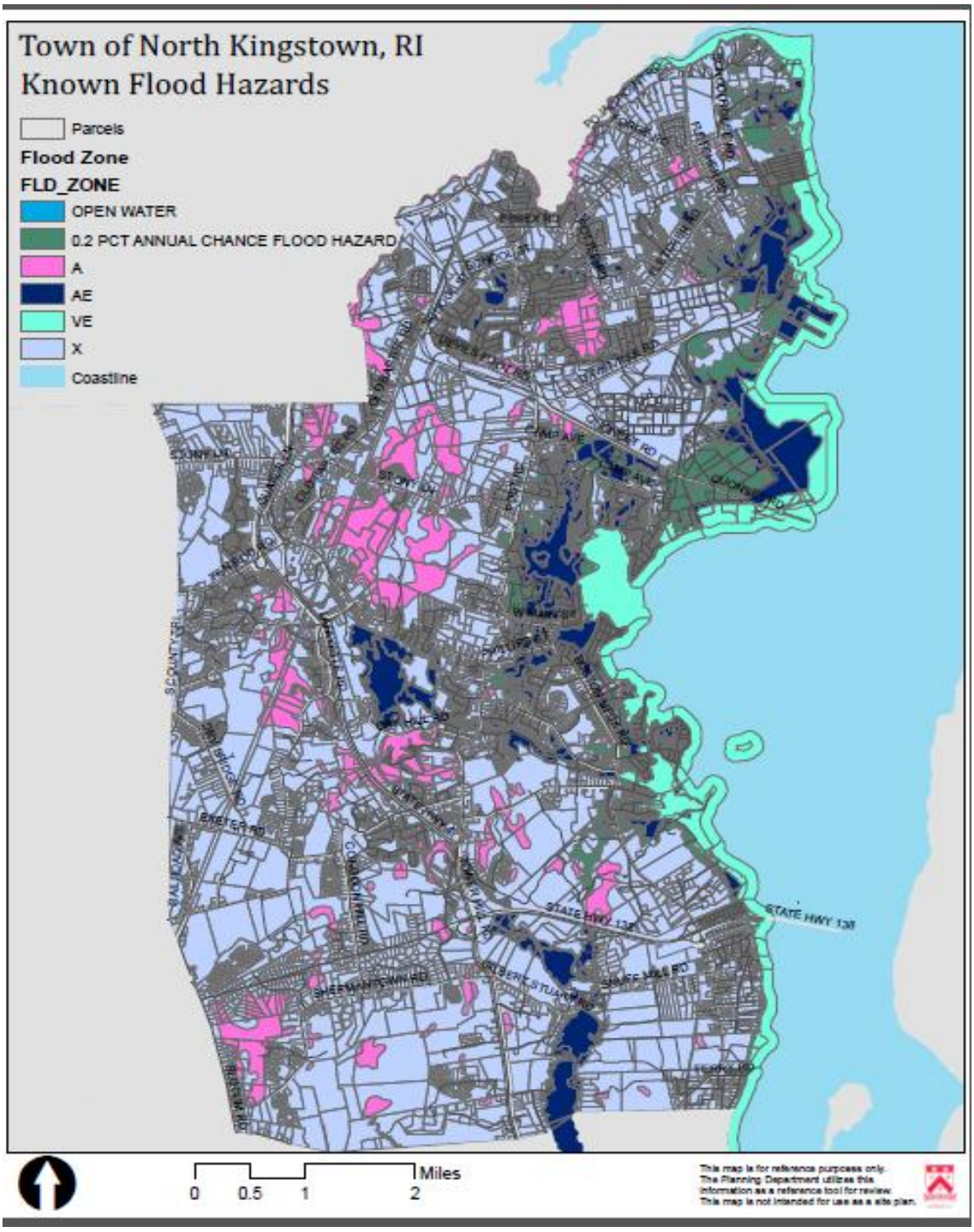
Hurricanes are tropical based storms that travel north up the Atlantic coast and feature heavy rain and high velocity winds. The state has seen as increase in storm intensity (not frequency) for nor'easters and hurricanes. The present 1% chance storm (100-year storm) could be seen more frequently and cause an increase in flooding, wind damage, and erosion. Hurricanes occur in the late summer to early fall, as opposed to nor'easters, which are similar to hurricanes in effect but occur in the winter months. Nor'easters have a typical storm surge of 3', which can increase flooding especially at high tide or spring tides. This storm surge occurrence of 3' happened in North Kingstown during Super Storm Sandy in 2012. Both types of storm can cause large amounts of damage across a wide area. Because hurricanes and coastal storms are the major natural hazards that the town faces on a regular basis, they are the primary focus of this hazard mitigation plan.

The probability of a named storm directly hitting Rhode Island in any given hurricane season is currently estimated at approximately 22% (Atlantic Oceanographic and Meteorological Laboratory, 2004). Map 4 shows the storm tracks of the 24 major coastal storms that have made land fall within 100 miles of North Kingstown in the past 50 years. Rhode Island has had three presidential disaster declarations due to hurricanes; Hurricane Gloria (1985) and Hurricane Bob (1991) and Hurricane Sandy (2012). There were also flooding declarations in 2007 and 2010 (FEMA). The town's

history includes several severe storms, including hurricanes and nor'easters, which have caused significant levels of damage to North Kingstown (Table 1). Damage in these storm events came primarily from two elements, flooding and wind.

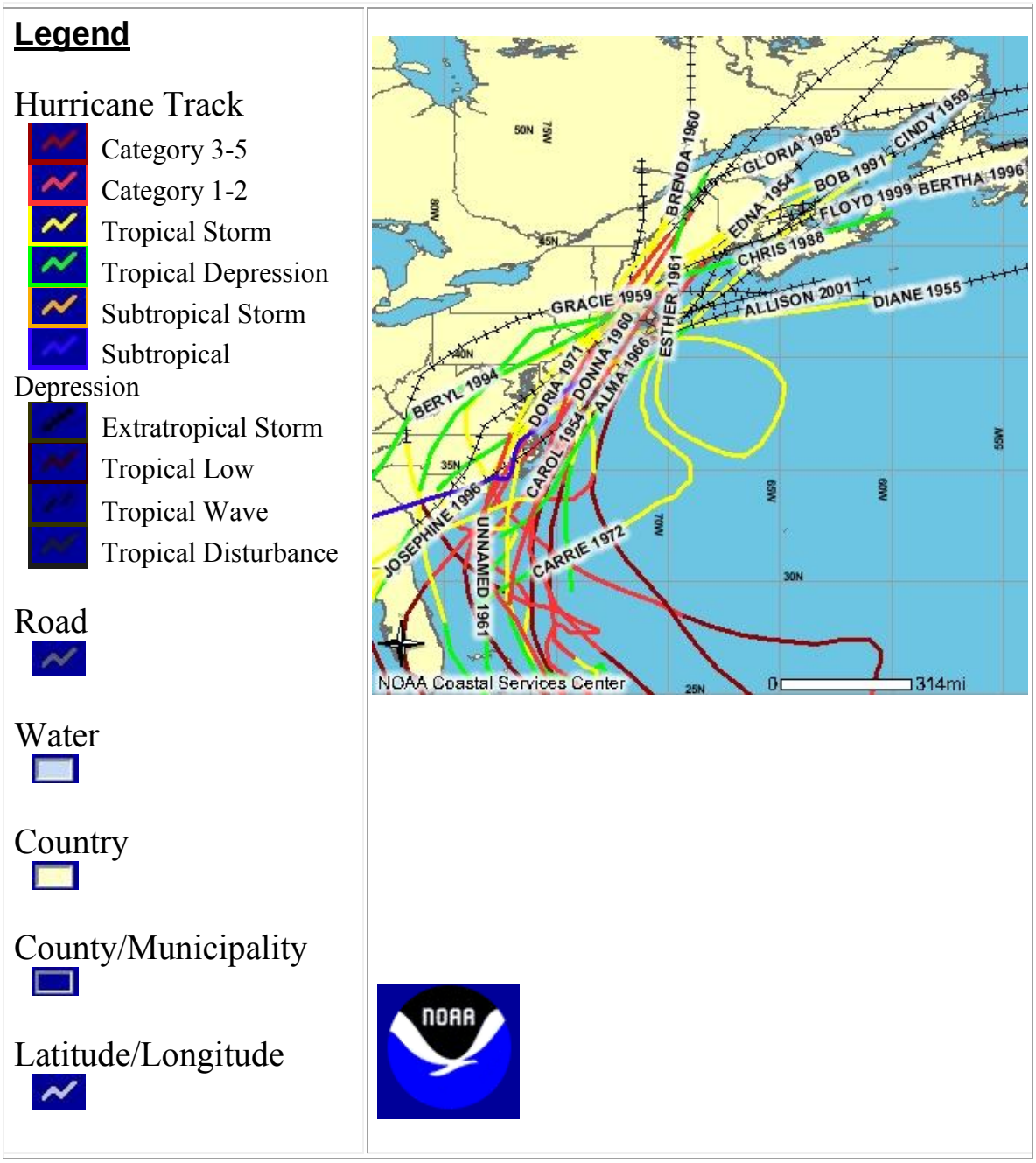
Floods are the most common type of natural disaster. Flooding during a hurricane can be caused by heavy rains and storm surge tides that rise from the sea up to 25 ft. higher than the normal high water level. Locations in North Kingstown that are vulnerable to inundation from the sea are indicated on Map 2 as hurricane surge inundation areas. Locations that are vulnerable to flooding due to heavy rain events are indicated as flood zones on Maps 1, 2 and 3. In March of 2010, five to ten inches of rain fell across Washington County resulting in rises in rivers and streams in North Kingstown. Numerous roads were flooded disrupting transportation for residents, employees, and emergency response personnel in town. A mudslide washed onto two rail tracks near Routes 403 and 4, disrupting rail service throughout Rhode Island. Some town roads were washed out from the flooding, with Featherbed Lane still closed to traffic. Additionally, the flooding rendered a town well pump station out of service for several months following the event.

North Kingstown has land area in the A, AE, VE, and X Flood Hazard zones as designated by FEMA (NFIP). The "A" and "AE" zones are classified as zones where properties have a 1 percent chance of flooding in any year and a 26 per cent chance of flooding over the life of a 30-year mortgage. "V" or "VE" zones indicate that properties have a 1 percent chance of flooding in any year and also face hazards associated with coastal storm waves. "X" zones are subject to a 500-year flood. These properties are outside the high-risk zones; therefore the risk is reduced, but not removed. These properties are in an area of overall lover risk. A 100-year flood has a one percent chance of occurring in any given year, and a 500-year flood has a 0.2% chance of occurring in any given year. FEMA designated flood zones are determined based on the elevation of the land and indicate areas that would be flooded in the event of heavy rains. Development, including simply paving, can increase the height and extent of flooding due to the loss of ground permeability.



Map 3: Known Flood Hazards in North Kingstown

Map 4: Historical storm tracks making landfall within 100 miles of North Kingstown in the past 50 years.



The National Hurricane Center's Sea, Lake, and Overland Surges from Hurricanes model (SLOSH) shows areas subject to inundation from the sea in the event of a hurricane **(Map 2).** The SLOSH model depicts the "worst case scenario" taking into account wind speed and direction, tides, and the topography of the land. Future sea level rise and coastal erosion will increase the area and extent of damage caused by coastal flooding.

In addition to wind and flooding, erosion is a hazard that can threaten life and property during a coastal storm. The Coastal Resources Management Program has documented shoreline change and average erosion rates. The location with the most severe erosion in North Kingstown is the Narragansett Bay shoreline from Pojac Point to just north of the Mount View neighborhood. This area is considered to be a "Category A" critical erosion area (CRMC), and is eroding at an average rate of 2.2 ft. annually. Development in this area must be set back at least 75ft. from a coastal feature, or 150 ft. in the case of a development of more than four units. The rest of the town's shoreline either has an erosion rate of less than 2 ft. per year or is actually accreting. Narrow barrier beaches, such as those at Casey Point, Green Point, and Bissel Cove can also be affected by significant erosion. A single large storm event can drastically change the shoreline depending on coastal soil conditions.

Boat damaged and washed ashore during *the 1938 Hurricane. Photograph courtesy of Richard Bowen.*

Table 2. Hurricane Category*

Category	Wind Speed (MPH)	Storm Surge (FT)
1	74 - 95	4 - 5
2	96 - 110	6 - 8
3	111 - 130	9 - 12
4	131 - 155	13 - 18
5	> 155	> 18

* Based on the Saffir/Simpson Hurricane-Scale Ranges

Hurricanes are classified by wind speed into five types. Table 2 outlines these five hurricane categories. Rhode Island is considered to be susceptible to a direct landing of storms from categories I through IV. It has been estimated that North Kingstown's peak wind gust in a typical 100 year period is likely to be between 110 and 125 MPH (HAZUS-MH). Hurricanes reaching the New England region experience an increase in forward motion that compensates for decreased wind speeds so that lower class hurricanes can potentially cause considerably more damage than would normally be expected.

Rhode Island has an increased susceptibility to hurricanes due to its position, along with Connecticut and Massachusetts, on a landform that juts eastward into the Atlantic

Ocean. Also, the configuration of the Narragansett Bay can have a funneling effect on the tidal surges accompanying hurricanes causing high levels of coastal flooding in the upper portions of the bay.

Poplar Point property after the 1938 Hurricane. Photograph courtesy of Richard Bowen.

The most significant storm to hit North Kingstown was the hurricane of 1938, a category III storm. Wind speeds as high as 121 miles per hour were reported and there was severe coastal flooding.

The following has been taken from a first-hand account of the 1938 hurricane written by Alice Armington of Poplar Point on September 21, 1938.

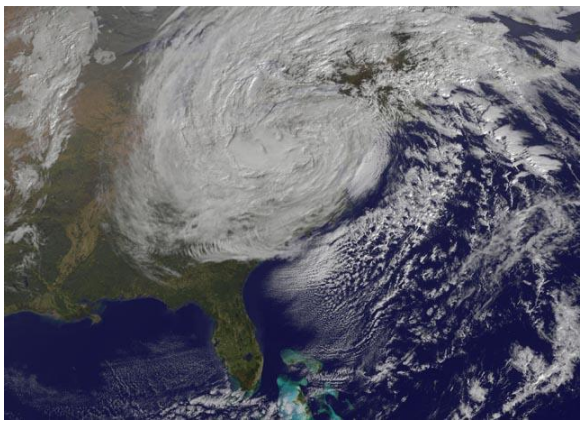
"*…I wandered around from window to window looking out on a boiling ocean with wharves and boats and big timbers being towed about like rubber balls…Then the cellar doors on the water side blew in and the winds rushed up through the floors and all the linoleum rose up…I looked out the south window to where the Richardson house should be, nothing there…Both that house and garage and the Kilgus house and garage had been torn to kindling wood and carried across the road and into the lots beyond…About an hour after I got out of the larger house, it split up and was carried off into the lot across the road…By some miracle it didn't hit the cottage where I was as it went by."*

In the hurricane of 1938, a summer colony at Quonset lost 100 cottages and nine people were killed. Many homes were destroyed throughout the town and Wickford village in particular was hard hit. Students were trapped overnight in Wickford Elementary School and many of the elm trees lining Main Street were downed. A bronze plaque at the corner of Main and Brown Streets shows the historic high water mark from this storm.

Poplar Point property after the 1938 Hurricane. Photograph courtesy of Richard Bowen.

Many hurricanes have directly or indirectly struck Rhode Island in the past century, so one can easily expect further hurricane activity in the future. If the predicted effects of global warming are correct, than hurricanes and other severe storms will occur with more frequency and intensity in the future, increasing the chances of a hurricane reaching Rhode Island's shores.

The two most recent significant hurricane storms to strike Rhode Island as of the drafting of this Plan (2013) were Tropical Strom Irene in August 2011 and Superstorm Sandy in October 2012. Each of these storms had similar impacts in that they caused serious damage to homes and infrastructure due to high winds and falling trees. In both storms there were many instances of power lines that were damaged and many streets were not passable due to fallen debris and trees. In each storm, thousands of residents throughout the state were left without power as a result of high winds and some flooding from the storm. For Tropical Storm Irene, FEMA announced that federal aid has been made available to the State of Rhode Island to supplement state and local recovery efforts in the area affected by the storm beginning August 27, 2011. For Super Storm Sandy, FEMA made a similar announcement regarding the state of Rhode Island beginning October 26, 2012.



Superstorm Sandy (left) had a devastating impact on communities along the eastern seaboard of the United States, including parts of North Kingstown.

North Kingstown, R.I., August 28, 2011 -- A home and power lines are damaged after Tropical Storm Irene passes through Rhode Island. Photograph courtesy of FEMA.

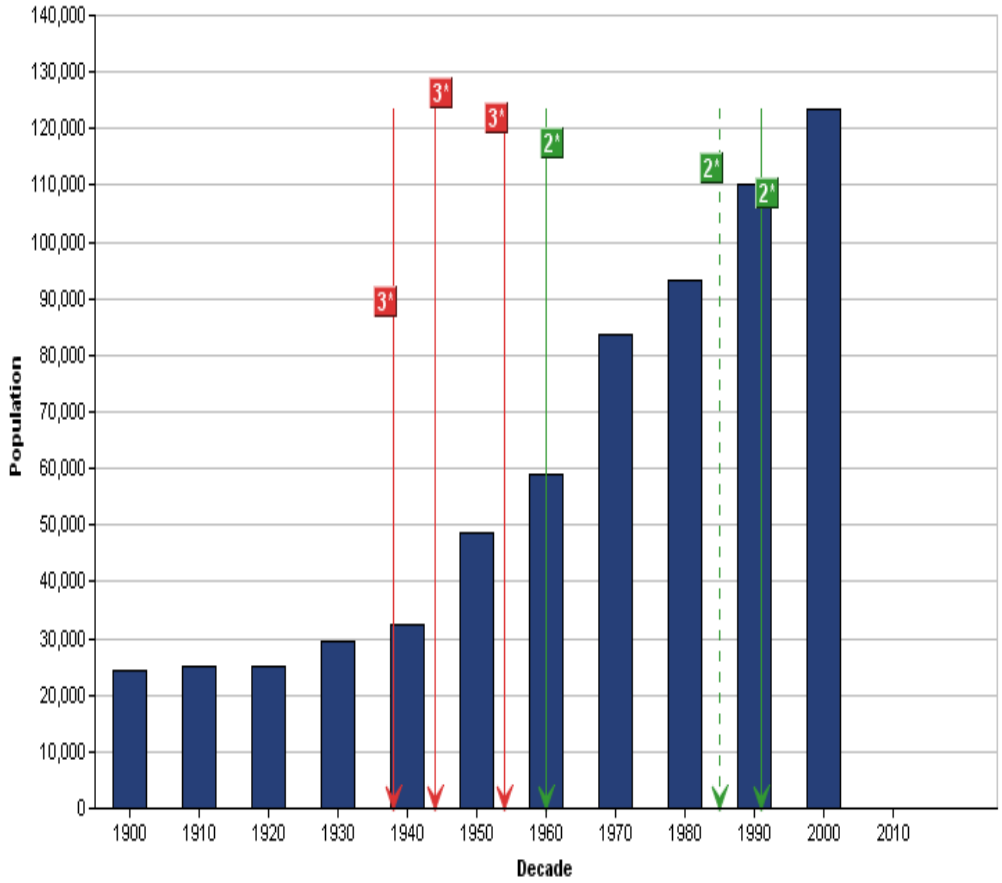
The devastating hurricanes and storms that struck Rhode Island during the early and mid 1900s were part of a period of increased hurricane formation in the tropical Atlantic. Between 1970 and 1994 the Atlantic had a period of below normal hurricane formation. In the mid 1990s a new period of increased hurricane activity began due to warmer surface water temperatures in the tropical Atlantic. Therefore, the likelihood of a major hurricane striking Rhode Island is currently greater then it was during most of the past several decades.

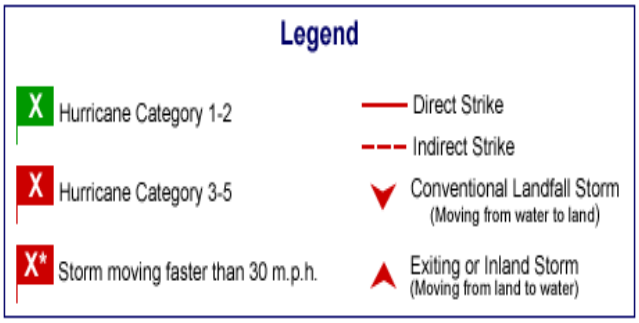
Because the town's most damaging hurricanes occurred over fifty years ago, many new residents are unaware of the seriousness of the risk. As coastal population has increased, locations where development was previously destroyed by hurricanes have been redeveloped, some with particularly vulnerable structures. Figure 1 shows the increasing population of Washington County along with major hurricane strikes to the county.

The town is registered for the HURREVAC 2000 software program developed jointly by FEMA and the Army Corp of Engineers. This program will alert the town to approaching hurricanes through live data files from the National Hurricane Center via the Internet at www.hurrevac.com/about_win.htm. As these files are received, the program processes the data and analyzes the threat posed to the community from a particular storm allowing town officials to make informed decisions as to the town's response.

Figure 1: The population of Washington County and major hurricane strikes to the county

Hurricane Strikes vs Population for Washington, Rhode Island





Hurricane Strike Data: National Hurricane Center

Population Data: U.S. Census Bureau

NOTE:Population values may be missing in some counties, particularly for earlier periods. This is most often attributable to the fact that the county had not yet been established.

NOTE:There may be discrepancies between the strike data shown in this chart and the HURDAT strike data used in the Historical Hurricanes Tracks Tool. The National Hurricane Center is currently updating the strike data used for these charts. For more information visit http://www.aoml.noaa.gov/hrd/data_sub/re_anal.html

NOTE:Population data is current as of 2000 U.S. Census. X-axis on graphs depict years through 2010 to illustrate storms that have occurred from 2000-2006.

Wildfire

While fire is now known to have an important regenerative role in many ecosystems, many factors, natural and manmade, can combine to create devastating natural disasters far beyond the effects of natural wildfire processes. Drought conditions, coupled with a build-up of dead underbrush and other kindling can lead to a fire, with the presence of a spark. Such a situation is especially dangerous when there are a number of homes present in forested areas, as is the case in parts of North Kingstown. Firefighters use different and often incompatible methods when fighting wildfires as opposed to home fires. In addition, the presence of homes precludes the ability to conduct controlled burns in order to keep the amount of kindling low and mitigate large-scale wildfires. Access to both the site and to a water source is another important issue that can affect how intense and potentially damaging a wildfire can be (Planning for Post-Disaster Recovery and Reconstruction, 1998).

As of 2005, almost 50 percent of North Kingstown's total acreage was forested. While this percentage has fluctuated over time, there have been very few wildfire occurrences in the town and none of these have caused great amounts of damage or burned on a large, uncontrolled scale. The two largest fires in North Kingstown's recent history occurred in 1968 and 1974 in the Slocum area. Sparks from the adjacent railroad tracks lit both of these fires, which burned in an area exceeding 500 and 300 acres respectively. Currently, North Kingstown is considered to be in a low fire danger class (U.S. Forest Service, 2004), and a recent state wide analysis prepared by the Rhode Island Department of Environmental Management Division of the Forest Environment concluded that, based on land cover, North Kingstown has a low risk of wildfire. Based on population the town has moderate risk.

Tornadoes

According to FEMA publications, North Kingstown is located in wind zone II, which has a design wind speed of 160 mph. The area has had an average of less than 1 strong tornado (categories F3-F5) per 3,700 sq. ft. According to FEMA's wind risk matrix, this means that the town has a low risk of tornadoes; however wind shelters are still advisable due to the region's susceptibility to hurricanes. The National Climatic data center reports an average of 0 tornadoes per year in Rhode Island, and the Tornado Project reports that there have been 0 tornadoes in Washington County between 1950 and 1995. Based on this history, it can be concluded that a tornado in North Kingstown would be a very rare event; however it cannot be ruled out because the conditions that generate tornadoes can happen anywhere.

Poplar Point home after a snowstorm event.

Severe Winter Storms

Although generally outside of the extreme winter weather areas of the Northeast, Rhode Island is still subject to possible heavy winter weather events including significant snow and ice accumulation. Snow accumulation can cause serious damage to structures, especially those with flat roofs, and possibly cause roof collapse. The combination of ice and wind can bring down utility poles, leading to a variety of problems with communication and electricity loss. Snowmelt can lead to flooding well after the actual snowstorm has past.

A snow-covered West Main Street in Wickford during the 1890s looking west towards Route 1.

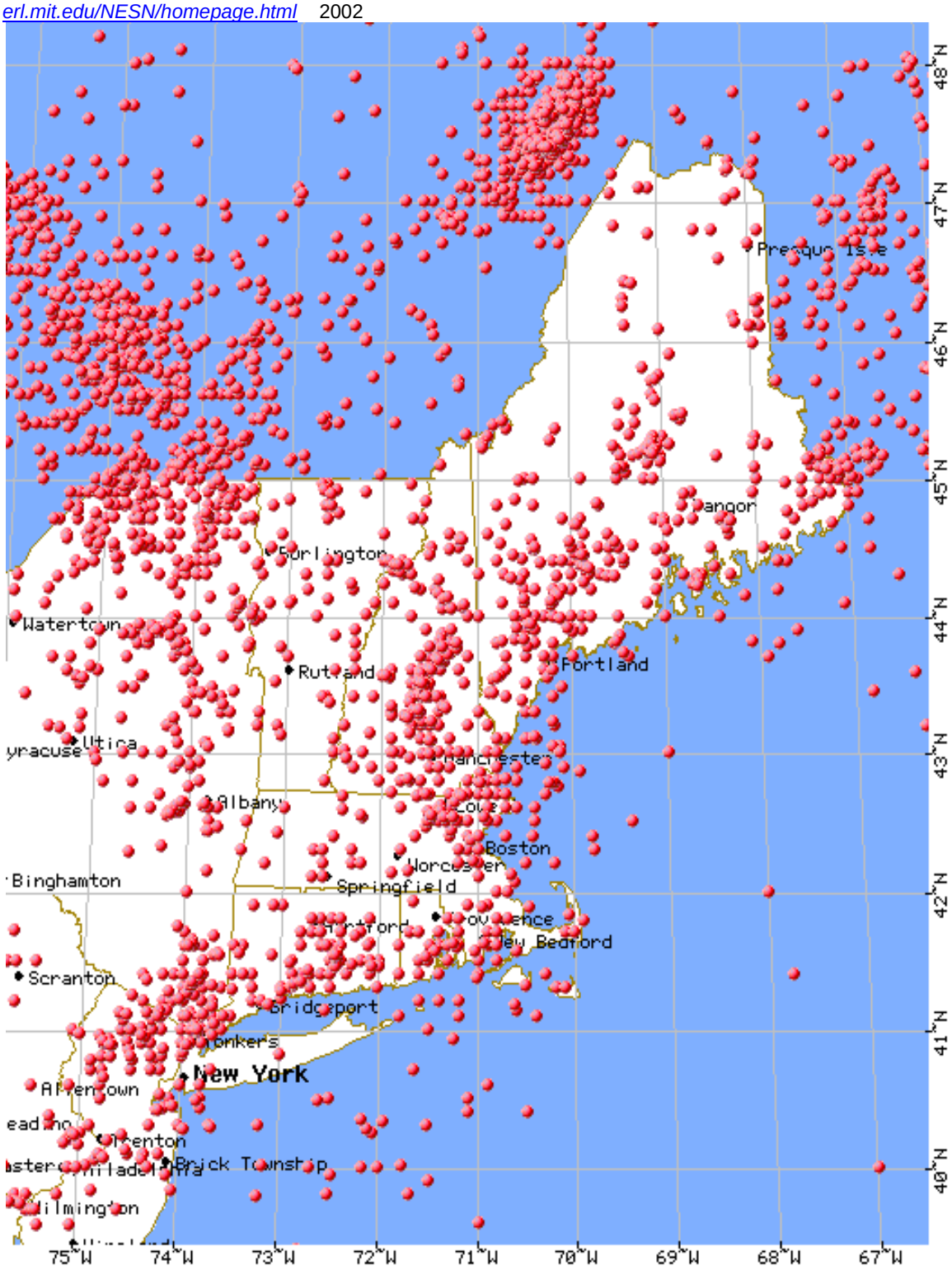
Blizzards in 1906 and 1978, along with an ice storm in 1966 are remembered as some of the town's worst winter storms. In the 1978 blizzard some residents were without electricity for up to a week and many roads remained impassable for up to five days. The Blizzard of 2013, also called Nemo, caused major power outages and dropped upwards of 3 feet of snow throughout areas of Rhode Island. The National Climate Data Center storm events database contains records of 13 severe winter storms that have struck Washington County, Rhode Island between 1996 and 2013. No deaths or injuries are reported.

Earthquake

An earthquake is an abrupt release of accumulated strain on the Earth's tectonic plates occurring along a fault line. Damage in an earthquake stems from ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy. The effects of an earthquake are mitigated by distance and ground materials between the epicenter and a given location (Planning for Post-Disaster Recovery and Reconstruction, 1998). An earthquake in New England affects a much wider area than a similar earthquake in California due to New England's solid bedrock geology (NESEC).

According to the US Geological Survey website the seismic hazard for Rhode Island is 2-4%g (peak acceleration). While there is a low probability of an earthquake occurring in Rhode Island, it is not an impossible event. There have, in fact, been 15 earthquakes since 1928 with one in June 1951 registering a 4.6 on the Richter scale centered in Kingston. Narragansett Bay is considered a regional hot spot for earthquake activity, with many of the past quakes occurring in the bay or its immediate vicinity. Map 5 from the New England Seismic Network/MIT displays the past earthquake activity in New England.

Map 5: New England Seismic Network / MIT (NESN-MIT); *http://www-erl.mit.edu/NESN/homepage.html* 2002



Drought

Drought can be generally defined as a period of drier than normal conditions over a large area, which, in some manner, reduces water levels. Droughts are different from other natural hazards in that they do not consist of a short, easily defined event such as a hurricane or an earthquake, but instead they gradually appear, last for a time period, and then gradually return to normal. Drought conditions can last for weeks, months, even years. Droughts can have serious economic, social and environmental effects on an area. Crops and livestock can be lost, industries can lose productivity, and wildlife habitat can be destroyed. Cumulatively these effects can easily equal the cost of a severe hurricane or other natural disaster. As aquifer levels are drawn down, seawater can be drawn into wells located near the coast *(RI Drought Management Plan,2002).*

Precipitation levels vary widely from region to region and from year to year. In Rhode Island, the average yearly precipitation is 41 to 47 inches. A drought becomes apparent after a period of time over which there are lower than normal precipitation levels. Stream and river flow is reduced, lake and reservoir levels fall, and groundwater is found at increasingly lower depths. As water availability becomes increasingly scarce, water use prioritization becomes necessary. Rhode Island is considered at risk to short-term droughts, which often occur in the summer months and long-term droughts, which on average appear once every eleven years. Droughts in Rhode Island most often begin with an abnormally dry winter *(RI Drought Management Plan, 2002).*

There have been at least seven major droughts in Rhode Island since 1929 including a long-term drought in the mid sixties and seasonal droughts in the summers of 1999 and 2002 (*RI Drought Management Plan, 2002*). During the 1999 drought many shallow wells in the state dried up. During summer of 2002 Rhode Island experienced increasing levels of drought as water levels dropped and water use restrictions were enacted all over the state.

Currently, Rhode Island has mid-range hydrological conditions, meaning that it is not significantly drier or more moist than normal. The current town water plan predicts a rise in water use as the town's population increases. This increase in water use may lead to greater problems during drought conditions in the future. Additionally, climate change studies suggest that higher summer temperatures will likely increase drought, especially since precipitation is not expected to increase in summer. The Town has adopted numerous strategies to reduce the use of water for non-essential uses such as watering restrictions in the months of July and August to include a twice a week lawn watering program, an inkling block rate price structure, and most recently a major reduction in size to the Town's water service area. This will substantially reduce the maximum build out requirements of the water system. The Water Department alerts, notifies and provides awareness through constant updates in "The Puddle" to its residents regarding water issues.

Sea Level Rise (SLR)

In 2011 the Town of North Kingstown collaborated with Rhode Island Sea Grant College Program (RISG) at the University of Rhode Island on a pilot project to map assets of the town vulnerable to sea level rise. Sea level rise is an increasingly important consideration for hazard mitigation as it relates to flooding and the impacts of severe storms in coastal areas. The Town of North Kingstown is fortunate to have these innovative mapping resources available as a result of this pilot project. This project created SLR maps for the Town of North Kingstown that can be viewed on our webpage under the climate adaptation section.

RISG has a long-term commitment to understanding climate change impacts on sea level rise, flooding and erosion, and the resulting economic, social and environmental implications. The pilot project consolidated the best available digital elevation data for coastal Rhode Island as of 2010, resulting in a series of map and data products that state and town resource managers and decision makers can use to assess vulnerability to projected sea level rise. The pilot project used 1 foot, 3 foot, and 5 foot sea level rise and hurricane scenarios to help address concerns of the likelihood of 3-5' sea level rise in RI by 2100 (or 1-3' by mid century). The purpose of the pilot in North Kingstown was to demonstrate the use of these tools for local planning and action to address sea level rise and increased inundation expected in the future.

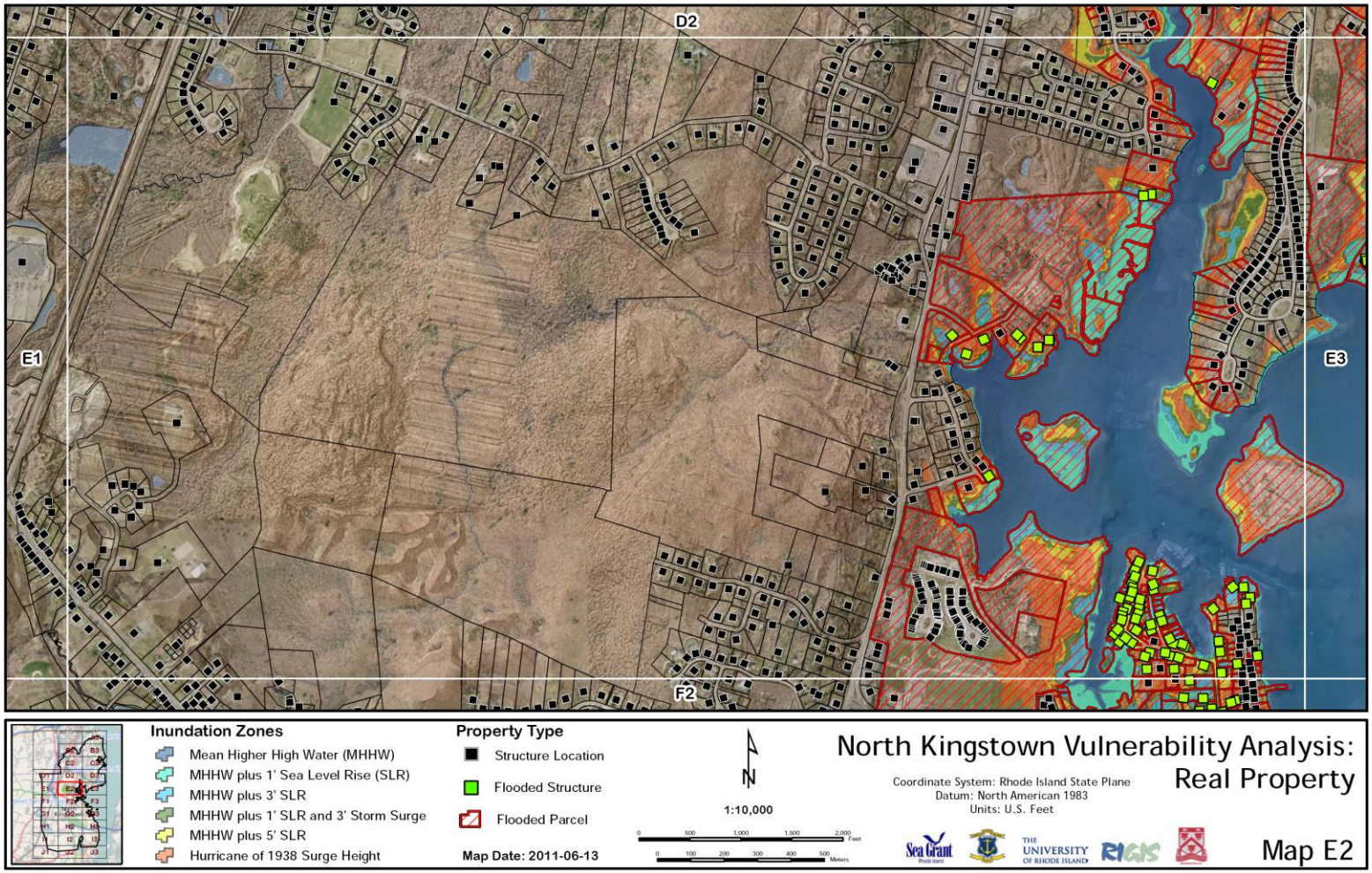
With a foundation of high quality digital elevation data, North Kingstown decision makers can: 1) Begin to assess vulnerability and prioritize risks to sea level rise and increased storminess; 2) Implement existing state sea rise policy and programs which consider the impact of accelerated sea level rise on coastal permitting; 3) Develop new programs that incorporate sea level rise considerations into future drafts of the local comprehensive plan, the hazard mitigation plan, and capital improvements; and 4) Address ecosystem-based adaptation options for wetlands and living shorelines.

In the course of mapping vulnerable assets, the pilot project included two sets of maps—Real Property and Facilities/Infrastructure—each depicting a set of related assets vulnerable to various inundations scenarios. Statewide Geographic Information Systems (GIS) coverage's were used primarily, with additional North Kingstown supplementary data to enrich the analysis (i.e., parcels, culverts).

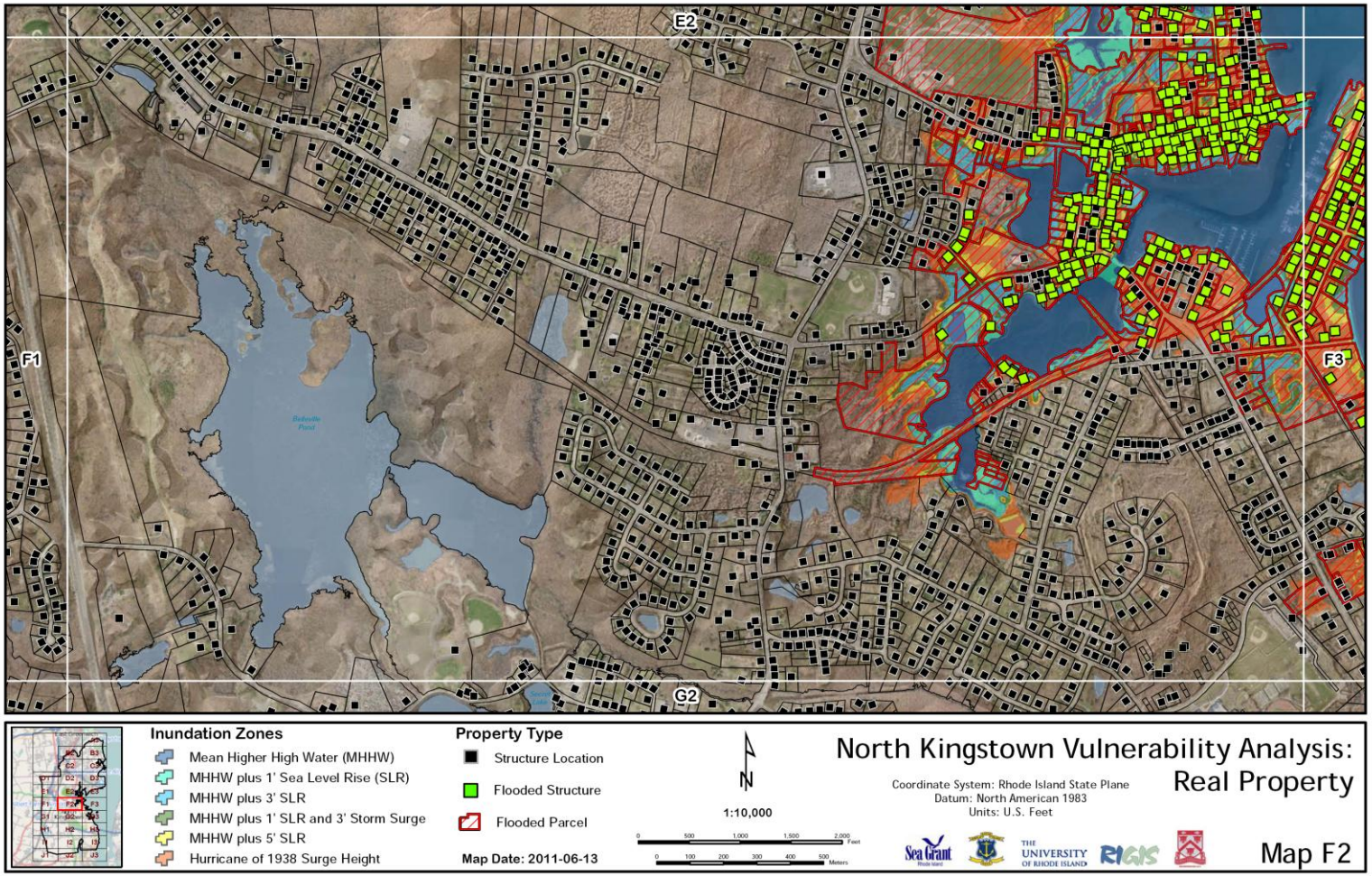
The report "Mapping Assets Vulnerable to Sea Level Rise, North Kingstown, RI" contains detailed information regarding inundation scenarios, including summary tables and maps of vulnerable assets. Maps 6 and 7 of this plan illustrate a sample of the mapping resources included within the report. For more information on the RISG pilot project, and to access the entire report, visit: http://seagrant.gso.uri.edu/climate/slr_tools.html

Further information and facts about the North Kingston's Sea Level Rise project is outlined on http://www.seagrant.gso.uri.edu/z_downloads/coast_nk_factsheet.pdf

Map 6:. Sample 1 from "Mapping Assets Vulnerable to Sea Level Rise, North Kingstown, RI" by RISG



Map 7. Sample 2 from "Mapping Assets Vulnerable to Sea Level Rise, North Kingstown, RI" by RISG.



2.2 Vulnerability Assessment Overview

Hurricanes, Coastal Storms and Flooding

The major impact of a hurricane or coastal storm hitting North Kingstown would come from inundation of the flood zones and storm surge areas. When the areas of town that are vulnerable to rain-caused-flooding are combined with the areas that are vulnerable to storm surge inundation, they together cover approximately 5,500 acres, or 19% of the town (RIEMA). These flood hazard zones include all coastal areas and a large amount of the stream, river, and wetland areas of the interior of the town (Map 1, 2 & 3). Approximately 7,280 people, or 30% of the town's total population, live in these flood vulnerable areas during hurricane season.

While the primary land use in these areas is residential, there are business uses mixed throughout. Together, the more than 3,000 homes and businesses in coastal and riverfront areas have a total value of approximately $138,000,000 as of 2005. Wickford Village is particularly vulnerable to flooding. In addition to residences and businesses, many public facilities and utility lines are located in flood and storm surge areas. These include the Town Hall, Town Hall Annex, and Town Emergency Operations Center, as well as water lines that are carried across potentially vulnerable bridges.

Flood damage comes from both the presence of the water and its ability to carry large pieces of debris such as boats and houses into other houses and structures. Roads running perpendicular to the coast can act as surge channels, carrying the storm surge further inland at a higher rate and concentration. Coastal erosion during a storm event may also put structures at risk.

Wind damage is another significant aspect of coastal storms and has its most direct effect on coastal buildings. Wind speed can drop dramatically as one moves inland, falling 70 to 80 percent one-half mile to one mile inland (Planning for Post-Disaster Recovery and Reconstruction, 1998). Windblown debris broken free from buildings and trees can also be dangerous during a storm. Clean up and damage repair from wind can be very expensive.

Populations that would be of particular concern during a coastal storm include two daycare facilities in the evacuation 'A' areas, located in Wickford and near Bissel Cove, and one daycare center in the 'B' evacuation area in Quidnessett. There are also two day-care centers that are in close proximity to 'A' flood zones. There is no elderly housing or nursing homes located in either a flood zone or an evacuation area. While there are no mobile home parks in the evacuation areas, these locations can still be vulnerable to damage from high winds.

Wildfires

Because North Kingstown's land cover places it in a low fire danger class, it is unlikely that a fire would burn out of control and cause significant damage; however fires are especially dangerous in locations where many houses are present in a forested area. This is the case in parts of North Kingstown, especially the western and southern parts of town. Since the previous plan a new fire station was constructed in Slocum in accordance with the comprehensive plan's objective to relocate one of the town's fire stations to better serve this portion of town.

Severe Winter Storm

All parts of the town can be affected by severe winter weather including significant snow and ice accumulation. Buildings with flat roofs are especially vulnerable to collapse due to snow accumulation; and ice accumulation can bring down utility lines and damage forests. Business functions and activities can be disrupted by temporary loss of electricity and impassable roads. The largest loss of property value caused by a winter storm within the past decade was $700,000 for all of Washington County (National Climate Data Center).

Earthquake

The buildings most vulnerable to earthquake damage are those built before 1977, when state building codes began requiring greater earthquake resistance. Masonry buildings are especially vulnerable, as well as structures located on deep or unconsolidated soils. Because North Kingstown's peak ground acceleration is approximately 3.6%, with a 10% chance of exceedance in 50 years (U.S. Geological Survey), an earthquake with enough intensity to cause damage would be unlikely.

Drought

A drought in North Kingstown would primarily be felt in the form of lost income to agricultural and tourist industries, damage to wildlife habitat, increased risk of wild fires, and well salinization. Residents would also be affected by water use restrictions. North Kingstown has 29 farms and nearly 1000 acres in agricultural production (*Rhode Island Agricultural Digest, 2003).*

Tornadoes

In the highly unlikely event of a strong tornado in North Kingstown, the structures that would be most susceptible to damage would be those built before 1990, when the state building code was amended to include requirements for wind load resistance. The four mobile home parks in the northern part of town would also be of special concern.

Sea level Rise

Sea level rise primarily impacts the coastal area of town in which there are a mix of residences, business uses, and public facilities. Wickford Village and the Quonset Business Park are particularly vulnerable to sea level rise. As previously stated, there are more than 3,000 homes and businesses in coastal and riverfront areas that have a total value of approximately $138,000,000 as of 2005. It cannot be understated the impact Sea Level Rise will inevitably have on wetlands, which are critically important for flood control and habitat viability.

2.3 Land Uses and Development Trends in Hazard Areas

Development in the town varies from the large industrial/business park of Quonset Point to the turf farms and low-density residential areas of Slocum to historic village centers along the coast. The majority of development in the town is single family residential. Based on the 2010 Census, the population of North Kingstown was estimated at 26,486 and the town has approximately 11,327 housing units.

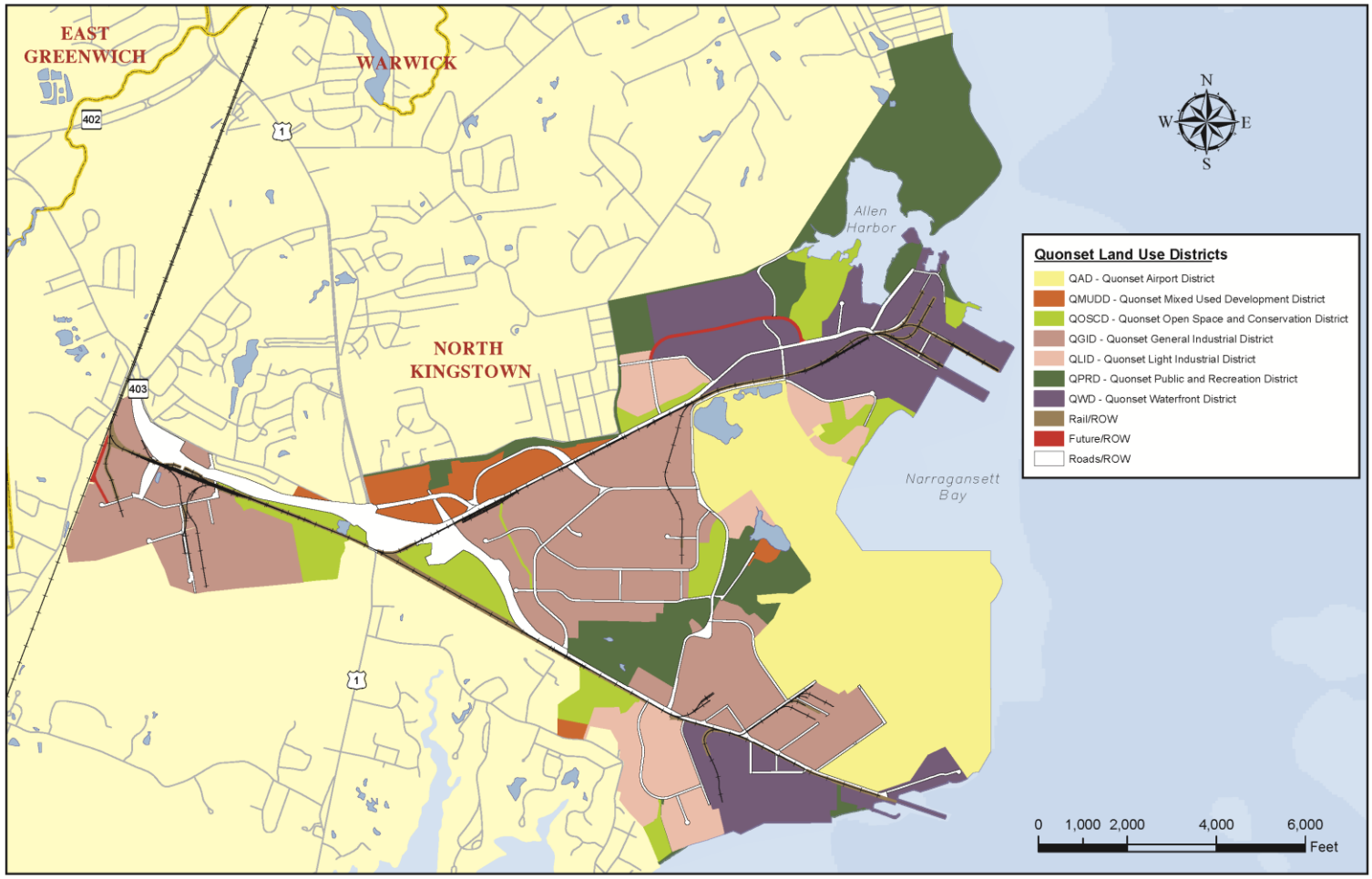
North Kingstown's scenic coastline has attracted residential, waterfront commercial, and other development for many years. Coastal buildings are primarily residential with more than 3,000 homes and businesses in coastal flood or storm surge areas. Most of these areas are close to being fully built out, and it is expected that existing land uses will generally continue.

More recently, development has moved towards the western portion of the town as the available land on the coast has become mostly developed. During the time between 1990 and 2010 the number of residential units in town increased approximately 19%. A significant percentage of these new units are located in the southwest corner of town. Nearly all are single family homes, and most are in cluster subdivisions with common open space. A build out analysis conducted in 2008/2009 showed that there is potential for approximately 7,512 more housing units to be developed in North Kingstown. Approximately twenty-three percent of the town's land area is protected from development by purchase of development rights or is permanent open space.

The only remaining large tract of developable land in the coastal area is the Quonset Business Park under the control of the Quonset Development Corporation (QDC). This 3,207 acre area includes an airport, a seaport, retail area, several recreational facilities, and is the primary location for industrial land uses in town. Between 2000 and 2012, 2.8 million square feet of industrial development was developed. Approximately 350 acres are still available in the park for future industrial development. The Quonset Business

Park Master Land Use and Development Plan puts forward a vision for 6,400 new jobs to be generated at the park over the next 10 years in addition to the 8,800 that currently exist there. Transportation and infrastructure improvements to support this future development are underway. Parts of the industrial park are highly vulnerable to storm surge based on the SLOSH model and storm history in that area. Included in this plan are action items intended to promote disaster resistant design for future development at the Quonset Business Park and to reduce the vulnerabilities of existing structures. The QDC has prepared an emergency response plan for the park.

Map 8: Land use plan for Quonset Development Corporation (QDC)



2.4 Assets and Potential Losses

The following sections provide a general description of the community's assets, which would be at risk in the event of a natural disaster. In order to better quantify North Kingstown's potential losses, the action plan also includes plans to conduct a detailed inventory of structures, infrastructure, and critical facilities vulnerable to damage (Action #18). The outcome of the analysis will be dollar estimates of potential losses due to damage to structures and their contents, and loss of function of structures. This analysis will also reveal in greater detail the structures or neighborhoods of town that are most susceptible to damage in the event of a natural disaster, so that actions can be taken to reduce these vulnerabilities. It cannot be understated the effect that climate change and sea level rise will have on potential losses, with increasing frequency of storms, surges, and spring tide elevations.

Economic and Social

According to tax assessor's data as of 2005, the total value of coastal and riverfront residential and commercial buildings in town is approximately $138,079,100. Therefore, if a hypothetical storm event were to result in an average of 25% damage to these structures, the structural damage would total $34,519,775. Damage to building contents and functional down time of businesses would cause additional losses. A building can be damaged to 25% of its replacement cost in a flood of less then two feet depth.

FEMA's data from November 2013 indicates a total of 911 properties insured by NFIP and vulnerable to flooding (*Table 3*). There are a total of thirteen severe repetitive loss properties in North Kingstown as of July 2013. Since 1978 there have been a total of 279 claims with $1,571,633 paid for losses. Specific vulnerabilities can be found on the risk matrix (Table 4) and on Maps 1, 2 & 3.

Table 3. National Flood Insurance Information for North Kingstown*

Total Flood Insurance Policies	Polices in 'V' Zones	Policies in 'A' Zones	Total Coverage	Number of Claims Since 1978	Number of Severe Repetitive Loss Properties
911	18	528	$233,039,100	279	13

There are several different historical and socially significant structures that are located in evacuation and flood zones. The historic district in Wickford and its harbor are particularly vulnerable to hurricane damage. The existing Harbor Management Plan includes a Storm Preparedness Plan that is consistent with this Hazard Mitigation Plan. The residential, commercial, and industrial areas subject to inundation during a flood or

hurricane all pose the threat of introducing hazardous chemicals and wastewater into the environment and therefore represent a possible health risk after the event that can inhibit rescue operations. Large inundation areas can be found along the Hunt and Narrow Rivers, at Pojac Point, Quonset Point, Wickford, and around Bissel Cove.

As of July 2004 Rhode Island State Building Codes place North Kingstown in wind zone 2, which requires new constructions to be able to withstand winds up to 110 MPH. The previous design wind speed was 90 MPH. Flood proofing construction has been required in flood zones since the 1970's. Any buildings constructed before these codes went into effect are potentially vulnerable to severe storm events.

Since 1977, State building code has required that new buildings and major reconstructions be designed to withstand earthquakes measuring up to 3.0 on the Richter scale. Therefore, buildings built before 1977 may be vulnerable to earthquakes of that scale. Old masonry buildings and large structures are most vulnerable to earthquake damage. Bridges, dams, and roadways are also susceptible to damage in the event of an earthquake.

Public Infrastructure

The town owns and operates a large number of facilities in coastal areas subject to flooding and storm surge. Most significant of these are the two town hall buildings; both are located in the hurricane surge area while the main town hall is in an 'X' zone and the Town Hall Annex is in an 'AE' zone (Map 2). In the event of a serious storm, sensitive equipment and important documents can both be destroyed leading to a variety of problems in town management including the loss of historic records. In addition, the town emergency operations center and the National Guard Stations at Quonset are within the hurricane evacuation areas designated for the most severe hurricane events (Map 2). Two elementary schools, Fishing Cove, and Hamilton, face damage as well in the event of a severe storm (Map 2). The North Kingstown Free Library is another vulnerable town structure subject to storm surge and high winds.

Flooding can expose or otherwise compromise septic systems leading to contamination and public health concerns. The town maintains two wastewater pumping facilities, one at Wickford Point and the other on Mark Drive, while the QDC has a wastewater facility in Quonset Point. All of these wastewater facilities are subject to flooding and storm surge presenting severe water contamination issues. Flooding can also wash out bridges leading to disruption in water provision at the point where it is carried over bridges. The Hussey and Brown Street Bridges in Wickford both carry water lines, as do bridges over Cocumscussoc Brook on Post Road and the Annaquatucket River on Boston Neck Road. The town has several different recreational facilities in coastal areas subject

to flooding and storm surge including Allen Harbor Marina, the Town Dock in Wickford, the various buildings at the end of Beach Street, and Wilson Park. Finally, the highway garage on West Main Street is subject to both flooding and storm surge.

Utility lines represent another key vulnerability in the town. High winds and ice/snow storms can bring down phone and electric lines disrupting power and communication to parts of the community and affecting the operations of businesses. The town also has many dams that may be vulnerable to flooding or earthquake damage. An earthquake could also pose a threat to older town buildings such as the Town Hall and Wickford Elementary School.

Natural Resources

The most important natural resource upon which North Kingstown is dependent is its water supply. The town's water comes from three different aquifers, the Hunt, Annaquatucket, and Pettaquamscutt. The average daily use is well below the safe yield levels and water is supplied to parts of both Narragansett and Jamestown. Volume II of the North Kingstown Water Supply System Management Plan deals extensively with emergency responses and mitigation actions for droughts, water contamination, supply disruption, and many other situations. Impermeable surfaces above the aquifer can severely restrict the amount of water infiltrating the ground and recharging the aquifer, exacerbating the effects of a drought.

With almost 50 percent of the town being forested, wildfire can be a concern, especially during drought conditions. Large areas of forested lands include the town owned parks, Cocumscussoc State Park, and private lands, mostly in the western and southern parts of the town. Protection of wetlands should continue to be a central effort as these resources are critically important for flood control and habitat viability.

The town's aquatic environments are significant not only for their high level of quality but also in their susceptibility to disruption from natural and manmade events. Flooding may also pose a significant risk to the RI Department of Environmental Management fish hatchery on Hatchery Road. In the event of septic failure due to flooding or storm surge, the resulting discharge could severely impact, and even destroy, important aquatic habitats such as eelgrass beds and shellfisheries. Large-scale coastal storms can also cause serious erosion to town beaches, thereby eliminating important coastal buffers and town recreational areas.

Shelters and Evacuation Routes

The number of people seeking emergency shelter in the event of a natural disaster is difficult to determine; it can be affected by the type and severity of the disaster, amount of forewarning, awareness of shelter locations, and the number of alternative destinations for individual residents. Severe storms with little forewarning can cause the most stress on shelter capacity, as people are more likely to seek shelter when they have less time to make alternative arrangements. Residents of nursing homes and mobile home parks are often the most likely groups to seek public shelter in the event of a natural disaster. Tourists visiting the town may also require shelter access, especially during the summer months that coincide with the hurricane season.

The Red Cross estimates that an average of 10 percent of the town's population will need to utilize public shelters in the event of an emergency situation. With a current population of 26,486 in North Kingstown, that would be approximately 2,648 town residents seeking public shelter. Currently the town has two Red Cross approved shelters, Davisville Elementary School, and Wickford Middle School. The Red Cross has identified some regional shelters to bolster town capacities, such as utilizing space at the University of Rhode Island during the summer months.

As with emergency shelter use, it is also difficult to determine how many residents will evacuate coastal areas in the event of a severe storm, except in cases in which evacuation is mandatory. Many people often decide to remain in their homes for the duration of a storm. Evacuation routes for residents leaving the coastal evacuation areas, designated using the SLOSH models, have been created by the North Kingstown Police Department (Map 2). To facilitate evacuation, traffic control points to be manned by police officers during an evacuation have been created at significant road crossings and bridges (Map 2). Evacuating some areas will be of special concern due to limited access, specifically those places with only a single access road that can potentially be blocked by flooding or downed trees. Loop Drive in Wickford, which can only be exited over the Loop Drive Culvert, is one such place where flooding could keep residents from evacuating. The Hurricane Evacuation Study has been updated and a map was prepared in June 2013 to reflect this, which is available to view on the town's website. This indicates hurricane evacuation zones that are recommended from potential worst-case hurricane surge inundation.

2.5 Coordination with Neighboring Municipalities

North Kingstown borders on six other towns: East Greenwich, Exeter, Jamestown, Narragansett, South Kingstown, and Warwick. Issues concerning hazard mitigation transcend these boundaries requiring that planning for natural hazards coordinate with, and make considerations to these neighboring municipalities. Water is one of the most important issues concerning North Kingstown and many of its neighbors regarding both its source and supply. The aquifers from which the town draws its drinking water extend into East Greenwich and Exeter, requiring that mitigation issues concerning drought and water supply contamination be coordinated with these towns. In addition, the town supplies water to Narragansett and also to Jamestown on an emergency basis such that water use restrictions during a drought must be coordinated with these towns. The North Kingstown Water Supply Management Plan deals with many of these inter municipal issues.

Emergency evacuation is another important issue that in some places requires cooperation with neighboring towns. Residents of both Jamestown and Narragansett will be utilizing North Kingstown evacuation routes in the event of a natural disaster. Jamestown, in particular, could have many residents evacuating through North Kingstown on Route 138. Some North Kingstown residents may evacuate through Warwick and East Greenwich across the Forge Road Bridge or Warwick residents may come through North Kingstown over the same bridge. Evacuation routes and emergency shelters are issues that should be coordinated amongst all six of these neighboring communities for the safety of all area residents.

Other areas for cooperation between towns have been identified in the actions portion of the plan. Before the plan can be amended into the comprehensive plan, copies will be provided to the neighboring communities for their review and comment.

3.0 – Mitigation Actions

After reviewing the town's existing hazard mitigation activities and capabilities for expansion, the North Kingstown Hazard Mitigation Committee has created a set of actions in order to address the previously identified risks and vulnerabilities and achieve the town's hazard mitigation goals. In general, the changes that have been made to the plan as part of the Hazard Mitigation Plan Update (2013) are designed to reflect changes in development, update information on natural hazards, show progress made toward mitigation efforts and changes in the town's priorities. The actions identified with this update will serve as an implementation plan as the town attempts to reduce its vulnerability to natural disasters. These actions are intended to reduce risks to public safety and to existing structures as well as to future development in town.

3.1 Existing Hazard Mitigation Activities and Town Capabilities

There are many existing plans, policies, and reports that in some way contribute to or inform the hazard mitigation process in North Kingstown. In order to formalize and greatly expand the town's hazard mitigation program, the town will use the capital improvement program to schedule funding for implementation of the actions in this Hazard Mitigation Plan.

The comprehensive plan has several different objectives and actions that can contribute to hazard mitigation. In the Transportation element, the plan calls for the creation of a bridge management program (Action C.1.9.2), which will ensure the continuous management and upkeep of the town's bridges, in effect making them more hazard resistant. In addition, the plan calls for improving roadway drainage (Action C.1.9.6) and improved storm water systems (Action C.1.9.7). Both of these actions will decrease the effects of flooding. In the Natural and Cultural Resources Element, Action NC.1.3.14 addresses reducing the amount of impervious surfaces in the town. Reduced impervious surfaces in flood zones can lower flood levels. The Community Services Element has many actions and objectives that can serve hazard mitigation including a new fire station at Quonset Point (Action CS.9.1.2) and providing for the secure storage and protection of vital town records (Action CS.14.2.3). Protection of the town's water supply is a critical component of this element, as reflected in Goal CS.8 Protect and Conserve Town Water Supply.

Actions to protect the water supply appear frequently in the comprehensive plan and other town plans and documents. The town's Groundwater Protection Plan forms the basis of the groundwater protection overlay zone. This overlay zone regulates the uses and densities that can locate in the aquifer area in an effort to protect the town's drinking water from contamination. The Water Supply System Management Plan has

extensive actions that should take place in the event of natural or man-made disasters to protect the water supply from contamination. As an additional protection measure, the town is committed to acquiring land and conservation easements in the groundwater protection areas. All of these actions limit the potential for groundwater contamination and ensure sufficient recharge of the aquifer, ultimately mitigating the effects of drought.

Another pertinent document includes the North Kingstown Tree Inventory Management Plan. This plan recommends regular tree trimming to reduce the potential for damage to utility lines from fallen limbs. The Emergency Operations Plan also includes a framework to assist town officials in planning and performing their emergency functions during a disaster. In addition to hazard mitigation, other related issues addressed in the Emergency Operations Plan include 1) preparedness, which is aimed at saving lives and minimizing damage, 2) response, which is aimed at preventing the loss of lives, reducing property damage, and 3) providing emergency assistance, and recovery, which is aimed at returning all systems to normal post-disaster. The town also has a Hazardous Materials Plan, which lists locations in the town where hazardous materials are stored, and covers response and recovery in the event of a hazardous materials spill. In addition, the Harbor Management Plan includes a Storm Preparedness Plan, which is consistent with the actions developed in this Hazard Mitigation Plan.

3.2 Mitigation Goals

The town's mitigation goals, which these actions are intended to achieve, are, in order of priority, to:

1) Reduce risks from natural hazards to **life and property** in North Kingstown,
2) Ensure the **safety of children** from natural hazards,
3) Ensure that the town's **emergency services** will be operational during a natural disaster, and plans are in place to expedite **recovery after a disaster**.
4) Reduce the vulnerability of the town's **infrastructure and utilities** to natural hazards,
5) Reduce the vulnerability of **municipal facilities** to natural hazards,
6) Reduce the vulnerability of the town's **cultural resources** to natural hazards,
7) Reduce risks from natural hazards to the employees and facilities at **Quonset Point**, and
8) Reduce the vulnerability of the town's **recreational resources** to natural hazards.

The following Risk Assessment Matrix (Table 4) is organized into major categories corresponding to each of the hazard mitigation goals as listed above. Within each goal are more specific mitigation objectives. These are organized according to the

vulnerable areas of town related to each goal, and are listed in the right hand column of the Risk Assessment Matrix. The mitigation actions that the town will take to achieve each of these objectives are listed in the action plan.

Table 4: Risk Assessment Matrix

	Vulnerable Areas (*in order of priority*)	**Location**	**Ownership**	**Natural Hazard**	**Risk** H=Historical P= Potential	**Primary Effects or Problem**	**Mitigation Objective**
Life and Property							
1	Coastal Neighborhoods (Actions #1-9)	Coastal/Riverside Quidnessett; Shore Acres; Camp Avenue; Wickford; Hamilton; Coastal Saunderstown; Narrow River Area; Mount View	Private & Municipal	Flooding (A,V); Storm surge; Wind	H - '38 and '54 Hurricanes P	Public safety; Septic system exposure leading to pollution and health risks; Private property loss; Utility interruptions	Ensure the safety of current and future residents. Protect property from damage. Reduce the cost of disaster clean-up.
2	Wickford Commercial Districts (Actions #10-11)	Wickford Village	Municipal & Private	Flooding (AE); Storm surge; Wind; Earthquake	H - '38 and '54 Hurricanes P	Loss of services and revenue; Private & public property loss	Ensure post-disaster business continuation.
3	Elderly Housing (Action #12-14)	Town-wide	Private	Storm surge; Wind	P	Public safety; Structural damage; Housing unit loss	Ensure the safety of elderly residents. Reduce the cost of disaster clean-up.

4	Wickford Village Housing (Action #15)	Wickford	Private	Flooding (X); Storm surge; Wind	P	Public safety; Public health (potential inundation of housing's sewage treatment facility); Environmental health; Housing unit loss	Ensure the safety of current and future residents. Protect property from damage. Reduce the cost of disaster clean-up.
5	Masonry Apartment and Mill Buildings (Action #16)	Town-wide	Private	Earthquake	P	Public safety; Structural damage	Ensure the safety of current and future residents. Protect property from damage. Reduce the cost of disaster clean-up.
6	Mobile Home Parks (Action #17)	Off of Post Road	Private	Wind	P	Public Safety; Private property loss; Utility damage	Ensure the safety of current and future residents. Protect property from damage. Reduce the cost of disaster clean-up.
7	All Vulnerable Structures (Action # 18-19)	Town-wide	Municipal & Private	Flooding; Storm Surge; Wind	H & P	Public safety; Property loss and damage	Inventory all vulnerable structures and estimate expected losses from a major hazard event.

Child Safety							
1	Town Schools (Actions #20-23)	Town-wide	Municipal	Flooding (A); Storm surge; Wind; Earthquake	H - '38 and '54 Hurricanes	Public safety; Structural & property damage; Loss of services	Ensure the safety of children. Reduce the cost of disaster clean-up and repair.
2	Day Care Centers (Action #24)	N.K. Daycare-Boston Neck Rd; St. Paul's Nursery-Main St; Sunshine Early Child Care Center-Iafrate Rd	Private	Flooding (A); Storm surge; Wind	P	Public safety; Structural & property damage; Utility damage	Ensure the safety of children. Reduce the cost of disaster clean-up.

Emergency Services and Recovery Plans							
1	Evacuation Routes (Actions #25-28)	Town-wide	Town and State	Flooding; Storm surge; Wind	P	Public safety; Loss of evacuation ability	Ensure the viability of evacuation routes.
2	Emergency Shelters (Action #29)	Davisville Elementary School; Wickford Middle School	Municipal			Lack of sufficient emergency shelter	Ensure available capacity for town residents in local emergency shelters.
3	Town Emergency Operations Center and Public Safety Complex (Action #30)	Post Road	Municipal	Wind; Earthquake	P	Loss of emergency response capability; Loss of communications	Ensure the accessibility and operational status of the center during an emergency.
4	Town Fire Stations 2, 3 & 5	Boston Neck Road, Post Road, Indian Corner Road	Municipal			Loss of emergency response capability	Ensure the accessibility and operational status of the stations during an emergency
5	Rhode Island Air and Army National Guard (Action #31)	Quonset Point	State and Federal	Flooding; Storm surge; Wind	H - '38 and '54 Hurricanes	Structural & property damage; Loss of services; Utility damage	Ensure the accessibility and operational status of the base during an emergency.
6	Post-Disaster Plans (Actions #32-33)	Town-wide	Municipal & Private	Flooding; Stormsurge; Wind; Ice and Snow; Earthquake; Drought	H & P	Public safety; Property damage; Loss of services and utilities	Expedite debris removal and recovery /reconstruction after a disaster.

Infrastructure and Utilities							
1	Dams (Action #34)	Town-wide	Municipal and Private	Flooding; Storm surge; Earthquake	P H- Mainly 2010 Flood	Public safety; Debris; Structural damage; Major property damage	Ensure structural integrity and ability to withstand coastal and riverine flooding.
2	Town Bridges (with utilities) (Actions #35-37)	Hussey; Brown Street; Babbit Farm; and Hamilton Mill	Municipal and State	Flooding (A); Storm Surge	H - '38 and '54 Hurricanes P	Loss of access; Structural damage; Water service disruption; Gas service disruption	Ensure structural integrity and ability to withstand coastal and riverine flooding.
3	Town Bridges (without utilities) (Action #35)	Loop Drive; Gilbert Stuart; Jamestown; Library Pedestrian; and Bridges over the Potowomut	Municipal and State	Flooding (A); Storm Surge	H - '38 and '54 Hurricanes P	Loss of access; Structural damage	Ensure structural integrity and ability to withstand coastal and riverine flooding.
4	Town Roads and Streets (Action #38)	Town-wide	Municipal and State	Flooding; Storm surge; Snow and Ice	H - '38 and '54 Hurricanes P	Loss of access; Structural damage	Maintain pass ability and repair roads quickly after a disaster.
5	All town and QDC Wells (Actions #39-41)	Town-wide and in East Greenwich and Warwick	Municipal	Flooding (A); Storm Surge; Drought	P	Public safety; Public health; Loss of services	Ensure protection of the water supply from contamination in the event of flooding. Ensure continued operation.

6	Water Distribution System	Standpipe Lane	Municipal	Wind, Flood	P	Public safety; Public health; Loss of services	Ensure protection of the water supply from contamination in the event of flooding. Ensure continued operation.
7	Electric Utility Lines and Facilities (Actions #42-43)	Town-wide	National Grid	Wind; Earthquake	P H	Public safety; Loss of services	Ensure public safety and continued service.
8	QDC Wastewater Facility (Action #44)	Quonset Point/Davisville	State	Flooding (V); Storm surge; Wind	H - '54 Hurricane	Loss of operations and services; Pollution; Loss of shellfish beds	Prevent contamination of surrounding environment.
9	Town Sewage Pumping Facilities (Actions #45-47)	Wickford Point and Mark Drive	Municipal	Flooding (A); Storm surge	P	Public safety; Public health; Loss of services	Prevent contamination of surrounding environment.
10	Town Sewer Lines	Post Road Corridor	Municipal	Flooding; Storm surge	P	Public safety; Public health; Loss of services	Prevent contamination of surrounding environment.
10	Wind Energy Systems and Meteorological Tower	Town Wide	Private and Municipal	Wind; Earthquake	P	Public safety; Public health; Loss of services	Prevent contamination of surrounding environment.
11	Phone Lines and Cell Towers (Actions #48)	Town-wide	Various Private Utilities	Wind; Earthquake	P	Loss of services	Ensure continued service.

12	Wickford Service Station (Actions #49-50)	Boston Neck Rd.	Private	Flooding (A); Storm surge; Wind	H - '54 Hurricane P	Loss of services; Pollution; Hazardous materials; Property loss	Prevent contamination of surrounding environment.

Municipal Facilities							
1	Town Hall (Actions #51-52)	80 Boston Neck Road	Municipal	Flooding (X); Storm surge; Wind; Earthquake	H - '38 and '54 Hurricanes	Loss of operations, records, and historic information; Structural damage; Loss of public services	Protect town records. Reduce the cost of disaster clean-up and repair.
2	Town Hall Annex (Actions #53-54)	55 Brown Street	Municipal	Flooding (AE); Storm surge; Wind; Earthquake	H - '38 and '54 Hurricanes & 2012 Hurricane Sandy P	Loss of operations, records, and historic information; Structural damage; Loss of public services	Protect town records. Reduce the cost of disaster clean-up and repair.
3	Senior Center; Cold Spring Community Center; and Art Association Building (Action #55)	Beach Street	Municipal	Flooding (A,VE); Storm surge; Wind	H - '38 and '54 Hurricanes P	Public safety; Loss of social services; Structural damage	Reduce the cost of disaster clean-up and repair. Reduce service disruption.
4	North Kingstown Free Library (Actions #56-57)	Boone Street	Municipal	Storm surge; Wind	P	Loss of Services; Structural damage	Reduce the cost of disaster clean-up and repair. Protect library resources.

5	Highway Department Facilities Building (Actions #58-59)	West Main Street	Municipal	Flooding (A); Storm surge; Wind	H - '38 and '54 Hurricanes P	Debris; Hazardous materials; Loss of services; Property loss	Reduce the cost of disaster clean-up and repair. Prevent contamination of surrounding environment. Reduce service disruption.
Cultural Resources							
1	Wickford Historic District (Action #60)	Wickford Village	Municipal & Private	Flooding (A); Storm surge; Wind; Earthquake	P H - '38 and '54 Hurricanes	Historic loss; Private and public property loss	Protect historic resources.
2	Gilbert Stuart Birthplace and Smith's Castle (Action #61)	Gilbert Stuart Road	Private	Flooding (A); Storm surge; Wind	H - '54 Hurricane	Structural damage; Historic loss	Protect historic resources.
Quonset Point							
1	Existing and Proposed Development at Quonset Point/ Davisville (Actions #62-66)	Quonset Point/Davisville	State, QDC and Private	Flooding (A,VE,X); Storm surge; Wind	P - '38 and '54 Hurricanes	Hazardous materials; Loss of revenue	Prevent contamination of surrounding environment. Ensure post-disaster business continuation.
2	Quonset State Airport (Action #67)	Quonset Point/Davisville	State	Flooding (A,VE); Storm surge; Wind	P - '38 and '54 Hurricanes	Loss of emergency response capability; Loss of transportation	Ensure continued operation. Reduce the cost of disaster clean-up.

Recreational Resources							
1	Town Harbors and Moorings (Actions #68-69)	Wickford Harbor Allen Harbor	Municipal and Private	Flooding (A); Storm surge; Wind	H - '38 and '54 Hurricanes	Public safety; Structural damage; Loss of boats; Damage to fishing industry; Utility damage	Protect property on land and water from damage. Reduce the cost of disaster clean-up and repair.
2	Town Beach, concession and restrooms (Action #70)	Beach Street	Municipal	Flooding (A,VE); Storm surge; Wind	H - '38 and '54 Hurricanes	Public safety; Loss of recreational services; Erosion	Maintain beach integrity; Reduce seawall damage; Reduce structural damage.
3	Ryan Park, Rome Point, Wilson Park, Cocumscussoc State Park, and Calf Pasture Point (Action #71)	Belleville Pond, Boston Neck Rd., and W. Main St.	Municipal and State	Flooding (A,VE); Storm surge; Wind; Fire	H	Structural damage; Pollution; Loss of services; Loss of trees; Loss of access	Reduce the cost of disaster clean-up and repair.
4	Municipal Golf Course (Action #72)	Quonset Point/Davisville	Municipal	Storm surge; Wind	H - '54 Hurricane	Debris; Loss of trees; Pollution; Hazardous materials; Loss of access; Structural damage; Economic loss	Reduce the cost of disaster clean-up and repair.

3.3 Action Plan

The action plan was created to achieve the mitigation objectives identified in the Risk Assessment Matrix (Table 4). The matrix is organized into major categories of concerns, such as life and property and child safety, drawn from the town's mitigation goals. Within each major category vulnerable areas are identified, such as coastal neighborhoods and schools. The mitigation actions in this plan are grouped according to the vulnerable area each is intended to protect.

Identification of Mitigation Actions

Mitigation actions are actions that are designed to reduce a town's vulnerability to the effects of natural disasters. Mitigation actions are different from emergency preparedness actions in that emergency actions address a town's response to a hazard event, while mitigation attempts to reduce the amount of damage a natural hazard can possibly cause in the first place. An emergency action in response to flooding would involve decisions about how to build an emergency sandbag levee while a mitigation plan would involve ensuring structures in the flood zone area are flood-proofed or even prohibiting structures in the flood zone area. Essentially, mitigation is about reducing the dangers, costs, and need for emergency action that is usually associated with natural disaster events.

Actions were drawn from the FEMA approved hazard mitigation plans of other Rhode Island towns, the deliberations of the Hazard Mitigation Committee, suggestions from the public, and the research of the planning staff. Actions were chosen for implementation based on their being within the authority and ability of the town to enact, feasibility, and having mitigation benefits sufficient to justify their costs of implementation. An example of an action that was considered but not selected for implementation was the idea of assessing vulnerability of cell phone towers to high winds and retrofitting as necessary. This action was not included because this was seen as the jurisdiction of each individual cell phone service provider. All of the actions included in the following action plan are considered appropriate for implementation given local conditions.

Each action includes a brief description of what the action will accomplish, who the responsible parties are, how much it will cost, how the action will be financed, and in what time frame the action will be completed. Some actions include reference to an example of how the action has been implemented elsewhere. The actions identified include modifications to the built environment, changes in town policies, distribution of public information on hazard risks, and the creation of community based organizations.

In addition, consideration has been made for actions to be taken both before and after a disaster occurs.

Prioritization of Actions

The vulnerable areas identified on the Risk Assessment Matrix were prioritized according to the town's hazard mitigation goals. The highest priority was assigned to areas where life and property or child safety would be at risk followed by emergency services, infrastructure, utilities, municipal facilities, cultural resources, Quonset Point, and recreational resources. Further prioritization was based on a variety of considerations including historical damage, number of residents potentially impacted, and the value of property, in economic as well as cultural/environmental terms. The priority assignment given to the vulnerable areas on the matrix plays a role in determining money allocation and the timeframe priority given to specific actions addressing those areas.

The Hazard Mitigation Committee's prioritization of each action was based partly on the prioritization of the vulnerable area each action is intended to protect and partly on the magnitude of benefit each action is likely to achieve as compared to its costs and overall feasibility. An example of an action that was selected for implementation and assigned high priority is the creation of a volunteer disaster assistance program. This program could be developed quickly without great expense and would be very beneficial for the preservation of life and property in the case of a natural disaster.

The Hazard Mitigation Committee created a set of time frames for the completion of each hazard mitigation action: Short term actions will be completed within six months, medium term actions within six to 18 months, and long term actions will be completed within 18 months to five years. In addition, some actions have been identified as ongoing, indicating that such an action requires continual implementation over time. In general, the time frame assigned to each action also corresponds to its priority. High priority actions were assigned a short term time frame and low priority actions were assigned a long term time frame.

Life and Property

Vulnerable Area #1: Coastal Neighborhoods

Action #1: Open Space Acquisition

Maintaining and securing land as open space in flood zones and coastal areas is one way to keep the number of people and homes vulnerable to severe storms and flooding from

expanding. The town's CRS rating can be improved as more of this vulnerable land is kept from being developed. The town has been actively acquiring open space to meet a variety of town goals, one of which is to protect land in flood zone areas. As one example, in 2008 the town purchased approximately 25 acres of land near Wickford Cove within Flood Zone AE and Flood Zone X as shown on the 2013 Flood Insurance Rate Map (FIRM).

The town will continue to take steps to protect land in flood zones and coastal areas. As a priority list of properties targeted for open space protection is developed, hazard mitigation, primarily targeting flood prone areas, will be an important part of the prioritization process. Consideration should be given for protecting future wetlands as depicted by Sea Level Affecting Marshes Model (See link in Section 2.1- Sea Level Rise for more information) to help ensure long-term vision and efficacy. Attention will also be given to providing public coastal access and habitat protection. The North Kingstown Land Conservancy and Narrow River Land Trust and CRMC Coastal and Estuary Habitat Restoration Program/Trust Fund could play significant roles in completing this action.

Lead:	Department of Planning and Development
Other responsible parties:	North Kingstown Land Conservancy, Narrow River Land Trust, Town Council, Conservation Commission, and RIDEM, CRMC Coastal and Estuary Habitat Restoration Program/Trust
Financing options:	FEMA FMAP grants, Land acquisition bonds (state and municipal), Land Bank, RI DEM, and other open space acquisition funding and strategies.
Cost:	Variable
Timeframe:	Ongoing (dependent on funding)
Priority:	High

Action #2: Volunteer Disaster Assistance Program

Volunteers working at the community level can be a tremendous asset to hazard mitigation efforts before, during, and after a natural hazard event. A community member acting as a Volunteer Disaster Assistance officer could coordinate community mitigation activities, act as a local hazard information source, and offer assistance to residents not able to help themselves. In preparation for an impending disaster, volunteers could help residents prepare their homes and facilitate evacuations if necessary. After a disaster, qualified volunteers could provide an initial damage report to town agencies, perhaps help the building department in providing emergency building permits, and aid resident clean-up efforts. These volunteers would be organized by and associated with the Rhode Island Chapter of the American Red Cross.

One emerging network to assist with monitoring and reporting on storm damage in vulnerable areas is the "Storm Reporter" network initiated by Save the Bay and CRMC.

Lead: RI Red Cross
Other responsible parties: Fire and Police Department
Financing options: Red Cross, Town Budget, Homeowner's association, FEMA

Cost: Staff time, Overtime
Timeframe: Short Term (6 months)
Priority: High

Action #3: Building Code Compliance Enforcement

The building official, in conjunction with the Town Engineer, will continue to enforce regulations regarding coastal buffers, wind resistance, flood mitigation, and earthquake resistance. Information regarding natural hazard vulnerability will be provided to potential homeowners and considered as building permits are reviewed. The Town of North Kingstown recently amended the Special Flood Hazard Overlay District. The new ordinance specifically defines the flood overlay district as those lots designated as Zone A, AE, AH, AO, A99, V or VE on the Washington County Flood Insurance Rate Maps for North Kingstown. The new regulations include a freeboard requirement that accounts for sea level rise (BFE +1) in V and Coastal A zones. The building official shall review all development proposed in the Special Flood Hazard Overlay District to ensure the development is in compliance with the provisions of the latest state building code concerning flood-resistant siting and construction.

Lead: Building Official's Office
Other responsible parties: RI CRMC, Department of Planning and Development
Financing options: Town budget, CDBG, NFIP ICC
Cost: Staff time
Timeframe: Ongoing
Priority: High

Update- Implementation being reviewed

Action #4: Hazard Mitigation in Technical Review Committee Meetings

The Technical Review Committee will review applications to ensure that they address hazard mitigation-related issues.

Lead: Department of Planning and Development

Other responsible parties: Other members of the TRC
Financing options: Town budget
Cost: Staff time
Timeframe: Will be ongoing
Priority: High
Update: Accomplished all TRC meetings consider HMP

Action #5 Hazard Mitigation Web Page

The town will utilize its website to create a dedicated web page with links to existing resources as a means to inform the public of natural hazard vulnerabilities. The town's website currently has information regarding flood areas, evacuation routes and inundation mapping on the public safety page. Links to the RIEMA and FEMA are available along with information related to property protection, power outages and storm tracking sites.

In addition, the town will insert information into "The Puddle" highlighting the resources that can be found on the town's website. The Puddle is the North Kingstown Department of Water Supply newsletter that is distributed to all water service customers.

Lead: Department of Planning and Development
Other responsible parties: Department of Information Technology
Financing options: Town budget
Cost: Staff time
Timeframe: Continued effort
Priority: High

Update: Complete

Action #6: Evacuation of Tourists

The police department will distribute information on town evacuation routes and emergency shelters to all registered phone numbers in North Kingstown through its Code Red system which operates as a "reverse 911". Additionally, the town's Storm Preparedness Plan addresses the need to find a safe haven for transient boaters in advance of a storm.

Lead: Police Department
Other responsible parties: Department of Planning and Development, Chamber of Commerce

Financing options:	Town budget
Cost:	Variable
Timeframe:	Short
Priority:	High

Action #7: Reduce and Manage Storm Water

Impermeable surfaces such as asphalt and concrete reduce the amount of water passing into the soil and increase the amount of run-off. This leads to higher levels of flooding and erosion. The town is required to comply with State Stormwater regulations. These include all standards and regulations contained in our approved RIPDES permit. The permit requirements are designed to reduce and manage stormwater runoff. The permit and its management plan are now in their fifth approval year. The entire town drainage system has been mapped, GPS located and all systems inspected for operational capacity. The permit has an educational and public awareness component, as well as standards for best management practices. The implementation of the program has been very successful in improving storm water management. The plan was also developed with an understanding of need to maintain evacuation routes and vulnerable neighborhoods. The town will continue to encourage the use of permeable paving materials and other creative means for controlling storm water by residential, commercial, and industrial landowners. A packet will be developed containing a selection of best management practices for stormwater management.

Lead:	Department of Public Works
Other responsible parties:	Department of Planning and Development, Engineering Department, Landowners
Financing options:	Town budget
Cost:	Staff time
Timeframe:	Medium Term (1-3 yrs)
Priority:	Medium

Action #8: Post-Disaster Hazard Mitigation Opportunities

Develop a list of properties in flood prone areas, especially coastal 'V' zones, for potential acquisition after a severe storm event in which the structure has been seriously damaged or destroyed. Repetitive loss properties should be prioritized on this list. NFIP requires that if a property is damaged or renovated totaling more than 50 percent of the property's market value it must be rebuilt to meet flood zone regulations. Coastal properties in the same situation would also have to meet CRMC requirements. Rebuilding would offer opportunities to incorporate new building codes with higher flood protection and sea level rise standards.

Lead:	Building Official's Office
Other responsible parties:	Department of Public Works, State floodplain manager and building code commissioner, CRMC
Financing options:	FEMA, RIEMA
Cost:	Variable
Timeframe:	Medium Term
Priority:	Medium

Action #9: Encourage OWTS Upgrades

Upgrading coastal onsite wastewater treatment systems (OWTS) would benefit the long-term protection of Narragansett Bay from nitrate leaching as well as mitigate the amount of pollutants introduced into the bay if the system is exposed during a storm event. The Planning Department along with the University of Rhode Island Cooperative Extension completed an educational brochure for the residents of the Wickford Harbor Watershed. This brochure was mailed to all of the residents in the watershed in hopes of educating them about the importance of maintaining and the benefits of upgrading their OWTS. The town continues to require that property owners have their OWTS inspected or pumped once every three years across the town. The town also makes low interest rate financing available to North Kingstown residents to help to ensure the proper maintenance and functioning of OWTS. The town has also started to install sewers in the Post Road Corridor area and will be researching the possibility of extending the sewers to southern portions of the town. All of these efforts will continue in order to protect the waters in and surrounding the town. Property owners in the flood plain who install advanced treatment systems should consider incorporating anti-floatation measures. Upgraded systems should include an emergency shut-off feature with instructions on how and when to use it.

Lead:	Department of Planning and Development
Other responsible parties:	RIDEM, RI Cooperative Extension
Financing options:	CDBG, RI Cooperative Extension
Cost:	Staff time
Timeframe:	Ongoing
Priority:	High

Vulnerable Area #2: Wickford Village

Action #10: Business Continuation

The Chamber of Commerce will develop strategies to help local businesses in flood prone and coastal areas recover from the effects of a natural disaster. The Chamber is in the process of updating its list of businesses and the people connected with those businesses that are authorized to enter the business in the period of time immediately after a disaster. This list will be for the use of the police department in their role of guarding properties after a disaster. In addition, the North Kingstown Police Department utilizes the CodeRED® Emergency Telephone Calling System to deliver critical emergency messages to both residents and businesses.

The Chamber will continue to communicate important updates from the Rhode Island Emergency Management Agency (RIEMA) to its members regarding severe weather alerts. The Chamber also maintains a membership database that includes what services, facilities, vehicular and other resources each member has that could be utilized in an emergency. The Chamber will assist with organizing business owners to collectively clean-up of their properties after a disaster. The police department will determine when safety considerations outweigh the right of a given business owner to access their property.

Lead:	North Kingstown Chamber of Commerce
Other responsible parties:	Police Department, QDC, Wickford Village Association, Building Official's Office
Financing options:	Town budget, NK Chamber of Commerce
Cost:	Staff time
Timeframe:	Medium Term
Priority:	Medium

Action #11: Protection of Repetitive Flood Loss Properties

The town continues to participate in the Community Rating System program and maintains its list of repetitive flood loss properties in town. The town will continue to seek funds to offer assistance to the owners of repetitive flood loss properties in town to be used to flood proof, elevate, or relocate these structures. Consideration should be given for sea level rise when deciding which properties should be maintained or upgraded.

Lead:	Department of Planning and Development
Other responsible parties:	Building Officials Office

Financing Options: FEMA Flood Mitigation Assistance grant program
Cost: Variable
Timeframe: Long Term
Priority: Medium

Vulnerable Area #3: Elderly Housing

Action #12: Protecting Coastal Facilities

The Scalabrini Villa Nursing Home is the only elderly long-term care nursing facility in North Kingstown vulnerable to the effects of a severe storm. The facility is located in a SLOSH evacuation area indicating that it is susceptible to damage from the storm surge and wind associated with a hurricane. In the event of an emergency, the town will work with the nursing home and Red Cross to identify the best location for the residents to evacuate to.

Lead: Building Official's Office
Other responsible parties: Police Department
Financing options: Town budget, Scalabrini Villa Nursing Home
Cost: Staff time
Timeframe: Short Term
Priority: High

Action #13: Ensuring the Safety of Elderly Housing and Nursing Homes

Natural Hazards occurring on a town-wide basis are a threat to all elderly housing and nursing home facilities in the town. The building official will provide assistance towards self-assessment of these structures as to their vulnerability to flood, high winds, earthquake, extreme winter weather, and power loss. Retrofitting will be conducted as necessary.

Lead: Building Official's Office
Other responsible parties: Senior Services
Financing options: Town budget
Cost: Staff time
Timeframe: Medium Term
Priority: Medium

Action #14: Elderly and Handicapped Residents

The Senior/Human Services Department will maintain their list of elderly and handicapped residents living independently in the town and share this list with Police and Fire Departments. The list will be divided by evacuation area and susceptibility to flooding or storm surge.

Lead:	Police and Fire Departments
Other responsible parties:	Senior Services Department, GIS
Financing Options:	Town budget
Cost:	Staff Time
Timeframe:	Ongoing
Priority:	High

Vulnerable Area #4: Wickford Village Housing

Action #15: Protecting Wickford Village Housing from Flooding and Storm Surge

The Wickford Village Housing complex is in the Five Hundred Year Flood Zone and the SLOSH (B) evacuation area. The town will provide resources on its webpage that will provide facility owners with guidance regarding conducting as assessment of structural vulnerability. Any information developed out of this assessment could act as a template for the rest of the town. Existing units have been renovated and new units will be built to meet the current floodplain standards. The town police station is connected into the recently upgraded OWTS as well. In addition, an evacuation plan coordinated with the town plans should be developed by the facility for senior and disabled residents.

Lead:	Department of Planning and Development
Other responsible parties:	Police Department, Building Official's Office, Senior Services
Financing options:	CDBG
Cost:	Staff time
Timeframe:	Short
Priority:	High

Vulnerable Area #5: Masonry Apartments and Mill Buildings

Action #16: Earthquake Mitigation

There are many apartment and mill buildings in the town built before the 1977 state building codes regarding earthquake resistance were adopted. The building official's

office will provide assistance to property owners that choose to conduct self-evaluations of their property's structural vulnerability to earthquakes. A collection of retrofit techniques will be compiled and made available to property owners.

Lead: Building Official's Office
Financing options: Town budget
Cost: Staff time
Timeframe: Ongoing
Priority: Low

Vulnerable Area #6: Mobile Home Parks

Action #17: Protecting Mobile Home Parks from High Winds

Mobile homes are traditionally identified as the type of housing most vulnerable to severe weather. None of the mobile home parks in North Kingstown are located in flood zones or coastal areas, but high winds from either a hurricane or tornado could cause serious damage. Park owners will be encouraged to provide information to their residents on what they can do to protect their property and where they need to go if a severe storm is approaching.

Lead: Building Official's Office
Financing options: Town budget
Cost: Staff time
Timeframe: Ongoing
Priority: High

Vulnerable Area #7: All Hazard Vulnerable Structures

Action #18: Inventory Assets and Estimate Potential Losses

In order to better inform the town's hazard mitigation efforts, an inventory of vulnerable assets will be conducted. The top priority for this analysis will be the natural hazard of greatest concern to the town, hurricanes, following which, other hazards will be analyzed. The inventory will make use of FEMA's HAZUS-MH software and will include structures, infrastructure, and critical facilities including any anticipated future developments. As a result of this analysis, dollar estimates will be generated of potential losses due to damage to structures, their contents, or loss of function. The information generated will be made available to the public and included in the next update of this Hazard Mitigation Plan.

Lead:	Planning Department
Other responsible parties:	Building Officials Office, Department of Public Works, Tax Assessor's Office
Financing options:	FEMA Pre-Disaster Mitigation or other grant program
Cost:	Staff time
Timeframe:	Medium
Priority:	Medium

Action #19: Maintain GIS Capabilities

After the last Hazard Mitigation Plan Update in 2005, the town's Department of Information Technology (IT) has developed a Geographical Information System (GIS) data warehouse by collaborating with municipal, state and federal agencies. The town's IT Department will continue to maintain this data warehouse containing: 911 Numbers, Assessor Data, Water Pipeline, Centerlines, Community Wellheads, DEM Wells, Easements, Edge of Pavement, Evacuation signs, Flood Zone, Groundwater Recharge Zones, Hydrology, Streets, Water Pressure Zones, Water Meter Pits, Wetlands, Hydrants, Parcels, Park n Rides, Zoning, Plats, Private Right of Ways, Water Service Areas, Pumping Stations, Quonset Water Supply, RIPTA Stops, RIPTA Routes, Voting Districts, Storage Tanks, Town Lines, and Water Accounts. Ortho photography and oblique imagery are also available in the following image sets 1999 B&W Ortho, 2003 RIDOT Color Ortho and 2008 Pictometry Ortho and Oblique data.

The IT Department will continue to empower municipal departments by creating a GIS user forum. This user forum consists of representatives from Planning, Assessors, Code Enforcement, Engineering, Water and Public Safety departments and plays a key role in the GIS policy and vision for the town. GPS units will continue to be used in the field to create comprehensive data sets like hydrants, evacuation sign, and water infrastructure layers for more accurate mapping and tracking of these resources. An Internet Mapping Server is available that offers all layers designated as "public" with the following features; abutters lists generator (from 200ft up to 1.5 miles), mailing label generator, interactive mapping, assessor data, 99 and 2003 Ortho photos, and measuring tools.

The town will continue to maintain ArcGIS Licensing Server that serves ArcInfo, ArcView, Spatial Analyst and ArcIMS licensing. ArcInfo, View and SA are made available to Planning, Engineering, IT and Code Enforcement. ArcIMS is available to all municipal departments.

Lead:	Town Information Technology Department

Other responsible parties: Planning Department, Building Officials Office, Department of Public Works,
Financing options: Town Budget
Cost: Staff time, Licensing Updates
Timeframe: Ongoing
Priority: Medium

Child Safety

Vulnerable #1: Town Schools

Action #20: Protecting Schools in the Flood Zone

There are three elementary schools located in a flood zone (A), Fishing Cove, Forest Park, and Hamilton. Two of these three schools are coastal and therefore susceptible to storm surge as well. Drainage and landscaping at all three schools has been maintained or improved in the last five years. The schools will be continually monitored to determine any additional steps that can be taken to make these schools more flood and storm resistant. Important school records should be stored in a manner to protect them from flood damage.

Lead: School Department
Other responsible parties: Building Official's Office Town Information Technology Department
Financing Options: Town budget, FEMA
Cost: Staff time, Variable depending on renovations needed
Timeframe: Ongoing
Priority: Medium

Action #21: Safety Procedures for School Children

Evacuation procedures for the town's schools will be continuously monitored and evaluated for their effectiveness. In the event of a natural hazard event that effects schools, children will be transported by bus to the nearest public shelter if necessary. A communication and notification plan is in place to inform the town, area schools, students, and associated school district resources of crisis response plans and hazard information. The communications are scalable and can be focused on; administrative contacts, a single bus, a school, or community wide in the case of regional events. All buses are equipped with a radio system to enable centralized dispatch and emergency

response if needed. The school department will coordinate with the Jamestown school department for emergency procedures for the high school students from that town. These planning steps are most important for the three schools in flood zones. The school department will acquire early warning weather radios from New England States Emergency Consortium (NESEC).

Lead:	Police Department
Other responsible parties:	School Department, RI Red Cross, Jamestown School Department
Financing options:	Town budget, NESEC
Cost:	Staff time
Timeframe:	Ongoing
Priority:	High

Action #22: Earthquake Preparation

The schools should consider conducting an inspection of facilities to determine their vulnerability to earthquakes. As necessary, the buildings will be retrofitted for earthquake resistance.

Lead:	School Department
Other responsible parties:	Building Official's Office
Financing options:	Town budget, FEMA, RIEMA
Cost:	Staff time, Variable, depending on needed renovations
Timeframe:	Medium Term
Priority:	Medium

Action #23: Post-Disaster Relocation

In the event of one of the schools in the flood zone being destroyed or severely damaged such that repair would cost at least 50 percent of the value of the property, consideration will be made of moving the school's location to an area outside the flood zone or potentially relocating students to underused schools such as Davisville Elementary. If the school is not moved, than it will be rebuilt according to FEMA standards for structures in flood zones.

Lead:	School Department
Other responsible parties:	Department of Planning and Development, Planning Commission, Town Council, Building Official's Office
Financing options:	FEMA, RIEMA
Cost:	Variable

Timeframe: Long Term
Priority: Low

Vulnerable Area #2: Day-Care Centers

Action #24: Protecting Day-Care Centers in the Flood Zone

There are two child-care centers in North Kingstown located in areas prone to flooding and storm surge, North Kingstown Daycare on Boston Neck Road and St. Paul's Nursery on Main Street. In addition, the Sunshine Early Child Care Center is located in a critical area within the Quonset Gateway area that may be significantly affected by traffic in the event of an evacuation. The town will utilize its updated webpage to provide hazard mitigation related information to the child-care providers across the community. As discussed under Action 5, a flyer highlighting the information that can be found on the town's webpage could be distributed to these locations as well. This information will include evacuation routes as well as additional guidance in developing an evacuation plan. Each facility will be responsible for developing an evacuation plan, with the assistance of the police department and coordinated with the town-wide plan for schoolchildren.

Lead: Multi Department
Other responsible parties: Police Department, Department of Planning and Development, Day-Care Centers, Building Official's Office
Financing options: Town Budget
Cost: Staff time
Timeframe: Short Term
Priority: High

Emergency Services and Recovery Plans

Vulnerable Area #1: Evacuation Routes

Action #25: Evacuation Route Markers

The town will cooperate with Rhode Island Department of Transportation in continuing to place signs at significant egress points to aid residents in the event of an evacuation. Though evacuation is generally not mandatory, early evacuation of certain neighborhoods with limited access, or in vulnerable coastal areas, will be considered. Placards will be placed on the emergency shelters identifying them as such. The town shall continue to host a map of evacuation routes that can be viewed by the public on the town website. The map shows shelter locations however the routes are not

intended to lead the public to shelters but rather shows the public the best way to reach the interstate system in the event of a storm.

Lead:	Police Department
Other responsible parties:	Fire Department, RIDOT, School Department, Town Highway Department, Department of Public Works
Financing options:	Town budget, RIEMA
Cost:	Staff Time
Timeframe:	Short Term
Priority:	High

Action #26: Maintain Viable Evacuation Routes

As a part of the town's tree maintenance plan, priority will be placed on trimming and maintaining the health of trees identified as running along evacuation routes and roads offering a single point of access to coastal and flood prone neighborhoods. The Public Works office has been working with the Town Tree Warden and National Grid on aggressive tree trimming programs for the past few years. The goal of the utility companies has been to minimize utility service and road blockages by downed wires and trees during storm events. The Public Works office also inspects town trees and expeditiously removes those that could potentially fall during storms and block roads. Consider effectiveness of a public outreach effort to Town residents regarding tree trimming and removal of rotten trees to protect properties and access routes.

Lead:	Department of Public Works
Other responsible parties:	Police Department, Town Tree Warden
Financing options:	Town budget
Cost:	Staff Time
Timeframe:	Short Term and Ongoing
Priority:	High

Action #27: Publish Evacuation Routes

The Planning Department will contact The North Kingstown View in regards to putting the North Kingstown Evacuation Routes Maps, including emergency shelter locations, in an upcoming edition. The North Kingstown View is a monthly publication that is distributed to all residents in the Town of North Kingstown. As indicated under Action #5, information could also be placed in The Puddle. This information could include reference to the town's webpage and a link to a map of the evacuation routes and shelters.

Lead: Department of Planning and Development
Other responsible parties: Police Department, Verizon Phone Company
Financing Options: Town Budget
Cost: Staff Time
Timeframe: Short Term
Priority: High

Action #28: Coordinate Evacuation Plans with Neighboring Towns

The police department will work with neighboring towns to coordinate evacuation routes. Jamestown, Narragansett, and possibly some Warwick residents would potentially evacuate during a severe storm event through or into North Kingstown. To ensure the safe and timely evacuation of all coastal residents these towns should ensure that their individual evacuation routes are compatible.

Lead: Police Department
Other responsible parties: Fire Department
Financing options: Town budget
Cost: Staff time
Timeframe: Short Term
Priority: High

Vulnerable Area #2: Emergency Shelters

Action #29: Additional Emergency Shelters

The town will continue to maintain the current shelters based on the standard requirements for emergency shelters as determined by the Red Cross. As the town population increases in the future, the town will ensure that adequate emergency shelter capacity exists. The town will evaluate its needs for additional emergency shelters that are specifically designated in the event of a hurricane. An evaluation of existing and potential shelter sites with regard to hurricane protection will be conducted with the Town Emergency Management Director, the Town Engineer, a representative from Red Cross, and other town officials as necessary.

Lead: Town Emergency Management Director
Other responsible parties: RI Chapter of the American Red Cross, Town Engineer, Police Department, Fire Department, School Department
Financing options: Town budget, Red Cross
Cost: Staff time
Timeframe: Short Term

Priority: High

Vulnerable Area #3: Town Emergency Operations Center

Action #30: Ensure Operation Ability of the Town Emergency Operations Center

The town recently completed a facilities project that rehabilitated Police and Fire Headquarters. This project also constructed a new Emergency Operations Center. All improvements were constructed out of the FEMA base flood area. The town also just completed the construction of a new telecommunications tower at this site, which improves town radio communications. The town will look at the feasibility of a disaster emergency help line based at the new Emergency Operations Center that town residents can call for information and help in preparing their homes for an approaching storm. The town shall also utilize its webpage and its Code Red system which operates as a "reverse 911" as necessary.

Lead: Police Department
Other responsible parties: Fire Department, Department of Public Works
Financing options: Town budget
Cost: Staff time
Timeframe: Ongoing
Priority: High

Vulnerable Area #4: Rhode Island Air and Army National Guard

Action #31: Ensure Operation Ability of the National Guard Base

The Air and Army National Guard Units stationed at Quonset Point would be an important asset to the town and state in the event of a natural hazard event. The base is located in a flood zone (A) and in a SLOSH (B) area. To ensure that National Guard units will be able to respond during a natural hazard, steps will be taken to protect the base structures and equipment. Structures will be inspected for their flood and earthquake vulnerability and structural renovations will be made as necessary. Procedures for shifting the operational base during a severe storm if necessary will be developed.

Lead: RI Air and Army National Guard Units
Other responsible parties:
Financing options: RIAC Budget
Cost: Staff time
Timeframe: Medium term

Priority: Medium

Vulnerable Area #5: Town-wide Post-Disaster Plans

Action #32: Debris Management Plan

The town will develop a plan for collecting and disposing of debris after a storm event. Locations where debris can be collected will be determined, with different locations for potentially hazardous debris, such as propane tanks, made separate. A list of hazardous material handlers regulated by the EPA can be found at http://www.epa.gov/enviro/html/em/index.html. As hazardous waste handlers and treatment facilities will be in high demand during a natural hazard event, the town should actively seek an agreement with one or more such vendors in order to ensure a timely response at a reasonable price. Even with this precaution, the site for hazardous material containment should be able to hold that material for an extended duration. The town has an active transfer station and several other sites in town that could be used to manage debris removal. The town also works with several waste hauling contractors, who could be brought in to assist with after a storm event.

Lead: Department of Public Works
Other responsible parties: RIDEM
Financing options: Town Budget
Cost: Staff Time
Timeframe: Medium Term
Priority: Medium

Action #33: Recovery and Reconstruction Ordinance

The town will consider adopting a recovery and reconstruction ordinance that will expedite the rebuilding of the town and the recovery of town services after a storm or other natural hazard event.

Lead: Department of Planning and Development
Other responsible parties: Building Official's Office
Financing options: Town Budget
Cost: Staff Time
Timeframe: Medium Term
Model: Model Recovery and Reconstruction ordinance in PAS report, Planning for Post-Disaster Recovery and Reconstruction, page 149
Priority: Medium

Utilities and Infrastructure

Vulnerable Area #1: Dams

Action #34: Dam Inspection and Classification

The town recently completed Emergency Action Plans (EAP) for all town owned and private dams located in North Kingstown. These dams include Bellville, Featherbed Land Dam, Chadsey Road Dam, Carr Pond Dam, Hamilton Reservoir Dam, Rodman Mill Dam, Secret Lake Dam, Shady Lea Mill Dam, Slocum Road Upper Dam, and Slocum Woods Dam. These dams are considered either high hazard, significant hazard or low hazard dams. The EAPs define responsibilities and provides procedures designed to identify unusual and unlikely conditions which may occur during a high intensity rain event. This plan is designed to notify the appropriate public officials and property owners of possible, impending, or actual failure of the dam in time to take remedial action.

The plans also outline a notification flow chart for various levels of emergencies. This EAP also establishes a monitoring system which can activate the plan, identifies the officials, organizations, agencies, and their respective responsibilities for implementing the plan and identifies those areas, structures, facilities and roads which might be affected by dam failure. Preventative actions are also identified in the event of a possible dam failure. The EAP Coordinator will review and, if needed, update the EAP at least once each year. EAP updates should take into account increases flow and water heights as a result of increase intensity of storms. Future EAP update may wish to reference materials from National Weather Service and USGS regarding additional information relating to street on dams.

The Belleville Dam was rebuilt several years ago. In addition, the town has hired a consultant that has been tasked with assessing the existing condition of the Featherbed Lane dam as well as the Forge Road Bridge dam.

Lead:	Public Works Department
Other responsible parties:	RIDEM
Financing options:	Town Budget, FEMA, RIEMA, RIDEM, FMA ICC
Cost:	Staff Time, Retrofits dependent on design and engineering
Timeframe:	Ongoing for publicly owned dams, Short term for privately owned dams
Priority:	High

Vulnerable Areas #2 and 3: Town Bridges

Action #35: Bridge Inspection

All town bridges will be inspected by RIDOT for structural integrity to determine their individual vulnerability to damage in the event of flood or earthquake. Bridges will be maintained and retrofitted as needed. A schedule of inspection will be developed by RIDOT to ensure that all bridges are maintained at a high level of safety.

Lead:	RIDOT
Other responsible parties:	Department of Public Works
Financing options:	Local and State funds, FEMA
Cost:	Staff Time, Retrofits dependent on design and engineering
Timeframe:	Ongoing
Priority:	Medium

Action #36: Emergency Procedure for Gas Lines Running on Bridges

Work with National Grid to create a plan for timely shut down of gas lines in the event of bridge collapse and line disruption. The bridges carrying gas lines are the Hussey Bridge, the Brown Street bridge, the Babbit Farm bridge over Cocumscussoc Brook and the Hamilton Mill bridge on Boston Neck Road.

Lead:	National Grid
Other responsible parties:	Department of Public Works, RIDOT, North Kingstown Hazard Mitigation Committee
Financing options:	New England Gas
Cost:	Staff Time
Timeframe:	Ongoing
Priority:	High

Action #37: Emergency Procedure for Water Lines Running on Bridges

The North Kingstown Water Department already has emergency plans in place to respond to broken water lines. These plans deal with shutting down the water and protecting the water from contamination. The Water Department will review these plans and determine if they adequately cover the possibility of a bridge being washed out by flooding and the possibility of water supply contamination that could result from floodwaters entering the system. Isolation block valves will be identified on either side of these bridges in order to separate a breached area from the rest of the water system. In addition, the water department will analyze the water service maps in order to

ensure that water can be adequately supplied to all customers even after a bridge has been washed out. The bridges that carry water lines are the Hussey bridge, the Brown Street bridge, the Babbit Farm bridge over Cocumscussoc Brook, the Hamilton Mill bridge on Boston Neck Road, the Stony Lane and Drybridge Road bridges over the railroad tracks, and the Forge Road bridge over the Potowomut River.

Lead: Water Department
Other responsible parties: RIDOT
Financing options: Town budget
Cost: Staff time
Timeframe: Ongoing
Priority: Medium

Vulnerable Area #4: Town Roads and Streets

Action #38: Keep Roads Passable During a Hazard Event and Extreme Tides

The Department of Public Works will continue to follow their program for keeping roads passable in the event of flooding or other hazards and ensure the timely repair of roads post-disaster. The town shall assess the road network of existing and new neighborhoods and commercial areas for flooding during extreme tides. Following this assessment, the town should develop flood mitigation options regarding tidal floods.

Lead: Highway Department
Financing options: Town Budget
Cost: Staff Time
Timeframe: Ongoing
Priority: Medium

Vulnerable Area #5: Wells

Action #39: Protect Town Wells from Flood Waters

Wells number 9 and 10 are located in Flood (A) areas. In the past, both of these wells have experienced flooding and well #10 experienced bacterial contamination that may have been the result of the blow off pipe being submerged by high river levels. Both these wells have been improved to raise equipment above flood level. The water department will continue to monitor these wells and will continue to abide by their standard procedure of turning these wells off when there is a threat of flooding in the area.
Lead: Water Department

Financing options:	FEMA, RIEMA
Cost:	Staff Time
Timeframe:	Ongoing
Priority:	High

Action #40: Protect the Town Water Supply from Contamination and Drought

The town continues to protect land in our groundwater protection area. Various techniques have been utilized to protect these lands. One technique is the direct purchase of land. Another technique is the purchase of development rights (PDR) program where the town purchases the right to develop the land and the property owner maintains ownership of the land. Another is the newly adopted transfer of development right (TDR) program where a land owner can sell off a set number development rights to another party while still maintaining ownership of the land. In this way, land in sensitive areas of town is protected from development while allowing less sensitive areas additional development where it is better suited. The town has also identified growth centers outside of the groundwater protection areas where development will be directed.

Lead:	Department of Planning and Development
Other responsible parties:	Water Department, Towns of East Greenwich, Exeter, and Warwick
Financing options:	FEMA grants, Land acquisition bonds (state and municipal), Land Bank, RI DEM, and other open space acquisition funding and strategies.
Cost:	Variable
Timeframe:	Ongoing
Priority:	High

<u>Vulnerable #6: Electric Utility Lines and Facilities</u>

Action #41: Tree Trimming

The town and the National Grid Company will continue to maintain street trees and other trees close to utility lines in a manner that will protect those lines in the event of a storm. This action will serve the additional benefit of reducing the amount of debris generated during the storm thereby reducing clean-up costs. The town Tree Inventory Management Plan calls for the removal of many different trees across town. Those trees from this list that pose a threat to utility service or other property in the event of a natural hazard will be prioritized for removal.

Lead:	Department of Public Works
Other responsible parties:	National Grid Co., Town Tree Warden
Financing options:	Town budget, RIEMA, Utility companies
Cost:	Staff time - variable based on cost of tree removal
Timeframe:	Ongoing
Priority:	Medium

Action #42: Underground Utility Lines

As the opportunity arises, the town will move utility lines underground, with first priority on lines in coastal areas. In addition, as new residential development takes place, utilities must be installed underground.

Lead:	Department of Planning and Development
Financing options:	Transportation Improvement Program Grants, FEMA, RIEMA, Special Tax Areas
Cost:	Variable, dependent on design and area.
Timeframe:	Long Term
Priority:	Low

Vulnerable Area #7: QDC Wastewater Treatment Facility

Action #43: Investigate Vulnerability and Retrofit as Necessary

The QDC wastewater treatment facility is in an area of a 'V' flood zone indicating that it is susceptible to breaking wave action during a serious storm. In addition it is in a SLOSH (A) area such that any hurricane will potentially impact the facility. The facility is elevated and designed for operation in the flood zone and has been designed to withstand up to 120 mph force winds. The QDC should evaluate issues of sea level rise as they relate to the facility's gravity systems and outfalls.

Lead:	QDC
Other responsible parties:	RIDEM
Financing options:	RIEMA, QDC, FMAP
Cost:	Staff time
Timeframe:	Medium term
Priority:	Medium

Vulnerable Area #8: Town Wastewater Pumping Facilities

Action #44: Shutting Off Service

The town will continue to assess the need to shut down the wastewater pumping facilities at Wickford Point and Mark Drive during a flood or sever storm event. In addition, the town has received approval for and is in the process of extending sewer service along the Post Road Corridor. As sewers are installed along the corridor, additional actions will be identified to ensure the functionality and service capabilities of the system. During a flood or severe storm event, the town engineer and/or water department should consider shutting down the wastewater pumping facilities.

Lead:	Engineering Department
Other responsible parties:	Water Department
Financing options:	Town budget and FEMA Flood Mitigation Assistance Program
Cost:	Staff time
Timeframe:	Ongoing
Priority:	High

Action #45: Flood-proofing

A new pump station will be installed at Wickford Point facility as part of sewering the Post Road Corridor. The new facility will meet flood-proofing requirements.

Lead:	Water Department
Financing options:	Town budget and FEMA Flood Mitigation Assistance Program
Cost:	Dependent of design and engineering
Timeframe:	Medium Term
Priority:	Medium

Action #46: Emergency Pumping

A wastewater facilities plan has been approved by the RI Department of Environmental Management. This plan addresses the need for pumping wastewater into a temporary or portable container in the event of a flooding.

Lead:	Department of Public Works
Other responsible parties:	Water Department

Financing Options: Town Budget
Cost: Staff Time
Timeframe: Long-term
Model: Narragansett
Priority:

Vulnerable Area #9: Phone Lines

Action #47: Protecting Land Line Phone Service

The town and the National Grid Company have and will continue to maintain street trees and other trees close to utility lines in a manner that will protect those lines in the event of a storm. This action will serve the additional benefit of reducing the amount of debris generated during the storm thereby reducing clean-up costs. The town Tree Inventory Management Plan calls for the removal of many different trees across town. Those trees from this list that pose a threat to utility service or other property in the event of a natural hazard will be prioritized for removal. If electric lines are put underground, than the phone lines should be considered for this treatment as well.

Lead: Department of Public Works
Other responsible parties: Phone Companies, Town Tree Warden, National Grid
Financing options: RIEMA, TIP, Phone Company
Cost: Staff Time
Timeframe: Ongoing
Priority: Medium

Vulnerable Area #10: Boston Neck Road Service Station

Action #48: Contain Hazardous Materials

The property owner will be contacted and asked to develop a plan to ensure the containment of hazardous materials in the event of a severe storm or hurricane. Special attention will be paid to underground storage tanks that could float or rupture in the event of flooding.

Lead: Building Official's Office
Financing options: Town Budget, the Service stations
Cost: Staff Time
Timeframe: Long Term
Priority: Low

Action #49: Investigate Vulnerability and Retrofit

The property owner will be given information on how to assess the structural integrity of the Boston Neck Road service station in terms of resistance to flood and winds.

Lead:	Building Official's Office
Financing options:	Town Budget
Cost:	Staff Time
Timeframe:	Long Term
Priority:	Low

Municipal Facilities

Vulnerable Area #1: Town Hall

Action #50: Investigate Vulnerability and Retrofit

The Town Hall is located in the 500-year flood zone and in a SLOSH (A) area. The building will be inspected to determine its need for flood proofing and earthquake retrofit. Renovations will be made as necessary. Hard copy records will be stored in such a way that they are protected from flooding in the building. The town is in the process of converting to electronic records in an effort to ensure protection of the records and reduce the amount of paper being stored. The town now has a centralized data center that our data, servers, telecommunications are kept, and is located in the Emergency Operations Center on Post Road. The data center is its own secured room that is protected by card readers, redundant power, fire suppression, water detection, and is climate controlled.

Lead:	Department of Public Works
Other responsible parties:	Town Information Systems Department, Building Official's Office
Financing options:	FEMA, RIEMA, Town Budget
Cost:	Staff Time, variable depending on renovations needed.
Timeframe:	Investigation – Short Term Remediation – Long Term
Priority:	High

Action #51: Post-Disaster Relocation

If the Town Hall is subject to serious damage or destruction, a new location will be found for locating Town Hall offices. The town has completed a study with a concept

plan and cost estimates to move the offices in the main Town Hall building to the former Wickford Elementary School. As discussed in Action #51, new equipment associated with the town's information technology department is now located at the Emergency Operations Center. The IT staff is now located in the Town Hall Annex.

Lead:	Town Manager
Other responsible parties:	Building Official's Office, Department of Planning and Development
Financing options:	FEMA Post-Disaster Recovery Assistance
Cost:	variable, in millions.
Timeframe:	Long Term – Post Disaster
Priority:	Low

Vulnerable Area #2: Town Hall Annex

Action #52: Investigate Vulnerability and Retrofit

The Town Hall Annex is located in an (AE) flood zone and in a hurricane surge area that has experienced repeated flooding during past storms. This building is also susceptible to impacts from seas level rise, extreme tides, and nor'easters. The annex building will be inspected and opportunities for flood, wind, and earthquake proofing identified. Retrofitting will be done as necessary with attention to maintaining the building's historical character. The town will also take steps to protect the records and documents currently stored in the basement of that building. Past flooding has damaged some of those records. The town is in the process of converting to electronic records in an effort to ensure protection of the records and reduce the amount of paper being stored. See Action #51 for details on the town's centralized data center.

Lead:	Building Official
Other responsible parties:	Town Information Systems Department, Department of Public Works
Financing options:	FEMA, RIEMA, Town Budget
Cost:	Staff Time, variable depending on renovations needed.
Timeframe:	Investigation – Short Term Remediation – Long Term
Priority:	High

Action #53: Post-Disaster Relocation

If the Town Hall Annex is seriously damaged or destroyed then a new location will be found for the departments located in this building. As discussed in Action #51, new

equipment associated with the town's information technology department is now located at the Emergency Operations Center.

Lead:	Town Manager
Other responsible parties:	Building Official, Department of Planning and Development
Financing options:	FEMA Post Disaster Recovery Assistance
Cost:	variable, in millions
Timeframe:	Long Term – Post Disaster
Priority:	Low

Vulnerable Area #3: Senior Center, Cold Spring Community Center, and the Art Association Building

Action #54: Investigate Vulnerability and Retrofit

The Beach Street facilities are in a Flood (A) zone and a hurricane surge area. The Cold Spring Community Center and the Art Association Building will be investigated for their structural vulnerabilities and retrofitted as needed. Attention will be given towards maintaining their historical character. The new Senior Center was built to meet current flood standards. In the event of destruction, the town will consider rebuilding these structures in another location. The former Senior Center building (Beechwood House) was moved to a private property in the area.

Lead:	Building Official's Office
Other responsible parties:	Senior Center Director, Recreation Director
Financing options:	FEMA, RIEMA, Town Budget
Cost:	Staff Time, variable depending on renovations needed.
Timeframe:	Investigation – Short Term Remediation – Long Term
Priority:	Medium

Vulnerable Area #4: North Kingstown Free Library

Action #55: Investigate Vulnerability and Retrofit

The library is located in the storm surge area. The town will ensure that the library building will be able to resist the high winds and flooding associated with a severe storm or hurricane. The trees surrounding the building, with special attention to those on the waterside, will continue to be well maintained with the removal of dead limbs to

prevent their being blown into the building during a storm. Any trees that are removed will be replaced such that a natural wind-block is maintained.

Lead:	Building Official's Office
Other responsible parties:	Library Director, Tree Warden
Financing options:	FEMA, RIEMA, Town Budget
Cost:	Staff time, variable depending on renovations needed.
Timeframe:	Investigation – Short Term Remediation – Long Term
Priority:	Medium

Action #56: Protect Library Resources

The library will continue to maintain its disaster plan with an inventory of those parts of the collection that are irreplaceable. Many of these items are located in an interior storage room that is climate controlled. There are some items in the collection that are closer to windows and on the lower level. The disaster plan outlines actions to be taken on these items.

Lead:	Library Director
Financing options:	Town Budget, private library related grants
Cost:	Staff Time
Timeframe:	Medium Term
Priority:	Medium

Vulnerable Area #5: Highway Department Facilities Building

Action #57: Contain Hazardous Materials

All hazardous materials, including fuel and other automotive fluids, will be stored in such a manner that they will not be spilled or leak in the event of flooding.

Lead:	Department of Public Works
Financing options:	Town Budget
Cost:	Staff Time
Timeframe:	Long Term
Priority:	Low

Cultural Resources

Vulnerable Area #1: Wickford Historic District

Action #58: Retrofitting Historic Homes

The town will continue to work with the North Kingstown Historic District Commission in reviewing changes to historic structures as it relates to mitigating flood, sea level rise, and wind damage. As ownership changes over time, properties will be upgraded to meet flood standards.
Historic homeowners should be directed to resources that will assist them in a self-inspection of their properties to determine how vulnerable their structures are to storm damage.

Lead:	Building Official's Office.
Other responsible parties:	Historic District Commission, Historic Wickford, Department of Planning and Development
Financing options:	Town budget, Private Grants for Historic Preservation
Cost:	Staff time
Timeframe:	Medium
Priority:	Medium

Vulnerable Area #2: Gilbert Stuart Birthplace and Smith's Castle

Action # 59: Retrofitting the Buildings

The Gilbert Stuart Birthplace and Smith's Castle will continue to monitor and mitigate potential flood damage while maintaining the historic integrity of the home. The Gilbert Stuart Birthplace and Smith's Castle will continue to maintain their natural hazard plan for removing or otherwise protecting valuable exhibit pieces when there is a threat of flooding.

Lead:	Gilbert Stuart Birthplace, Smith's Castle
Other responsible parties:	Building Official's Office, RIHPHC, Department of Planning and Development
Financing options:	RIEMA, FMA ICC, Gilbert Stuart Birthplace, Smith's Castle
Cost:	Staff time, variable depending on design and engineering.
Timeframe:	Short
Priority:	High

Quonset Point

Vulnerable Area #1: Existing and Proposed Development at Quonset Point

Action #60: New Development

Quonset Point is an area that has in the past been hard hit by hurricanes and severe storms in the past. All new development will be required to meet at least the current flood, wind, and earthquake resistance building codes..

Lead:	State Building Code Commissioner
Other responsible parties:	QDC, CRMC
Financing options:	QDC, developers
Cost:	Staff Time
Timeframe:	Ongoing
Priority:	High

Action #61: Current and New Development

A large percentage of the Quonset Point coastline predominantly in the area of the airport is in fact filled land put in by the Navy in 1940 when the base was built. Measures to protect structures and utilities on airport land from earthquake damage is a state issue and will be addressed by the State Building Code Commissioner and other state departments as necessary.

Lead:	State Building Code Commissioner
Other responsible parties:	CRMC, Rhode Island Airport Corporation
Financing options:	QDC, Private businesses, developers
Cost:	Staff Time, variable depending on renovations needed.
Timeframe:	Ongoing
Priority:	Medium

Action #62: Outreach

Current businesses in the flood and surge areas of Quonset Point will be informed of their location relative to natural hazards, primarily hurricanes, and given information on how they can protect their property and employees. As properties change ownership over time, structures are often upgraded to meet flood standards.

Lead:	FEMA, RIEMA, State Building Code Commissioner

Financing options:	QDC
Cost:	Staff time
Timeframe:	Ongoing
Priority:	High

Action #63: Hazardous Material Containment

Businesses operating with hazardous materials will be identified. These businesses will be requested to develop plans that ensure the containment of those materials in the event of a severe storm or hurricane. The Quonset Development Corporation (QDC) does not collect hazardous material information themselves. They submit a Tier 2 report to the state Fire Marshall. The QDC does have their own MSD sheets for their facilities.

Lead:	Fire Marshall (State and Local)
Other responsible parties:	QDC
Financing options:	QDC, Private businesses
Cost:	Staff Time
Timeframe:	Ongoing
Priority:	High

Action #64: Business Continuation

The Chamber of Commerce will develop strategies to help businesses located in Quonset in flood prone and coastal areas recover from the effects of a natural disaster. The Chamber will continue to maintain its list of businesses and the people connected with those businesses that are authorized to enter the business in the period of time immediately after a disaster. This list would be for the use of the police department in their role of guarding properties after a disaster. In addition, the North Kingstown Police Department utilizes the CodeRED® Emergency Telephone Calling System to deliver critical emergency messages to both residents and businesses.

The Chamber will continue to communicate important updates from the Rhode Island Emergency Management Agency (RIEMA) to its members regarding severe weather alerts. The Chamber also maintains a membership database that includes what services, facilities, vehicular and other resources each member has that could be utilized in an emergency. The Chamber will assist with organizing business owners to collectively clean-up their properties after a disaster. The police department will develop criteria for determining when safety considerations outweigh the right of a given business owner to access their property. QDC distributes a blast fax and email to businesses in the business park to warn them of an impending storm.

Lead:	North Kingstown Chamber of Commerce
Other responsible parties:	Police Department, QDC, Building Official's Office
Financing options:	NK Chamber of Commerce, QDC
Cost:	Staff time
Timeframe:	Medium Term
Priority:	Medium

Vulnerable Area #2: Quonset State Airport

Action #65: Investigate Vulnerability and Retrofit

The airport is located in a coastal flood zone and in a storm surge area. The Rhode Island Airport Corporation (RIAC) will work with the State Building Code Commissioner and other state departments to assess the airport's structural vulnerability to flood, wind, and earthquake and retrofit as necessary. RIAC has requested a Letter of Map Revision (LOMR) from FEMA regarding flood zones on airport land. After the result of this request is determined, RIAC will assess the potential impact of any flooding on the facilities to determine how best to ensure that no hazardous materials are released in the event of flooding. RIAC will then work with the town to develop a plan for securing hazardous materials such that they are not vulnerable to flooding be created.

Lead:	State Building Code Commissioner, Rhode Island Airport Corporation
Financing options:	RIAC
Cost:	Staff Time
Timeframe:	Medium term
Priority:	Medium

Recreational Resources

Vulnerable #1: Town Harbors, Docks, and Moorings

Action #66: Storm Preparedness Plan

The Harbor Management Commission has prepared and will continue to maintain a Storm Preparedness Plan as part of the Harbor Management Plan. The plan addresses mitigating the effects of severe storms on boats, marina infrastructure, and docks. The goals of the plan are to prevent the loss of life and property by properly preparing harbor and shoreline areas for storm events, completing an enforceable response and recovery plan, working with harbor and shoreline users to ensure that a coordinated

approach is applied to hazard mitigation, integrating harbor hazard mitigation activities with other ongoing local hazard mitigation programs, and identifying and completing long-term actions to redirect or avoid the hazard. While the Harbor Master is generally responsible for the protection of people not property, no boats have been lost because of equipment failure during a storm in the last ten years.

Lead:	Harbor Management Commission
Other responsible parties:	Harbor Division, Department of Planning and Development, Individual Marina Owners
Financing Options:	Town budget
Cost:	Staff time
Timeframe:	Ongoing
Priority:	Medium

Action #67: Wickford Harbor Breakwater

The Army Corps of Engineers inspected the Wickford Harbor breakwater in 2001. At that time, the inspection showed that the structures had not significantly deteriorated and still serve the authorized public purpose of protecting the outer harbor. The Army Corps did not feel that repairs were warranted in the near term. The Corps will continue to monitor the condition of the structures and schedule repairs as needed.

Lead:	Planning Department
Other responsible parties:	Harbor Division
Financing options:	Army Corp of Engineers, FEMA
Cost:	Subject to design and engineering.
Timeframe:	Ongoing
Priority:	Low

<u>Vulnerable Area #2: Town Beaches</u>

Action #68: Beach Maintenance

Beaches can play an important role in preventing erosion and protecting coastal properties. While the regulatory environment and cost factors can be challenging, the town supports the efforts to re-nourish local beaches. The town will work with the CRMC to research the possibility of and necessity of beach re-nourishment and even establishment of new beaches in various locations including Wickford Harbor, Quonset Point, and the Town Beach. If possible sand washed onto roads from beaches during a storm will be returned to those beaches; otherwise, a specific location will be determined where the sand can be temporarily stored until a permanent location can

be found. Dredged sand may also be used for beach re-nourishment, with CRMC approval.

Lead:	CRMC
Other responsible parties:	Department of Planning and Development, Department of Public Works, Department of Leisure Activities
Financing options:	RIDEM, CRMC
Cost:	Variable with amount of sand displaced
Timeframe:	Long Term
Priority:	Low

Vulnerable Area #3: Ryan Park, Chafee Nature Preserve (Rome Point), Wilson Park, Cocumscussoc State Park, Calf Pasture Point

Action #69: Fire Protection

During periods of dry weather and drought, the fire department will monitor large forested areas in an attempt to catch a fire before it is able to grow and cause significant damage. The water department already runs a similar patrol during drought conditions in the western part of the town over the aquifer. The fire department will also ensure that there is adequate access to forested parcels and a local source of water. Quantities of underbrush and dead limbs can allow a fire to quickly become very large and burn out of control. The fire department will assess the level of underbrush in these parks and determine if a controlled burn or other means of removal is necessary. The fire department will continue to suspend the issuance of some burning permits during the time period of March 15th to May 15th as this is the peak forest fire danger season.

Lead:	Fire Department
Other responsible parties:	Water Department
Financing options:	Town budget, RIDEM
Cost:	Staff time
Timeframe:	Medium term
Priority:	Medium

Vulnerable Area #4: Municipal Golf Course

Action #70: Investigate Vulnerability and Retrofit

The North Kingstown Municipal Golf Course is located in a flood zone and a storm surge area. Golf Course facilities will be inspected for their structural vulnerability to flood, wind, and earthquake and retrofits will be made as necessary. Plans for the secure

storage of hazardous materials will be made. Loss of revenue from lost playing time due to a natural disaster would cause problems and a loss of revenues for many of the town's recreation activities.

Lead:	Building Official's Office
Other responsible parties:	Leisure Activities Director
Financing options:	Town Budget
Cost:	Staff Time
Timeframe:	Investigation – Short Term Remediation – Long Term
Priority:	Low

4.0 – Implementation

In any plan, the implementation section is one of the most important. Without a clear sense of who is responsible for a given action and in what timeframe it should be completed, many important goals can be lost. A plan must include a clear course for action.

Each action description in the previous section includes a brief statement of responsible parties, funding sources, and expected timeframe for completion. These descriptions form the basis for implementation. From this basis, actions will be incorporated into departmental work plans. Individuals, organizations, and other groups outside of town departments with responsibility for plan actions will work with the appropriate town department to form a schedule for implementation and coordination with town activities. The Capital Improvement Program will be used to schedule the funding of actions from the town budget.

Plan Adoption and Incorporation into Existing Plans

The plan was adopted by the Town Council at the public meeting on January 27, 2014. It is currently with FEMA and RIEMA awaiting approval and recommendations.

The adoption of the North Kingstown Hazard Mitigation Plan into the North Kingstown Comprehensive Plan will ultimately have an effect on all nine elements of the comprehensive plan. In the land use section, further development will be directed away from hazard areas, such as the flood zones, as well as away from groundwater recharge areas. The evacuation routes and bridge maintenance make up the additions to the circulation element. Economic development is affected in many ways, from placing development away from hazard areas to forming cooperative agreements with businesses to ensure that adequate supplies are available to the town in the event of an emergency. The hazard mitigation plan will have some of its greatest influence in the community services and facilities element as outreach programs are developed to inform and prepare residents for natural hazards; as important building and site plan review processes incorporate hazard mitigation into their reviews; and as town facilities are retrofitted to protect them and the important records they contain from damage or destruction during a natural hazard. Natural and cultural resources will also be protected as plans are developed for park clean-up after a storm and methods of protecting historic buildings are researched and distributed. The open space, conservation, and recreation element will benefit from both the preserved open space in hazard vulnerable areas and the storm hazard plans that will be developed for the town's harbors. The Post Road corridor element will be influenced in the storm water

management techniques and underground utility lines that will be encouraged for the purpose of hazard mitigation. Finally, the hazard mitigation plan will strongly affect the Quonset Point element in that, much of Quonset Point is located in flood zones and storm surge areas therefore requiring that new construction respect that fact and build to avoid and resist storm damage.

4.1 Monitoring, Evaluation, and Updates

The North Kingstown Hazard Mitigation Committee will meet bi-annually (July and December) to assess progress on action completion and the effectiveness of actions already completed. Changes in timeframe or other aspects of implementation will be made as necessary. Flood Maps will be reviewed at these meetings to ensure they are accurate and kept up to date. The Director of Planning will serve as the Hazard Mitigation Plan lead, coordinator and point person for the public.

The North Kingstown Hazard Mitigation Committee will continue to meet twice yearly to assess the effectiveness of the plan, and make revisions as necessary to improve its effectiveness. The yearly updated plan will be submitted to and reviewed by RIEMA following local approval. In addition, the committee will meet following a natural hazard event to discuss the effectiveness of plan elements and to review community input based on their experiences during and after the event.

Evaluation of the plan will consider whether there have been any changes to the nature, magnitude, or type of risks and whether the goals and objectives of the plan are still current and appropriate. New actions will be considered at this time. Outcomes of implementation, thus far, will also be considered, including participation and coordination of all involved agencies, resources available for plan implementation, and any problems that have arisen in implementation.

Future sea level rise will have a tremendous impact on the extent of damage caused by flooding and storms. At a minimum of 10-year intervals, the Hazard Mitigation Committee will assess the need for changes in the flood and storm surge maps and implement those changes as available technology permits. Actions and policies pertaining to properties in the current flood zones and storm surge areas will be extended to any properties falling within these new areas. In addition, hazard mitigation should be an integral part of any considerations for protecting coastal properties from sea level rise, whether by structural or non-structural methods.

Continued Public Involvement

The public will continue to be involved in the hazard mitigation planning process through regular meetings of the Local Hazard Mitigation Committee to be held twice a year. The Planning Board and Town Council will also involve the public in the plan maintenance process by holding annual advertized meetings to provide updates and findings on the progress and implementation of the plan. The public can also stay involved through the use of the town's web site www.northkingstown.org, where updates to the plan, upcoming meetings and other hazard mitigation topics, will be posted. This is updated regularly and was last updated on November 4, 2013. Communication with the public will be provided at all stages, to include the adoption, implementation, evaluation and monitoring of the plan and will play a key role for the Town of North Kingstown in the Hazard Mitigation process.

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Town of North Kingstown. February 2004. *Emergency Operations Plan.*

Town of North Kingstown. *Water Supply System Management Plan.*

US Geological Survey. July 2004. *www.usgs.gov*

USDA Forest Service. July 2004. *www.fs.fed.us*

APPENDIX A: TECHNICAL AND FINANCIAL ASSISTANCE FOR MITIGATION

STATE RESOURCES

Rhode Island Emergency Management Agency
645 New London Avenue
Cranston, RI 02920
Phone: (401) 946-9996

Coastal Resources Center
University of Rhode Island
Narragansett Bay Campus
Narragansett, RI 02882
Phone: (401) 874-6224

Coastal Resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879
Phone: (401) 277-2476

Department of Administration/Division of Planning
One Capitol Hill
Providence, RI 02908
Phone: (401) 277-6478

State of Rhode Island Building Committee Office
Building Commissioner's Office
One Capitol Hill
Providence, RI 02903
Phone: (401)277-3529

Rhode Island Builders Association
The Terry Lane Corporation
Terry Lane
Gloucester, RI 02814
Phone: (401) 568-8006

Department of Transportation-Design Section/Bridges
2 Capitol Hill, Room 231D
Providence, RI 02903
Phone: (401) 277-2053

Rhode Island Department of Business Regulations
233 Richmond Street
Providence, RI 02903
Phone: (401) 277-2246

State Fire Marshal's Office
272 West Exchange Street
Providence, RI 02903
Phone: (401) 277-2335

Rhode Island Banking Commission/Associate Director
233 Richmond Street
Providence, RI 02903
Phone: (401) 277-2405

Public Utilities Commission
100 Orange Street
Providence, RI 02903
Phone: (401) 277-3500 Ext. 153

Department of Environmental Management
Division of Parks and Recreation
2321 Hartford Avenue
Johnston, RI 02919
Phone: (401) 277-2635

FEDERAL RESOURCES

Federal Emergency Management Agency
Mitigation Division, Region I Office
J.W. McCormack POCH, Room 462
Boston, MA 02109
(617) 223-9561

U.S. Army Corps of Engineers
New England District
424 Trapelo Road
Waltham, MA 02254
(617) 647-8505

Department of Agriculture
Natural Resources Conservation Service
(formerly Soil Conservation Service)
451 West Street
Amherst, MA 01002
(413) 253-4362

Department of Commerce National Weather Service
Forecast Office
445 Myles Standish Boulevard
Taunton, MA 02780
(508) 823-2262

Economic Development Administration
143 North Main Street, Suite 209
Concord, NH 03301
(603) 225-1624

Department of the Interior
1849 C St., NW
Washington, DC 20240
(202) 208-3100

National Park Service
Rivers and Trails Conservation Program
Regional Office
15 State Street
Boston, MA 02109
(617) 223-5203

U.S. Fish and Wildlife Service
New England Field Office
22 Bridge Street, Unit #1
Concord, NH 03301-4986

Department of Housing and Urban Development
Community Development Block Grants
Region I - O'Neill Federal Building
10 Causeway Street
Boston, MA 02222
(617) 565-5354

Small Business Administration
360 Rainbow Boulevard South, 3rd Floor
Niagara Falls, NY 14303
(716) 282-4612 or (800) 659-2955

Environmental Protection Agency
Region I - JFK Federal Building
Government Center
Boston, MA 02203
(617) 565 3400

OTHER RESOURCES

The Association of State Floodplain Managers (ASFM)
Professional association with a membership of almost 1,000 state employees that assist communities with the NFIP. ASFPM has developed a series of technical and topical research papers and a series of proceedings from their annual conferences. Many mitigation "success stories" have been documented through these resources and provide a good starting point for planning.

Floodplain Management Resources Center
Free library and referral service of the ASFPM for floodplain management publications. Co-located with the Natural Hazards Center at the University of Colorado in Boulder, staff can use keywords to identify useful publications from the more than 900 flood-related documents in the library.

Institute for Business and Home Safety (IBHS)
(formally Insurance Institute for Property Loss Reduction)
An insurance industry-sponsored, nonprofit organization dedicated to reducing losses—deaths, injuries, and property damage—resulting from natural hazards. IBHS efforts are directed at five specific hazards: flood, windstorm, hail, earthquake, and wildfire. Through its public education efforts and information center, IBHS communicates the results of its research and statistical gathering, as well as mitigation information, to a broad audience.

Volunteer Organizations
Organizations, such as the American Red Cross, the Salvation Army, Habitat for Humanity, Interfaith, and the Mennonite Disaster Service, are often available to help after disasters. Service organizations, such as the Lions, Elks, and VFW are also available. These organizations have helped others with food, shelter, clothing, money, etc. Habitat for Humanity and the Mennonite Disaster Service provide skilled labor to help rebuild damaged buildings incorporating mitigation or flood-proofing concepts. The offices of individual organizations can be contacted directly, or the FEMA Regional Office may be able to assist.

Flood Relief Funds
After a disaster, local businesses, residents, and out-of-town groups often donate money to local relief funds. They may be managed by the local government, one or more local churches, or an ad hoc committee. No government disaster declaration is needed. Local officials should recommend that the funds be held until an applicant exhausts all sources of public disaster assistance. Doing so allows the funds to be used for mitigation and other projects that cannot be funded elsewhere.

New England States Emergency Consortium (NESEC)
Lakeside Office Park
NESEC conducts public awareness and education programs on natural disaster and emergency management activities throughout New England. Brochures and videotapes are available on such topics as earthquake preparedness, mitigation, and hurricane

safety tips. NESEC maintains a web page that is accessible at http://www.serve.com/NESEC.

The New England Floodplain and Stormwater Managers Association (NEFSMA)
Professional organization for New England floodplain and stormwater managers. Provides workshops, conferences, and a newsletter to membership and interested individuals and companies. Contact: Nicholas Winter, chairman, at (617) 727-0488 or NEFSMA's homepage on the Web at http://www.seacoast.com/~nefsma.

APPENDIX B: EXISTING PROTECTION SYSTEMS - FEDERAL AND STATE

National Flood Insurance Program:

All of Rhode Island's 39 municipalities participate in the NFIP. This program is a direct agreement between the federal government and the local community that flood insurance will be made available to residents in exchange for community compliance with minimum floodplain management regulations. Communities participating in the NFIP must:

1. Adopt the Flood Insurance Rate Maps as an overlay regulatory district.
2. Require that all new construction or substantial improvement to existing structures in the flood hazard area be elevated or (if nonresidential) flood-proofed to the identified flood level on the maps.
3. Require design techniques to minimize flood damage for structures being built in high hazard areas, such as floodways or velocity zones

In return for community adoption of these standards, any structure in that community is eligible for protection by flood insurance, which covers property owners from losses due to inundation from surface water of any source. Coverage for land subsidence, sewer backup and water seepage is also available subject to the conditions outlined in the NFIP standard policy (see Appendix A, Federal Resources, for contacts regarding insurance coverage and purchase). Since homeowners' insurance does not cover flooding, a community's participation in the NFIP is vital to protecting property in the floodplain as well as being essential to ensure that federally backed mortgages and loans can be used to finance flood prone property.

Increased cost of compliance (ICC) coverage has recently been implemented for all new NFIP policies and renewals and is intended to be "mitigation insurance" to allow homeowners whose structures have been repeatedly or substantially damaged to cover the cost of elevation and design requirements for rebuilding with their flood insurance claim up to a maximum of $15,000.

Community Rating System:

A voluntary initiative of the NFIP, the CRS was developed to encourage communities to perform activities that exceed the minimum NFIP floodplain management standards. If a community participating in the CRS performs activities that include maintaining records for floodplain development, publicizing the flood hazard, improving flood data, and floodplain management planning, then the flood insurance premiums paid by policy holders in the community will be reduced by 5 to 45 percent. Developing a flood mitigation plan will help communities gain additional credit under the CRS.

Coastal Barrier Resource Act:

Administered by the U.S. Fish and Wildlife Service, this program has mapped public and private land identified as undeveloped coastal barrier areas. These areas may be denoted as "Otherwise Protected Areas" if they are owned by public entities. In the coastal barrier areas shown on FEMA's Flood Insurance Rate Maps, structures newly built or substantially improved after the date shown on the maps are ineligible for federal flood insurance. This serves to restrict new development in these areas because the purchase of flood insurance is required to obtain federal-backed mortgages and improvement loans for structures located in special flood hazard areas.

State Barrier Beaches:

Your community may have barrier beaches, as defined by the state's R.I. Coastal Resources Management Program. The regulations applying to these areas are enforced by CRMC. These regulations restrict alteration of the beach and/or dunes and the construction of coastal engineering structures. New or substantially reconstructed buildings generally must be elevated to a minimum of one foot above base flood elevation. No new commercial development is allowed on barrier beaches. If a structure is damaged more than 50 percent, it cannot be rebuilt.

Warning Systems and Emergency Operations Plans:

Your community may have a flood warning system in place and should have a plan for response to flooding. In addition, RIEMA has offices throughout the state that maintain area-wide plans for flood events.

Evacuation Plans and Systems:

Your community's emergency operations center should have evacuation plans in place. For communities near a nuclear power plant, evacuation plans are required, and may also be used for flood evacuation. RIEMA may have additional evacuation plan information.

Land Use Restrictions:

There are several federal and state regulations that serve to restrict land use in certain areas that may help reduce flood hazard vulnerability. If your community has open land owned by the state or federal government, examine what restrictions are placed on its development. In addition, the state Wetlands Protection Act regulates the development of all lands identified as significant to the protection of resources identified in the Act.

Septic Systems:

If there are areas in the community not served by a public sewer system, state septic system regulations influence development and may be a consideration for mitigation alternatives that include rebuilding and elevation of structures. Specific design requirements must be met for any construction in coastal velocity zones or river floodways. Generally, an inspection of a septic system is required if there is a change in use of the structure, an increase in flow, or failed system. Limited inspections are required if the footprint of the structure is being changed. Upgrades are required by the state if an inspection reveals a failed system. However, local regulations may be more restrictive than state requirements, requiring inspections or upgrades in other cases.

Economic/Community Development:

There may be programs existing to help flood proof homes using Community Development Block Grant funds. There may be housing assistance programs in the community that can be used following a major flood, achieving both the objectives of reducing flood damage and improving the community's housing stock (see Appendix A, federal resources, for more information).

Hazard Mitigation Grant Program:

Also known as the 404 Program or HMGP, this program is available only after a federally declared disaster occurs. It represents an additional 15 percent of all the infrastructure and individual assistance funds that are provided to states to repair damages and recover from losses, and is administered by the state in partnership with FEMA. Having a plan or completed mitigation action matrix prior to a disaster event is extremely helpful in meeting the state's deadlines for applications and ensuring the project is eligible and technically feasible. It provides 75/25 matching grants on a competitive basis to state, local, and tribal governments, as well as certain nonprofit organizations that can be matched by either cash or in-kind services. The grants are specifically directed toward reducing future hazard losses, and can be used for projects protecting property and resources against the damaging effects of floods, earthquakes, wind, and other hazards. Specific activities encouraged under the HMGP include acquiring damaged structures to turn the land over to the community for open space or recreational use, relocating damaged or damage-prone structures out of the hazard area, and retrofitting properties to resist the damaging effects of disasters. Retrofitting can include wet or dry flood-proofing, elevation of the structure above flood level, elevation of utilities, or proper anchoring of the structure.

Flood Mitigation Assistance:

The Flood Mitigation Assistance (FMA) program makes grants available on a pre-disaster basis for flood mitigation planning and activities, including acquisition, relocation, and retrofitting of structures. FMA grants for mitigation projects will be available only to those communities with approved hazard mitigation plans. A certain amount of funding is allotted to each state per year based on a risk formula for floods. Each state has the discretion to award funds to communities or to state government agencies. States may use whatever criteria or method they choose to award the funds as long as the applicant and the proposal are eligible. The program may fund up to 75 percent of the total cost of the proposed project, with a minimum of 25 percent of the cost coming from the community. A minimum of half the community share must be cash or "hard match." Funds can also be granted to communities to help them prepare local flood mitigation plans. The same match requirements apply. Once a community receives a planning grant, however, it is not eligible to receive additional planning grants for another five years. For further information on the FMA program or ICC coverage contact RIEMA at (401) 946-9996.

Pre-Disaster Mitigation:

FEMA's Pre-Disaster Mitigation (PDM) grant program is a nationally competitive program. Projects can be funded up to a maximum $3 million federal share. Up to 75% of the total project cost can be federally funded. The state or local community provides a 25% cost share, which can be "in-kind". Small, impoverished communities may be funded up to 90%. In order to be eligible to receive a PDM 2004 grant, the state or local community must have an approved hazard mitigation plan in place by Nov. 1 2004.

Earthquakes and Hurricanes:

A certain amount of funding is allotted to each state per year based on a risk formula for earthquakes. Coastal states are allocated funds based on a risk formula for hurricanes. Each state receiving such funds has the ability to grant project funds to a community. There is not a match requirement on the part of the community, but the funds are limited, and are generally only available once a year. The projects or products proposed for such funding must demonstrate that earthquake or hurricane risk will be reduced or eliminated, and the proposed project or product is a cost-effective measure (a stringent cost/benefit analysis need not be performed). Information about the amount of funding available per year and the state requirements for eligibility and performance may be obtained from RIEMA at (401) 946-9996.

APPENDIX C: Newspaper Clippings Related to Past Natural Disasters

Rhode Island Mother Says, 'Oh, We're Living'

How Hurricane 'Carol' Hit One Family

By JOHN WARD
(Providence Journal-Bulletin)

WICKFORD, R. I. (AP)—Mr. and Mrs. Malcolm Jenne and their four children go to bed at 9 p. m. by the light of a single kerosene lamp that their family physician gave them.

That's all the light they have.

They didn't have any light Tuesday night and had to go to bed at dusk. The hurricane had carried away power lines in this little village on Narragansett Bay, 18 miles south of Providence.

That storm had left them with their home but with a cellar full of water, a yard covered with puddles of salt water, no lights, no heat, no facilities for storing food and none for cooking it.

The Jennes, whose children range from three years to 22, are typical of hundreds of families braving it out in many of the flood areas of Rhode Island, leading a bare existence in their water-soaked homes, struggling along with makeshift meals, sleeping in makeshift beds, wearing what clothes the storm has left them.

Mr. and Mrs. Jenne were working at the Quonset Point Naval Air Station and their son Robert at a bank in Providence when the storm hit.

A nursemaid, Mrs. Ethel Rose of Allenton, got the three children, two boys and a girl, three to six years old, rushed them from the house and drove them in her auto through rising waters to refuge at her own home.

The Jenne family was reunited late Tuesday afternoon to find the flood waters had virtually destroyed all of their first-floor furnishings, including everything in two bedrooms.

Last night, Mrs. Jenne, who perhaps typifies all the housewives and mothers in the area, said, "Oh, we're living."

"We have just one kerosene lamp, Dr. Patrick O'Brien loaned it to us. The first night we went to bed at eight, but now we go at nine.

"We have been cleaning up and cleaning up. We get food as we need it for each meal from a store four miles away.

"We finally got our gas man to hook up our bottled gas stove yesterday afternoon. Before that we had to eat cold food like frankfurters although Wednesday we had steaks cooked on our outdoor grill.

"We invited our neighbors, Mr. and Mrs. Gardner Willis and their children over that night. They're worse off than we are. They live on the first floor and had 36 inches of water. We only had 24 inches.

"We just threw out all the children's shoes—10 pairs—and bed slippers. When we get paid tomorrow, we've got to buy new shoes for everybody. We've got most of our spare clothes hanging on the line to dry.

"My husband has carried four trailer loads of stuff, including our studio couch and rugs, to the town dump and there's a lot more down the cellar to go."

The back and side yard at the Jenne place were typical—shortly before dark last night—of yards throughout the flood area, as families ate meager meals at makeshift picnic tables, mostly salvaged furniture, and cooked food nearby over charcoal fires.

A reporter inquired whether the Jennes had asked for assistance from the Red Cross. Mrs. Jenne answered, "We leave the Red Cross to the poor people. They need it a lot more than we do."

56 FOWLER STREET
WICKFORD

Hurricane *Carol* Lashes Rhode Island

August 31, 1954

Published by

PROVIDENCE JOURNAL COMPANY

Price: $1 a Copy

IN 1954 Rhode Island realized it must learn how to live with hurricanes. The hard fact was driven home, leaving no chance to rationalize. Another huge cyclonic storm, spawned in the subtropics, had come and gone. Banshee winds and massive tides had done their savage work once more.

Sixteen years before, on September 21, 1938, the greatest hurricane in Rhode Island history raged across the state leaving 317 dead and $100,000,000 in property damage in its wake. It was a freak, said many as they picked through the debris, and will never happen again.

But in 1944, in the predawn darkness of September 14, there was grim warning that this was not the case. Another hurricane zeroed in upon the state, smashed down thousands of trees, ripped at roofs and roared impotently along the shores, its power impaired by an unfavorable tide.

Then on August 31, 1954, the lesson was learned. Pouring out of the night, the winds of Hurricane *Carol* brought Rhode Island summer to a premature end. The storm arrived at express train speed and departed as fast, leaving the shores of the state a shambles, 19 dead, scores injured, and the business district of the state's largest city spitting out dirty flood water from its basements and street level shops for the second time in 16 years.

Carol, a pretty name for a monster, was the third hurricane of the year to form in the warm latitudes of the Atlantic. Some said the U.S. Weather Bureau chose women's names for the storms because they were unpredictable. *Carol* was unpredictable, lazing along the southern coast for days before taking deadly aim, but there its feminine characteristics stopped.

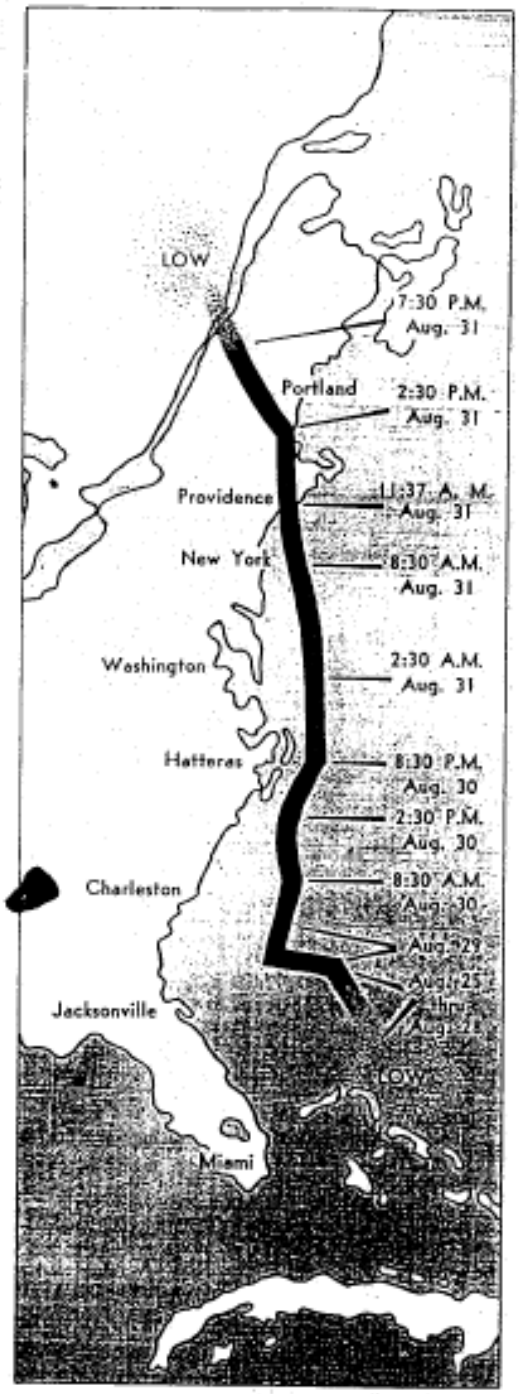
The forces of nature built a roadway for *Carol,* a low pressure area suitably moistened by rains, and the hurricane bored in. It caught Rhode Island and eastern Massachusetts in the outside arc of its counter-clockwise winds, with its center moving along the Rhode Island-Connecticut boundary line. The state lay in the zone where the speed of the vicious storm, estimated at more than 50 miles an hour, is added to the speed of the winds whirling within it.

The result: devastation. Property damage totaled at least $200,000,000 in Rhode Island alone, possibly half a billion dollars in the entire Northeast. Nearly 3,800 Rhode Island homes simply disappeared or lay in shattered heaps along the beaches. More than 2,000 boats, skiffs, fishing craft and proud yachts were destroyed or seriously damaged.

But these are cold statistics.

The real story was in the hearts and eyes of the people who suffered, the waterfront home owners who clambered to rooftops in terror as great gray waves chewed out the insides of their neat dwellings, the boatowners who watched helplessly as their gallant craft fought at their moorings for hours and then disintegrated, the store owners in Providence who saw the flood tides thrust down the aisles, swell over countertops and destroy millions of dollars worth of choice merchandise.

After the storm the state gasped for breath for days, and those who lived and worked inland realized that they too had been hit. Almost all electric power, the life blood of a modern community, had ceased to flow over the wires. An estimated 200,000 workers were idle as repair crews sought to restore power to the business offices and manufacturing plants. Home-



CAROL'S course, from its origin near the Bahama Islands to its breakup in Canada, shows rate the hurricane picked up speed in the hours before it hit Rhode Island.

owners ate suppers cooked over charcoal or Sterno, by candlelight, and kept perishables and milk in tubs or picnic cold boxes filled with ice.

Some residents in the rural areas had no water. Their electric pumps were useless. And others found service through certain water systems reduced or interrupted for various reasons attributed to the storm.

The great storm had its heroes, hundreds of them, who waded, swam and floundered through swirling water to bring their marooned fellows to safety. And along the shore areas it brought forth the best in human nature as neighbors pooled their meagre resources to help one another.

It spawned a small but ugly crop of human vultures too, the looters who moved into stricken homes and shops even before the waters completely receded to fatten on the possessions of the victims.

Police acted fast in the days that followed to offer what protection they could. Aided by the full force of the National Guard, military reserve units and civil defense workers, they cordoned off the battered sections of the state to all except emergency workers.

Gradually order replaced chaos as bulldozers thrust back the deep sand dunes where once there had been roads and great cranes lifted the hulks of sunken boats. Carpenters beat a staccato symphony on thousands of damaged roofs while fleets of trucks, pressed into service from many sources, roamed the streets of city and hamlet alike gathering the mountainous piles of limbs and trunks which once spread a green canopy over the state. Gradually power returned. Lights winked on and the big factories summoned their workers back.

And in the talk of the veterans of the storm comparisons were made. Which was the greater, Hurricane *Carol* or the nameless fury of September 21, 1938? The facts were indisputable. The hurricane of 1938 was still without peer. Its flood tides mounted 13 feet nine inches above normal high water level in Providence. Hurricane *Carol* had pushed the tide up precisely 13 feet above normal.

The 1938 storm moved more slowly and poured its peak destruction on the state for about two hours, with sustained winds of 121 miles an hour and gusts of far greater force. Hurricane *Carol* lashed the state with its peak winds for about half as long, reaching full force at 11:37 a.m. when a gust estimated at 105 to 115 miles an hour thrust the anemometer needle off the dial at the U.S. Weather Bureau at Hillsgrove. Moments earlier the top sustained velocity of 90 miles an hour was recorded.

The 1938 storm was a massive doughnut with its center over the Connecticut River Valley. Its deadly eastern semicircle spread a wide band of destruction through the heart of New England. Hurricane *Carol* achieved its greatest fury in a band stretching from New London, Conn., to the Cape Cod Canal.

Loss of life was not comparable. Yet in this fact there was a puzzle. The shore areas where damage was greatest in both storms appeared to have suffered almost equal devastation. The surge of tide thrust up by Hurricane *Carol* was almost as high. And on August 31, 1954, the summer season at Rhode Island's beach resorts was at the zenith. Yet the death toll was low.

The reasons were several. Hurricane *Carol* struck in the morning. Visibility, vital when you are

struggling for the safety of a stairway, rooftop or improvised raft, was relatively high. The hurricane of 1938 reached its peak about 5:15 p.m., nearly a month later in the year. Almost complete darkness came with the storm. This time thousands fled from unprotected sections before the storm reached its full fury. Before, many refused to believe what they saw, clung to their exposed dwellings to the last and actually rushed to the shore to watch the water rise.

The lesson had been partially learned, but not completely.

On the afternoon of August 31 and the days that followed complaints arose that the U.S. Weather Bureau had provided insufficient warning of the storm's approach. Its bulletins had spoken of northeasterly gales and abnormal tides until too late to take full precautions for the southeast hurricane winds and flood tides which actually arrived.

Power failed over much of the state at 9:10 a.m. on August 31, and when the full import of the storm was realized radio warnings were almost useless.

Two days after the storm the season's fourth hurricane rushed harmlessly past, well out to sea, touching off brief panic in certain exposed coastal communities. Then on Friday, September 10, eleven days after Hurricane *Carol*, the state settled down to the business of living with the storms.

Hurricane *Edna*, a huge storm with 135 mile an hour winds near its center, rolled toward the battered shore. This time the state was ready.

Through the daylight hours of Friday newspapers, radio and television warned of the storm's progress. All radio and television stations went on night-long watch. Storm shutters and sandbags appeared. Waterfront districts were evacuated as sweating clerks in downtown stores cleaned out cellars only recently cleared of flood water, removed all merchandise to upper floors. Firemen, police, civil defense units, the Red Cross and other welfare agencies mobilized all personnel. Never in the history of Rhode Island had such complete preparations against disaster been made.

At the last moment the storm veered northeastward, arriving on an ebb tide. Rhode Island caught the backlash of its winds, suffering relatively minor damage.

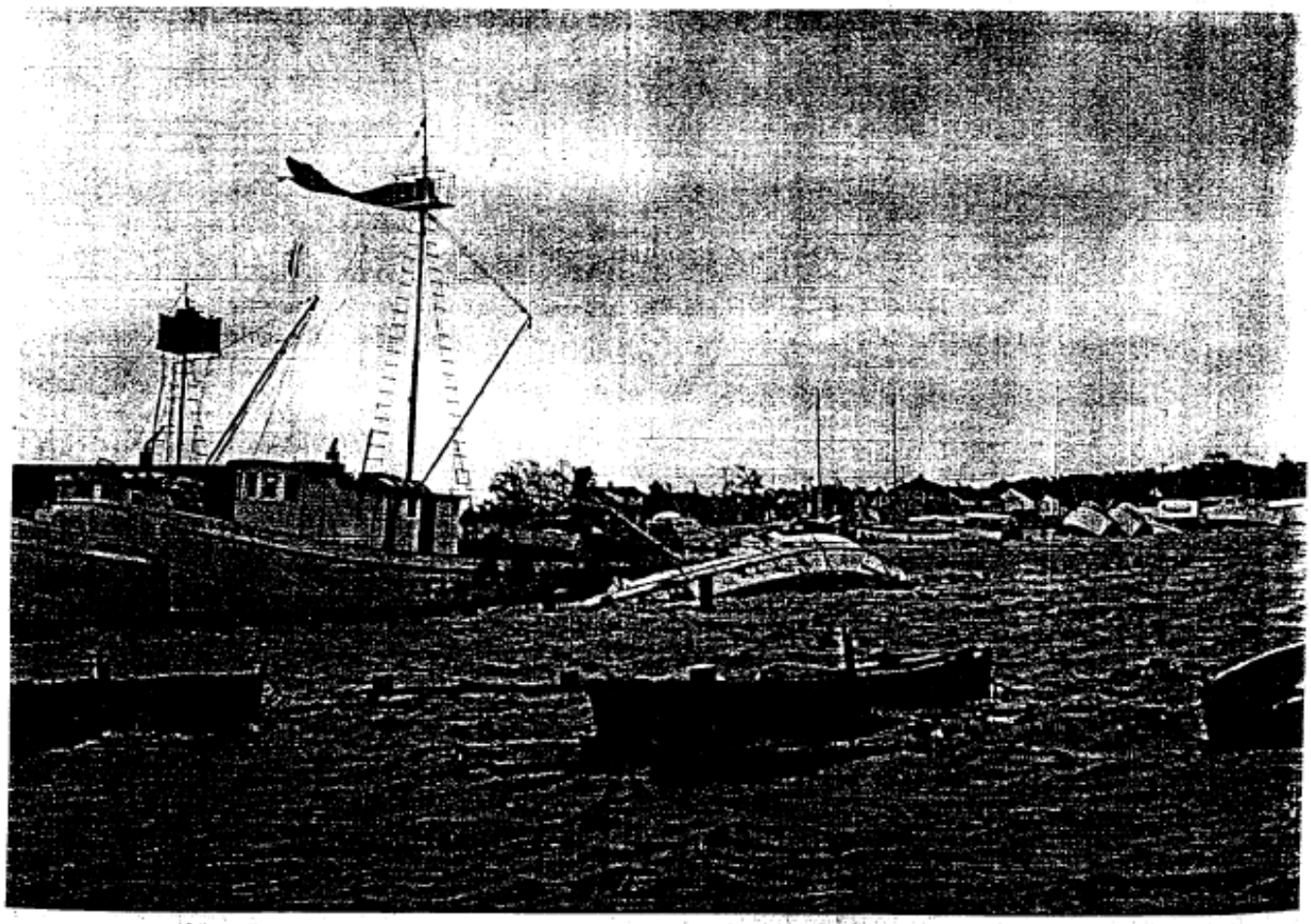
A glancing blow. The state now knew that two facts are vital once hurricane warnings have gone out: the condition of the tide when the storm arrives and the location of its center.

In 1815, 1938 and on August 31, 1954, the storm center had passed to the westward and the hurricane had arrived at high tide with destructive force. In 1869, 1944 and September 11, 1954, the tide was on the ebb.

The ledger was neatly balanced, three and three.

1954

EAST GREENWICH Cove water engulfed East Greenwich Yacht Club. The scene off Water Street looked like this at the storm's height.



POGIE BOATS tied up at Wickford took a fierce battering. Here's Wickford harbor when wind abated at noon.

The Providence Journal
HURRICANE EXTRA
PROVIDENCE, RHODE ISLAND, WEDNESDAY, SEPTEMBER 1, 1954
PRICE FIVE CENTS

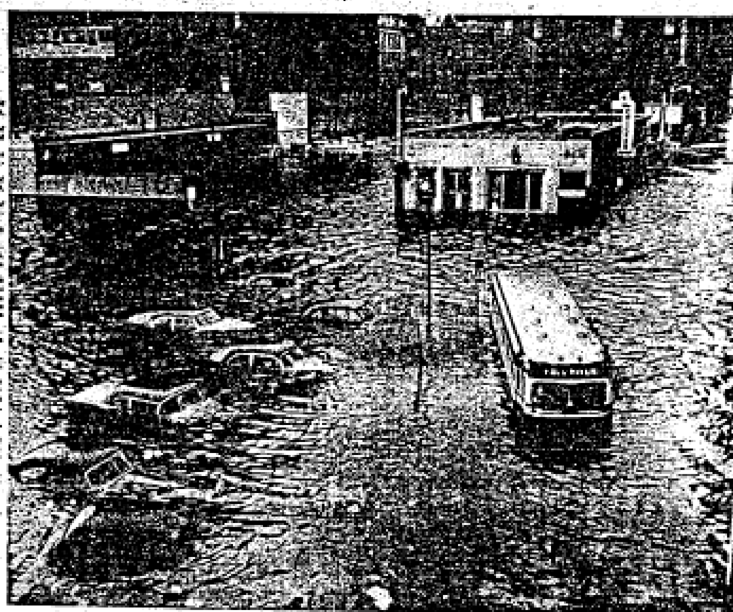
Hurricane Leaves 16 Dead, Scores Hurt, $100,000,000 Damage Along R.I. Coast

Rhode Island Casualties

DEAD

STILL MISSING

INJURED



WINDSHIELD DEEP, WATER INUNDATES INTERSECTION, BUS TERMINAL AT FOUNTAIN AND EDDY STREETS.

Devastating Blow, High Tides Mash Houses, Piers, Boats

By STUART O. HALE

Rhode Island lies wounded this morning in the wake of a devastating hurricane which ripped its coastal communities into shreds, mashed houses, docks and boats to splinters and left a mounting toll of dead and injured.

Early today at least 16 persons were known dead and scores were injured.

Initial estimates placed property damage at more than the $100,000,000 hurricane of Sept. 21, 1938, until yesterday the greatest storm to strike the state in modern times.

Most of the state was without power throughout the night and spokesmen for the Narragansett Electric Company, the principal power source, expected little improvement today.

Hundreds of families, driven from their houses and summer dwellings along both sides of Narragansett Bay and on the ocean shoreline, spent the night in fire stations, makeshift shelters and the homes of inland friends. In many cases their belongings consisted of the clothes on their backs.

Shortly before midnight Chief Murphy ordered the downtown sections of Providence closed to the general public until further notice. His order was designed to prevent looting during the many hours of tedious salvage operations awaiting store operators.

Hurricane Carol, third to whirl out of the South Atlantic this season, bored a course of devastation across Rhode Island virtually without warning.

Rhode Islanders awoke yesterday morning to find the storm almost at their throats.

Although weather advisories urged marine interests to remain alert, no solid warning as to the seriousness of the storm came from official weather bureau sources until 10:30 a.m. (DST). By that time 100-mile-an-hour gusts and mounting tides prevented all but cursory preparations.

Power failures as early as 9:30 a.m. prevented thousands from getting an official report at all until it was too late.

The Hillsgrove Weather Bureau reported last night that winds roared steadily at 80 to 90 miles an hour during the storm with gusts up to 105 miles an hour.

As the storm center passed, tides thrust close to 1938 marks, carving great gashes out of the shoreline from Westerly to Providence, pushing up breakers 30 to 40 feet high, and sending flood waters raging through city streets.

By noontime, downtown Providence, inundated almost 16 years ago, was under four or more feet of water. Store fronts were smashed in and automobiles entirely submerged. Thousands of office workers were marooned in upper floors of downtown buildings.

The greatest heartbreak came for residents of summer colonies who returned to find foundations, a broken water pipe spouting like a broken fountain, an overturned icebox, a half buried child's toy—or nothing. In some sections only low sand dunes remained to mark a once populous summer colony.

Hundreds of boats, ranging from small skiffs to luxurious power cruisers and sailboats were smashed to kindling wood. In most cases the owners had no time to remove them to safe anchorages.

40 Boats Sunk Or Damaged At Pt. Judith Pond

The fleet gathered at Galilee for the Atlantic Tuna Derby sustained major damage, with 40 expensive boats sunk or damaged at their moorings in Point Judith Pond.

No single area in the state could be selected on the basis of immediate surveys as the hardest hit. Among those which appeared to take the worst beating were the Misquamicut-Weekapaug section of Westerly, the Narragansett-South Kingstown shore, Oakland Beach and Conimicut Point in Warwick.

In those sections scores of summer homes simply vanished. Scores of those remaining were shells, completely gutted of furnishings.

Seawalls weighing thousands of tons were smashed to pebbles and thousands of trees, both inland and along the waterfront, were smashed to the ground, creating serious traffic bottlenecks throughout the state.

National Guard To Stop Looting

Early last night Governor Roberts ordered out all units of the Rhode Island National Guard to supplement local police patrols hastily thrown up to prevent looting. A state of emer-

Continued on Page 2, Col. 1

Warning Late On Hurricane

Hub Bureau Advisory Given Only Half Hour Before Arrival

Continued on Page 6, Col. 5

Westerly is Badly Battered; Nine Are Reported Missing

By NORMAN J. WARNER

Continued on Page 2, Col. 1

Horrors of Watching Parents Perish In Wild Sea Described

By PAUL F. BOYD

Flooded-Out Journal Is Published At The Woonsocket Call

Electric Power Out In State

Prospect Of Restored Service Today Dim; Work Crews Imported

Continued on Page 2, Col. 3

Minority Report Hits McCarthy

Continued on Page 6, Col. 4

Continued on Page 5, Col. 3

On the morning of August 31, 1954, about 10:30, a tropical hurricane struck Providence, roaring a symphony of death and destruction. The waters of the Providence River rose to a height of approximately 18 feet above the average low tide level in three hours' time. The entire central business section, an area nearly a mile in diameter, was flooded, as well as three miles of the industrial area along the waterfront.

By rare good fortune, a photographic account was made of the harrowing scenes and appalling damage in downtown Providence. These pictures are reproduced here without any retouching to provide a graphic historical record for posterity, and to portray the paralyzing blow that Providence has suffered and survived.

At this time the business establishments affected are working at their Herculean tasks of reconstruction needed for normal operation.

This booklet was placed in production Thursday, September 2, 1954 at 4:30 P. M. Halftones were made, assembled, and plates completed for the presses to start printing at 2:00 A. M. Friday morning. Twenty thousand copies were placed on sale at 2:30 Friday afternoon.

This was all accomplished at Livermore and Knight Company and Bank Lithograph Company in the heart of the disaster area, although no commercial power was available and no other companies were manufacturing.

Both plants will be back to normal operation on Tuesday morning, September 7, 1954.

Providence, September 3, 1954

Plated, lithographed, and bound in their own plant
in the heart of the flood area.

Photographs by Adler's, Inc. and the
Reproduction Service

Great hurricane left residents without potable water

If there's one thing that most folks take for granted these days, it's that when you turn on the faucet in your kitchen or bathroom, good clear drinkable water is going to come out. But it wasn't always that way. Back exactly 64 years ago this week, the good people of the villages of Wickford and Hamilton were learning this lesson the hard way.

You see, 64 years ago, those folks had just gotten over the horror of the worst hurricane to ever hit these parts. The waters of the Narragansett Bay had subsided and left an awful mess. Trees were uprooted, homes were destroyed or moved off their foundations, boats were parked where no one ever imagined they could be, people were missing, families were separated, cars were swept away never to be seen again, and everything was covered in the most foul slimy mud that you could possibly imagine.

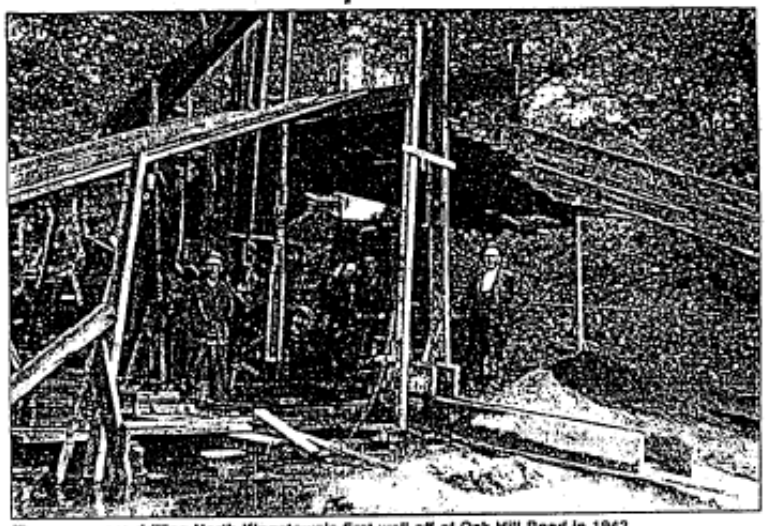
The View from Swamptown

G.T. Cranston

But that wasn't the worst of it, as these harried and overwhelmed folks were just realizing. Everywhere from Pleasant Street to Poplar Point to Salisbury Avenue people were realizing that the truly unthinkable had happened. Everyone's well had turned brackish. Nowhere across that wide swath of homes was there anyone with drinkable water. The delicate balance between the fresh groundwater of the land and the salty sea of the Narragansett Bay had been forever changed by the giant hurricane. It was a public health crisis of major proportions.

The elected and appointed officials of the town met in crisis mode. For the time being it was decided that the overworked men of the town's Fire Department would bear another burden. Each day they would make the rounds and fill up the pails and buckets that were left out on the front steps and porches of all the residents of the affected areas without water. That was for the short term; the long-term solution required something that seemed an enormous task. Some way would be found to provide the town's people with good drinking water again.

With this daunting task in mind, a group of prominent citizens began to meet informally at the beginning of 1939. By spring of that year, they were officially sworn in as members of the state-sanctioned North Kingstown Water Commission. Chairman Hiram Kendall, secretary Irving Hazard and committee members Wilfred Kingsley, Walter Cook and Edgar Burchell wasted no time. They immediately weighed all options and decided that designing and constructing a distribution system that would run from the North Kingstown-East Greenwich border at the Hunt River all the way down the Post Road to a standpipe at Juniper Hill and then into the affected areas would be the most expeditious. They negotiated a contract to purchase water from the neighboring town of East Greenwich at the rate of 7.5 cents per thousand gallons.



These men are drilling North Kingstown's first well off of Oak Hill Road in 1942.

Although noted cartoonist and illustrator Paul Loring poked fun at the water system installation in September 1939, all of Wickford knew how serious a business the project was. Loring's artwork is used with permission of his family.

Engineering firms and construction contractors were interviewed, plans were drawn up, contracts were signed, and work began post haste. All this was done in the evenings, night after night, as these men were volunteers and had full-time jobs to go to as well. All the while the tireless volunteers of the Fire Department continued their daily ritual of water deliveries door to door, one home at a time. It was an exhibition of community spirit at its finest.

After a mere nine months, in January 1940, in which time miles upon miles of 12-inch water main was lain, a 625,000-gallon riveted standpipe was constructed and countless homes were tied into the system. The valves were opened at the border and clean water again began to flow into the homes of Wickford, Poplar Point and Hamilton.

Eventually, in 1942, the town would sink its own well and end its dependence on its neighbor to the north. But that was not an issue then, for after 16 long months of waiting patiently for the man from the Fire Department to deliver a few gallons of clean water, people's lives finally got back to normal. But you can bet that folks who lived through that water crisis never again took that clean, clear water pouring out of the tap for granted. Something to think about when you're about to grumble over odd/even lawn watering, eh?

Write to Tim Cranston in care of this paper, either by e-mail at editorial@neindependent.com or at P.O. Box 244, North Kingstown, RI 02852.

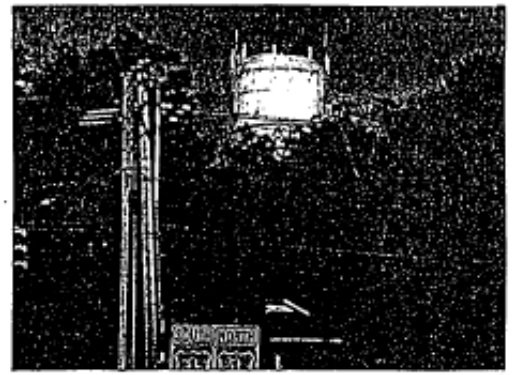


PHOTO: JAMES RUSH

The water tower at Juniper Hill, shown as it appears today, brought drinking water back to the residents of Wickford and Hamilton about 16 months after the Hurricane of 1938.

Providence Journal 9/19/02

Emergency plan would aid town during disasters

A plan drafted by a town committee will help the town deal with natural disasters, put it in line for emergency aid and save residents money on flood insurance.

BY ERIN EMLOCK
JOURNAL STAFF WRITER

NORTH KINGSTOWN — As the town faces record-low water levels and a ban on outdoor watering, the threat of a hurricane is probably the farthest thing from most residents' minds.

NORTH KINGSTOWN

But the town's Local Hazard Mitigation Committee has been working for the past eight months on a plan to better prepare the town for floods, wildfires and even earthquakes.

The committee recently completed a draft Hazard Mitigation Plan, which will

SEE **DISASTER, B 5**

Disaster

Continued from Page B-1

which will be discussed at the Town Council's work session tonight.

Once the plan is in place, the town will be eligible to get money from the Rhode Island Emergency Management Agency and the Federal Emergency Management Agency to implement strategies identified in the plan, according to committee member James Freas.

"The plan is meant to make the town less vulnerable to a natural disasters before they happen," Freas said.

And if a natural disaster does strike and a state of emergency is declared, towns that have Hazard Mitigation Plans have priority in getting state and federal funds to help deal with the disaster.

In North Kingstown, the biggest threat is coastal flooding associated with hurricanes and northeasters, according to Freas.

The plan also lists tornadoes, wildfires, ice and snow, earthquakes and droughts as potential hazards to the town.

North Kingstown borders East Greenwich, Exeter, Jamestown, Narragansett, South Kingstown and Warwick; the plan identifies ways the town can cooperate with those communities during an emergency.

Freas said one of the plan's goals is to ensure that buildings on the coast are able to withstand coastal flooding. He said that by creating this plan, the town will help residents in these areas potentially save money on their flood insurance.

'The plan is meant to make the town less vulnerable to natural disasters before they happen.'

James Freas,
Local Hazard Mitigation Committee

The committee developed the plan in part by examining a map provided to the town by the Rhode Island EMA which shows flood and storm surge areas.

The committee them determined which areas of town could be vulnerable during a natural disaster.

The committee's members include representatives of the Police, Fire, Public Works and Planning Departments and the Rhode Island National Guard. The Town Council, town manager, harbormaster and a representative of the Chamber of Commerce are also on the committee.

APPENDIX D: LIST OF MEETINGS FOR PHASE II: SEA LEVEL RISE.

NORTH KINGSTOWN PHASE 2 - PROJECT MEETINGS

11/14/2012	NK TRC
3/14/2013	Peter Galvin
3/25/2013	NK Town Council
4/16/2013	NK Planning Board
4/18/2013	NK Public Lecture
4/19/2013	NK Public Roundtable discussions
4/20/2013	NK Open House
5/1/2013	NK Planning Dept Meeting
5/9/2013	NK Public Works & Engineering
5/14/2013	Madis Suvari, Wickford Plan Committee
5/15/2013	Quonset Development Corp
5/15/2013	NK Public Works & Engineering
5/16/2013	Wickford Plan Committee
5/23/2013	NK Planning Dept Meeting
6/6/2013	NK Chamber, Martha Pughe
6/7/2013	RIDOT - Peter Healey & Courtney
6/19/2013	Cedarhurst annual meeting
6/20/2013	Wickford Plan Committee presentation
6/25/2013	NK Planning Dept Worksession (June 25-27)
7/8/2013	NK Historic District Commission - provided notes for meeting
7/9/2013	NK Planning Dept Meeting
7/10/2013	NK Chamber walk around Wickford

7/10/2013	NK Conservation Commission presentation
7/15/2013	NK Chamber & Wickford Merchants Assoc meeting
7/16/2013	NK Planning Dept Meeting
8/1/2013	NK Planning Dept Meeting
8/6/2013	NK Planning Dept Meeting
8/15/2013	NK Planning Dept Meeting
8/24/2013	State Agency Data/Mapping Coordination Meeting
9/15/2013	North Kingstown Harborfest - Booth
9/19/2013	North Kingstown Community Forum - Cold Spring Community Center

APPENDIX E: PHOTOGRPAHS OF FLOODING IN NORTH KINGSTOWN