# New Shoreham, Rhode Island
# Local Hazard Mitigation Plan
# 2016 DRAFT

## A Multi-Hazard Mitigation Strategy

*Created by: The New Shoreham Hazard Mitigation Committee*

*Adopted by: New Shoreham Town Council* ***August __, 2016***

## New Shoreham Town Council

*Kenneth C. Lacoste, First Warden*
*F. Norris Pike, Second Warden*
*Mark Emmanuelle*
*Christopher Warfel*
*Terry Mooney*

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**DRAFT**

**NEW SHOREHAM TOWN COUNCIL RESOLUTION**
**New Shoreham, Rhode Island Local Hazard Mitigation Plan, 2016**
**(APPROVAL DATE)**

**WHEREAS,** the Town of New Shoreham recognizes the threat that natural hazards pose to people and property within the community; and

**WHEREAS**, the Town of New Shoreham has prepared a multi-hazard mitigation plan, hereby known as the New Shoreham, Rhode Island Local Hazard Mitigation Plan, 2016 in accordance with the Disaster Mitigation Act of 2000; and

**WHEREAS,** the New Shoreham New Shoreham, Rhode Island Local Hazard Mitigation Plan, 2016 identifies mitigation goals and actions to reduce or eliminate risks to people and property in New Shoreham from the impacts of future hazards and disasters; and

**NOW, THEREFORE, BE IT RESOLVED THAT:**

The Hazard Mitigation Plan is hereby adopted as an official plan of the Town of New Shoreham.

The Town offices identified in the Plan are hereby directed to pursue implementation of the recommended priority actions that are assigned to them. Any action proposed in the Plan shall be subject to and contingent upon budget approval if funding is required and this resolution shall not be interpreted so as to mandate any such appropriations.

The Town Council of the Town of New Shoreham has met the legal requirements for official adoption of its Hazard Mitigation Plan.

**FURTHER BE IT RESOLVED** that we decree that this resolution be made a part of the permanent record of the Town. Witness our hands and seal this (DATE OF PASSAGE).

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First Warden Kenneth C. Lacoste Second Warden F. Norris Pike

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Town Council Mark A. Emmanuelle W. Terrence Mooney

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Town Council Christopher G. Warfel Attest: Town Clerk Fiona Fitzpatrick

# I. Introduction to Hazard Mitigation

Hazard Mitigation is the process of acting to reduce or eliminate risk to people and property from the effect of natural hazards. Mitigation actions help to protect personal and public safety and property, and can significantly reduce the impact of future disasters.

Pre-disaster planning can significantly reduce the costs resulting from a disaster, and can make post-disaster operations more efficient. This, in turn, minimizes disruption of essential services and business operations, destruction of property, and injury and loss of life.

The purpose of the Natural Hazard Mitigation Plan is to identify local policies and actions that can be implemented to reduce risk and loss from hazards. These mitigation policies and actions are identified based on an assessment of hazards, vulnerabilities, and risks, and the participation of stakeholders and the public in the planning process. Planning and implementing mitigation activities can help to prevent or minimize these undesirable outcomes and simultaneously enhance the community's sustainability and safety, and its social, economic and environmental well-being.

The importance of hazard mitigation planning and implementation can be demonstrated by the potential losses of inaction. The following list highlights the types of damages and expenses endured time and again by communities facing similar natural hazards as Block Island.

**INITIAL DAMAGES**

- CASUALTIES INCLUDING RESIDENTS, TOURISTS, RESCUE PERSONNEL, PETS, AND LIVESTOCK.
- INFRASTRUCTURE DAMAGE AND PROLONGED INTERRUPTION OF UTILITY SERVICES.
- TEMPORARY AND PERMANENT BUSINESS CLOSINGS.
- DAMAGE TO INVALUABLE HISTORIC STRUCTURES.
- LOSS OF VITAL GOVERNMENT RECORDS AND DOCUMENTS.
- LOSS OF PERSONAL PROPERTY INCLUDING ITEMS OF IRREPLACEABLE SENTIMENT.

**EXPENSES AND AFTER-EFFECTS**

- EMERGENCY RESPONSE COSTS.
- FACILITY AND INFRASTRUCTURE REPAIRS.
- DEBRIS AND CONTAMINATION CLEANUP.
- DEPRECIATED REAL ESTATE VALUES.
- LOST WAGES AND SALES TAX REVENUE.
- RELUCTANCE OF NEW BUSINESS STARTS.
- PERMANENT ENVIRONMENTAL DAMAGE.
- HOME REBUILDING COSTS AND HOMEOWNER RELOCATION COSTS.

Formal adoption and implementation of this document will allow New Shoreham to gain credit points under the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS), which provides discounts on National Flood Insurance Program (NFIP) premiums for property owners in communities that participate in this voluntary program. It is a goal of New Shoreham to join the CRS program. FEMA's CRS program would allow property owners on Block Island to receive a discount on flood insurance policies.

Adoption of this Multi-Hazard Mitigation Plan will also increase New Shoreham's eligibility for federal grants available through FEMA's Hazard Mitigation Assistance Programs, including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), and Pre-Disaster Mitigation (PDM). In addition, the Rhode Island Emergency Management Agency (RIEMA) gives funding priority to municipalities that have completed a risk assessment and established mitigation projects with detailed information on the cost, timeline, and municipal department responsible for completing the project. Regulations pertaining to FEMA's flood mitigation grants and local hazard mitigation plans are provided in the Code of Federal Regulations (CFR), Title 44, Part 201.

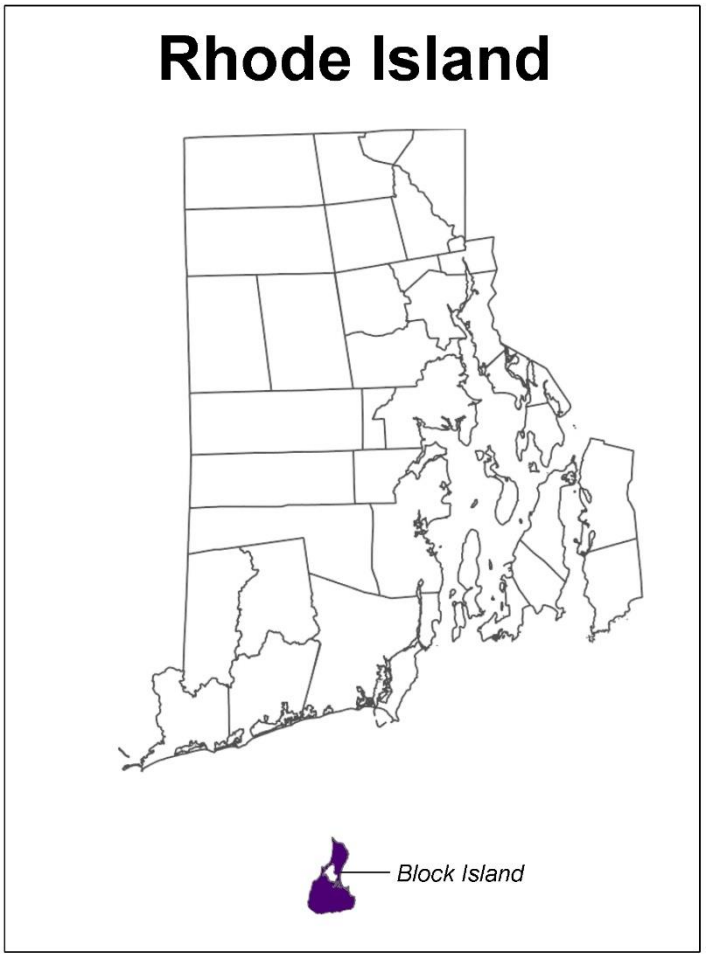
FEMA's Pre-Disaster Flood Mitigation Assistance Program makes grants available for communities to implement flood mitigation planning and activities such as acquisition, relocation, and retrofitting of structures. This program is only available for communities having a pre-existing approved hazard mitigation plan.

FEMA's Post-Disaster Hazard Mitigation Grant Program is only available for communities after a federally declared disaster. An approved mitigation plan expedites the application process for pre- and post-federal mitigation funding, as well as, assists in ensuring a funded project is eligible and technically feasible.

# 2. COMMUNITY PROFILE

## 2.1 Geography

The Town of New Shoreham, also known as Block Island, is located twelve miles off the coast of mainland Rhode Island, in Washington County. The island is approximately 8 miles from the northern sandy tip to the high southern bluff wall, and 3.5 miles at its widest point east to west. The island narrows to less than 1/10$^{th}$ of a mile at a north-south midpoint, referred to as the "neck" with the Atlantic Ocean to the east, and the Great Salt Pond to the west. Inland, 21 miles of paved roads and 39 miles of dirt roads provide vehicular access to over 1,600 residences.




Formed by glaciers over 10,000 years ago, the island's topography of rolling hills has elevations ranging from 0 at its shoreline to 190' at its highest point. The 49 mile coastline is comprised of both sandy beaches and rugged terrain, and punctuated by coastal bluffs which limit access by sea to several dock locations in two areas: Old Harbor on the eastern shore and New Harbor to the west. Just

inland, much of the land rises abruptly in high bluffs of glacial sand and clay composition. While visually majestic, these bluffs are extremely susceptible to erosion, in many locations at the rate of one foot or more per year. The bluffs also present obstacles to shoreline approach from both land and sea.

## 2.2 Demographics

Census 2010 documented 1,051 year-round residents on Block Island. RI Statewide Planning projects that the year-round population will grow steadily but only slightly, from a projected population of 1,116 in 2015 to just under 1,400 in 2040. The largest age groups according to Census 2010 are those 35-54 (330) and 55-74 (329).

Block Island experiences a dramatic seasonal population increase. The Block Island Chamber of Commerce estimates the population to be approximately 15,000 on any given day during the summer season, including day trippers, seasonal residents, those renting houses and hotel rooms, and those staying on private boats.

## 2.3 Land Use

Block Island has just over 6,000 acres within its land boundaries. Land use categories include three distinct areas: a compact, mixed-use "village" area, a buffer zone, called the "transition" area; and "countryside, primarily low-density residential. Most developed land is residential, and there are 1680 housing units. New Shoreham has 15 municipal buildings with a value of $38,328,413 as of March 2015, according to the Town's Insurance Company, Rhode Island Interlocal Trust.

The town center, located in the eastern Old Harbor area, is limited essentially to four streets, marked by seasonal shops and restaurants, two churches, one bank, one gas station, the post office, a daycare center, community center, library and town hall. The island's school and medical center are located just up the road, at the top of the hill. The town's beach pavilion is just to the north of the harbor. Very few businesses remain open on a year-round basis. The numerous shops and restaurants rely heavily on good summer weather, which ensures that thousands of tourists will visit the island each day.

## 2.4 Community Development & Development Trends

Although New Shoreham has permanently protected a large amount of open space, there is still vacant land available for residential development. The capacity for commercial development is very limited. Block Island's recent growth has been fueled almost entirely by the ability and desire of individuals to purchase vacation properties. Although moderate growth is expected to continue, the town continues to be committed to maintaining a balance and conserve resources to accommodate growth responsibly. Much of the remaining land for development is away from the coast and inland from flood zones.

## 2.5 Critical Facilities & Utilities

The Block Island Medical Center, the only medical center on the island, administers routine services and acute emergency care. Patients with serious injuries and conditions must be transported off-island to hospitals on the mainland via ferry, plane or helicopter. The center serves as the island's second shelter, with the Block Island School being the primary shelter. Damage to either the medical center or school would not only affect daily care and operations, but also leave the island without a shelter.

Other critical facilities include the island's Fire Station, which is the center for dispatch and emergency operations; the Town Hall, which provides essential services and administration, and whose vault houses vital records and documents.

Block Island's electricity comes from Block Island Power Company (BIPCO), a private power company. The company strives to operate in a climate where electric usage has to be geared to the summer months when the population expands to 15,000 people, whereas winter population and electric needs are substantially less. BIPCO runs its generators on diesel fuel and the fluctuating price of oil has a significant impact on the monthly charge for kilowatt hours.

The distribution system on island is in serious need of upgrade and financing. A project that will cost in the vicinity of 3 million dollars is problematic for this struggling company. Because all main power lines are above ground, they have been exposed to the elements and are that much more vulnerable because of age. Line loss is estimated at 14-16%. The town began requiring utilities in subdivisions to be buried many years ago, but all the main lines, many of them strung just a few feet from the ocean, remain exposed and vulnerable. The long range plan is to gain funding to bury the power lines that are most exposed in this way. The town supported a USDA grant application by BIPCO to assist in funding the needed distribution upgrade, but did not prevail. A second application is still pending.

Block Island is a sole source aquifer. Its groundwater supply is replenished only by rainfall, and its quality is essential to the town's quality of life and economic

wellbeing. The Block Island Water Company serves the island's commercial district, providing almost 50 percent of the annual supply from July through August. The municipal system relies on five active wells located in the Sands Pond wellhead protection area. Fresh Pond serves as an auxiliary reservoir. There are several other public groundwater supplies on the island, including the 1,200 acre Harbor wellhead area near the downtown commercial district. Contamination from toxins caused by flooding, or salt water intrusion as a result of low groundwater levels due to drought pose a serious risk to the safety of the island's water supply.

## 2.6 Transportation

Access to mainland Rhode Island is available via ferry on a year round basis. The main ferry terminal at Old Harbor supports passenger-only ferries and vehicle-carrying boats. Private cruise ships and boats also access the island via New Harbor, in the Great Salt Pond. Rough waters caused by storms and high winds can cause ferry service to be suspended.

Scheduled air service to Westerly, Rhode Island runs on a year round basis, and charter flights are available. Seasonal airline service is also available from T.F. Green in Warwick, RI to Block Island. Block Island Airport, located near the center of the island, is one of the busiest in the state, second only to T.F. Green. With no hanger, all aircraft are left on the grass or tarmac with tie-downs for longer durations. The short runway cannot support larger planes, although small jets have managed to land and take off safely. High winds and fog affect the ability of planes to arrive and depart.

Damage resulting from natural hazards to the harbors, docks, airport, ferries or planes would cripple the island in every way. Residents rely on transportation by water or air in order to access goods and services on the mainland. The island's tourist-based economy relies on the operation of transportation companies to bring tourists to Block Island. Natural hazards, and resulting damage to infrastructure, businesses, and rental properties have the potential to devastate the island's economy.

## 2.7 Historic and Natural Resources

Block Island has many historic and natural resources. Historic homesteads, farmland, two lighthouses, cemeteries, stone walls, scenic landscapes, 28 miles of greenway trails, and sites of archaeological significance are among the island's many resources. Over 43% of the island has been protected as open space, and the island has approximately 150 buildings of historic significance according to a report by Rhode Island Historical Preservation Commission. The Old Harbor Historic District boasts a concentration of historic structures including hotels in this dense walkable

19th century village. The island's two lighthouses are also major points of interest drawing thousands of visitors.

Natural resources include dramatic coastal bluffs, extensive beaches and sand dunes, the Great Salt Pond and smaller saltwater ponds and marshes, hundreds of freshwater ponds, wooded and wetland habitats and ecosystems, morainal grasslands, maritime scrubland, open fields and scenic vistas.

The island's habitats support over 40 species of rare and endangered wildlife, making it one of the most ecologically significant locations in Rhode Island and the northeast. Species include migratory shore and song birds, waterfowl, and raptors. Block Island is a critical stopover along the Atlantic Flyway.

The island's two largest freshwater ponds, Sands Pond and Fresh Pond, are part of the sole source aquifer upon which both public and private water supplies depend.

## 2.8 Commerce

Although there are a number of jobs providing necessary government and medical services, the modern economy is principally based on the island's status as a highly desirable vacation and tourist destination. Activity is concentrated during the summer months, from Memorial Day through Columbus Day.

Seasonal economic activity includes businesses in the hospitality industry – hotels, inns, guest houses, restaurants, seafood outlets, snack shops and bars. It also includes a range of retail: bicycle, moped and sports equipment rentals; real estate, property rental and maintenance services; landscaping and yard work; wedding and catering services; arts and crafts; taxi and guide services; fishing charters; and all of the construction trades, which represent a principal year-round activity that is supported by a strong second and vacation home market. There are also the businesses related to transportation to and from the island; the ferry and airline services, which have intensified schedules during the tourist season.

## 2.9 National Flood Insurance Program (NFIP)

Congress established the National Flood Insurance Program (NFIP) in the face of mounting flood losses and escalating costs of disaster relief to U.S. taxpayers. The goals of the program are to reduce future flood damage through floodplain management, and to provide people with flood insurance. Community participation in the NFIP is voluntary.

The Town of New Shoreham participates in the NFIP, and as such, New Shoreham residents are eligible to purchase federal flood insurance. On October 16, 2013, New Shoreham adopted updated flood insurance rate maps (FIRMs). In order to remain

in compliance with the NFIP, New Shoreham enforces floodplain management regulations to help mitigate the effects of flooding on new structures. New Shoreham utilizes digital FIRMs and other studies and regulates development in flood hazard zones.

## 2.10 Community Rating System (CRS)

The Community Rating System (CRS) is a voluntary part of the National Flood Insurance Program that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum floodplain management requirements. The incentives are in the form of insurance premium discounts. CRS ratings are on a 10-point scale (from 10 to 1, with 1 being the best rating), with residents of the community who live within FEMA's Special Flood Hazard Areas (SFHA) receiving a 5% reduction in flood insurance rates for every Class improvement in the community's CRS rating.

New Shoreham is working with RIEMA to gain entrance into the CRS. This will involve implementing public information, mapping, loss reduction and flood preparedness activities.

## 2.11 Recent & Significant Storm Events

Several significant events have impacted New Shoreham and the region in recent years. Most notably are major flooding (March 2010); Tropical Storm Irene (August 2011); Snowstorms (January 2011 & February 2013); Hurricane Sandy (October 2012); and Blizzard Juno (January 2015).

# 3. PLANNING PROCESS

## 3.1 Goals & Objectives

*The following goal and objectives have been identified for the New Shoreham Rhode Island Hazard Mitigation Plan, 2016.*

*Goal*

***To eliminate or reduce the risk to human life, property, and the local economy from the effects of natural hazards and climate change***

*Objectives*

- ✓ PROTECT THE LIVES AND PROPERTY OF NEW SHOREHAM RESIDENTS, VISITORS, AND BUSINESSES
- ✓ SAFEGUARD NEW SHOREHAM'S CRITICAL FACILITIES AND INFRASTRUCTURE
- ✓ PRESERVE NEW SHOREHAM'S CULTURAL AND HISTORIC SITES AND NATURAL ENVIRONMENT
- ✓ IMPLEMENT PRIORITY HAZARD MITIGATION STRATEGIES

## 3.2 Building Support: Community Involvement, Roles & Responsibilities

This natural hazard mitigation plan is an important step in addressing, in a comprehensive manner, the natural hazards faced by the island. The Town of New Shoreham is committed to fulfilling the goals and actions set forth in this Plan. These strategies and actions will be carefully coordinated among the various town departments, private voluntary organizations, and commercial and industrial interests which all must be continuously involved in hazard mitigation planning.

## 3.3 Planning Team, Technical Assistance & Local Leadership

The original New Shoreham Local Hazard Mitigation Plan was adopted in 2006. The Town of New Shoreham was awarded a 2010 Pre-Disaster Mitigation Grant from Rhode Island Emergency Management Agency (RIEMA) to fund preparation of a Hazard Mitigation Plan Update. This 2016 Plan updates the 2006 Plan. The 2016 Plan update process was conducted by the Town of New Shoreham, led by Shirlyne

Gobern, Administrative Assistant to the Town Manager, under the direction of Town Manager Nancy Dodge. Ms. Gobern was assisted by the Town's Hazard Mitigation Committee and Town Planner Jane Weidman. GIS Consultant Martha Roldan provided mapping and technical services. The 2006 Plan forms the foundation for this Plan update. The hazard assessment and vulnerability portions of this Plan were initially prepared in 2006 by New Shoreham's Hazard Mitigation Committee, assisted by the consulting firm of Resource Specialists, Inc. New Shoreham provided staff time for data acquisition and GIS mapping. In August 2010, Town officials met with representatives from FEMA to review FEMA's Local Mitigation Plan Review Crosswalk to be used to guide the update process. The Hazard Mitigation Committee undertook the process of reviewing each section of the Plan, including the planning and plan maintenance process, risk assessment, and vulnerability analysis, and updating mitigation strategy, including goals and actions relating to mitigation efforts.

### New Shoreham Hazard Mitigation Committee

NANCY DODGE, TOWN MANAGER
SHIRLYNE GOBERN, ADMINISTRATIVE ASSISTANT TO TOWN MANAGER
JANE WEIDMAN, TOWN PLANNER
VINCENT CARLONE, CHIEF OF POLICE
MARC TILLSON, BUILDING OFFICIAL
STEPHEN LAND, HARBORMASTER
JOHN BREUNIG, WATER SUPERINTENDENT
CHRISTOPHER BLANE, SEWER SUPERINTENDENT
BONNY RYAN, WASTEWATER COORDINATOR, RESCUE SQUAD, AFFORDABLE HOUSING
MARTHA ROLDAN, GIS ADMINISTRATOR
FIONA FITZPATRICK, TOWN CLERK
BRYAN WILSON, RESCUE CAPTAIN
WILLIAM MCCOMBE, EMA DIRECTOR AND SECURITY DIRECTOR, INTERSTATE NAVIGATION
LOIS BENDOKAS, OWNER, NEW ENGLAND AIRLINES
MICHAEL SHEA, HIGHWAY SUPERINTENDENT

For the 2016 update, the Committee analyzed each section of the plan and revised it to include any hazard events that affected the Town, new facilities that increase the Town's vulnerability, and any new information deemed important to be included. It was determined that the hazards identified in the prior plan continue to pose a threat to the community. In light of new available data, two additional hazards were identified by FEMA that could be added: Climate Change and Sea Level Rise. A Study of Sea Level Rise was completed in 2013 by New Shoreham with the assistance of a New England Municipal Coastal Resilience Initiative Grant. Several actions identified in the original Plan approved in 2006 have since been completed, and new actions were identified during the years since the original Plan was adopted. Additionally, the narrative in each section was re-written, and sections were re-organized in an effort to strengthen the relevance and quality of the

information presented. Following State review, the 2015 draft plan was edited by Town Planner, Alison Ring, to address State comments.

## 3.4 Stakeholders

The New Shoreham Hazard Mitigation Committee is comprised of a combination of town officials and members of the business community representing planning, permitting, public safety, emergency management, public infrastructure, recreation and transportation. In addition to this representative group, key stakeholders from the local business community and environmental and conservation groups were invited to participate in the planning process. The island's major airline and ferry service companies were included as members of the Committee and, as such, were involved in the planning process. Conservation groups, major landowners on the island, were also involved in the planning process and were solicited for input. To facilitate continuity, stakeholder input from other planning endeavors, such as the local Comprehensive Plan update, were reviewed and incorporated where appropriate. Once adopted, the final 2016 Hazard Mitigation Plan will be incorporated into the local Comprehensive Plan as an appendix.

As an island twelve miles off the coast of mainland Rhode Island, the Town of New Shoreham shares no jurisdictional borders or bridges with any other municipalities, therefore, the draft plan was not solicited for comments from other communities.

## 3.5 Public

The public was encouraged to participate throughout the planning process. All meetings of the Hazard Mitigation Committee were properly advertised including in the local newspaper and open to the public. The input of business owners and nonprofit leaders was incorporated by the Committee. Appendix F includes the public notices for all meetings. Public involvement was also encouraged through the discussion of the updated Plan during Planning Board and Town Council meetings. Additionally, the original Hazard Mitigation Plan was made available at the Library and Town Hall for public access. The draft 2016 update was posted on the Town's website. No public comments were received.

The final 2016 Plan will be posted on the Town's website and copies will be made available at the Library and Town Hall.

Public involvement will be maintained through the implementation of this plan through regular outreach and educational opportunities. Mitigation strategies and actions will be addressed at public meetings of the appropriate town bodies.

## 3.6 Understanding the Community's Risks

The process of updating New Shoreham's Hazard Mitigation Plan provides an opportunity to review and assess weather and climactic events that have in the past or may in the future impact the community. To evaluate vulnerability, the Committee examined the town's risk from natural hazards and identified its vulnerabilities to those risks. The Committee used the Risk Assessment Matrix and GIS maps as tools for the assessment. Based on those, they established mitigation priorities. Sources of information used during the assessment include U.S. Army Corps of Engineers studies, RIEMA reports, municipal records, local knowledge, and historical accounts and data.

New Shoreham is located twelve miles off the southern coast of Rhode Island, and is physically isolated from the rest of the state. Due to its locations, it cannot rely on mutual aid nor coordinate with neighboring communities as other communities are able to. Its geographic location in the middle of the ocean also increases its vulnerability to certain natural hazards, especially the wind, erosion and flooding that result from hurricanes and coastal storms. Combined with the ecologically significant natural environment, and the abundance of seasonal properties, businesses, and populations, New Shoreham has many unique challenges when it comes to mitigating hazards. Isolation, distance, accessibility, communication and transportation must all be considered when planning hazard mitigation objectives and activities.

One of the most important aspects considered while completing this summary was the likelihood of the island community having to "fend for itself" with respect to the rest of the state. If the island's ferry and/or air transportation were suspended in the midst of a natural hazard, the community must be prepared to stand alone and cope with the after effects until transportation access is restored.

In considering the benefits of mitigating hazards, one must first realize the danger of not identifying and anticipating them, including damage and loss with regard to persons, property, resources, vital records, and the economy, and the interruption of utilities, essential services, and commerce.

The aftermath of natural hazards that are not mitigated can be costly in terms of emergency response, repairs and replacement to facilities, infrastructure and property, debris and contamination cleanup, lost wages and sales revenue, and environmental damage.

## 3.7 Discovery & Gathering of Resources

New Shoreham's Emergency Operations Plan (EOP), updated in 2011, guides the Town's emergency protocol for extraordinary emergency situations associated with various types of disasters, including natural, man-made, and technological. It

addresses pre- and post-disaster strategies to deal with hazards identified in this Plan, such as hurricane and flood warnings, dissemination of public information, evacuations, and shelters.

## 3.8 Review and Incorporation of Information with Stakeholder and Public Exchange

New Shoreham solicits in-depth responses from residents, business owners, boards and committees, and departments. Public community participation is promoted through public notices and invitations. Committee meetings are publicized and open to the public. Residents and business owners are notified when there are open positions on the Committee to ensure that a wide cross-section of the community is represented. The draft and final plans are posted on the town's website, and copies are available at Town Hall and at the Library.

## 3.9 Developing & Updating the Risk Assessment

The Town of New Shoreham enforces state and local building codes and participates in the National Flood Insurance Program. The local Comprehensive Community Plan outlines resources available to address various challenges including increasing development pressure, economic stability, open space preservation, public infrastructure and public facilities. Updating the plan with the elements and recommendations of the Natural Hazard Mitigation Plan will help to reduce the impact from a natural disaster. The town acknowledges that incorporating this plan and its mitigation initiatives into the Comprehensive Plan benefits the community by reducing human suffering, damage, and costs of recovery. It also helps to build and maintain the long-term sustainability and economic well-being of the town.

## 3.10 Developing & Updating the Mitigation Strategy

Since the adoption of its first local Natural Hazard Mitigation Plan in 2006, the Town of New Shoreham has been working to update and revise its latest Mitigation Plan. New Shoreham's Hazard Mitigation Committee has continued to work on revising and implementing the Plan to meet FEMA and RIEMA requirements.

The Committee recognizes that natural hazard mitigation is a continuous process. The actions recommended in this plan will guide the town's actions during the next five years. These actions address the highest priority risks to the community, and will help to reduce the community's vulnerability to these risks.

The Emergency Management Director, assisted by the Town Planner, will continue to be responsible for the overall coordination of the Hazard Mitigation Plan. They will coordinate with representatives from various departments, agencies, and

organizations involved in maintaining the Plan. The Town Planner will also be responsible for tracking and documenting the progress of each action using the Action Progress Form (Appendix G).

The previous 2006 Action Progress Form was not used during the five-year update period, so the evaluation had to be done by the Hazard Mitigation Committee. To encourage ongoing evaluation during the next five-year period, the Committee designed a new form. The format of the new form (Appendix G) was changed significantly to increase the amount of detail for each project, and make for easier use by the Emergency Management Director and Assistant.

Public community participation will continue to be promoted. Committee meetings will continue to be publicized and open for public input. Residents and business owners will be notified when there are open positions on the Committee to ensure that the community is well represented. The Hazard Mitigation Plan will be posted on the town's website, and hard copies will continue to be available at Town Hall and the Library.

## 3.11 Review & Incorporation of Stakeholder & Public Exchange

To update its Comprehensive Community Plan, New Shoreham solicited in-depth responses from its residents, boards and committees, departments, and business owners. Many of these responses relate directly or indirectly to natural hazard mitigation. In addition, meetings of the Hazard Mitigation Committee produced additional goals and policies. Based on the feedback gathered, the Risk Assessment was updated. Details are found in Section 3.

## 3.12 Bringing the Plan to Life: Implementation & Maintenance

The Town of New Shoreham has developed and updated its Hazard Mitigation Plan in an atmosphere of collaboration, cooperation, and community-wide participation and effort. Responsible implementation and allocation of resources will ensure that New Shoreham remains physically and economically resilient.

## 3.13 Method, Responsibilities, and Schedule

Each mitigation action has been assigned a priority, a date for implementation, and a responsible department for planning, monitoring and implementing. Successful hazard mitigation planning and implementation is an ongoing process, and is the responsibility of the Hazard Mitigation Committee with the support of town leaders.

## 3.14 Plan Review, Adoption, and Approval

The 2015 Hazard Mitigation Plan will go through several stages of review before its adoption and implementation. The Hazard Mitigation Committee unanimously recommended that this Plan be forwarded to FEMA Region 1 for review. Recommended revisions will be incorporated, and a final draft will then be prepared and submitted to RIEMA, who will forward the draft to FEMA. Once the Plan has received the APA notice from FEMA, the Town Council will vote on a Resolution to formally adopt the 2015 New Shoreham Hazard Mitigation Plan.

Once adopted, the Hazard Mitigation Plan will guide future hazard mitigation efforts. The responsible departments for each action will work to develop appropriate implementation schedules and funding. Although the priority ranking will guide implementation, the actions to be implemented will depend upon the availability of funding.

## 3.15 Monitoring

This Plan will be monitored and updated throughout the 5 year planning cycle. The Hazard Mitigation Committee will meet every 6 months, or following any significant event. They will work collaboratively to re-evaluate the Plan, track progress on action items, and discuss and document any new hazards or actions that may be identified. As actions are implemented or modified, the Mitigation Action Table will be adjusted and updates recommended. A full update of the Plan will be conducted every five years, and will incorporate a more formalized process for identifying hazards and risks, prioritizing actions, and analyzing the cost/benefit of such actions. All revisions to the Plan will be coordinated with RIEMA to ensure that the updates are consistent with State Hazard Mitigation Plan.

In year three, the schedule for the five year Update will be initiated by the Assistant. The Director will be responsible for convening the Committee and formulating a schedule for the update. These efforts may include seeking grant funding, involving and notifying community members and stakeholders, determining if new maps and studies are available or needed, and local, RIEMA and FEMA review.

## 3.16 Continued Public Involvement

The Town of New Shoreham will continue to involve the public as the Hazard Mitigation Plan process evolves. Residents and business owners will be notified and invited to join when there are open positions on the Committee to ensure that the community is well represented. Opportunities for public input will occur as part of the Town Council's regular business, and during public meetings and hearings held specifically to discuss the Plan. Public input is also solicited during the annual

budgetary reviews of emergency management and other department requests and expenditures. This engagement will continue through the life of this and subsequent Hazard Mitigation Plans.

# 4. RISK ASSESSMENT

The purpose of this section is to provide a comprehensive overview of how various natural hazards could impact New Shoreham. In this section, natural hazards are ranked in order of priority based on the frequency of occurrence and area of impact affected.

Identifying risk and vulnerability to natural hazards is central to determining how to allocate finite resources and determining which mitigation actions are feasible and appropriate. The hazard analysis involves identifying natural hazards that are a potential threat to New Shoreham, and analyzing each to determine the degree of threat posed.

Due to its location, the island is especially susceptible to coastal storms, hurricanes and Nor'easters, which pose erosion and flooding hazards. In addition, the island is vulnerable to severe winter weather and wind, lightning, and drought.

Block Island generally experiences several natural hazards each year; most as a result of coastal storms. Hurricanes also threaten quite often, causing significant damage as witnessed most recently by Hurricane/Super Storm Sandy in 2012. Sandy, while not categorized as a hurricane according to wind strength, caused most damage because of astronomically high tides over two cycles.

The following sections will describe historical events that have affected the island, its residents and visitors. These form the framework used to complete the Hazard Profile (Table 1).

Most of the following information was obtained from the National Climatic Data Center and the National Weather Service (Boston, MA) online database. Unfortunately, records have not been kept specifically for Block Island; rather, events are grouped by county. The only tables that are completely specific to Block Island are Windstorms (Table 2), and Rain/Flooding (Table 5). In the other tables, information specific to Block Island is designated by two asterisks (**).

Grouping Block Island weather events with those of Washington County does not always accurately represent the severity or effects of the events on Block Island. Although Washington County consists of many coastal communities, Block Island's location in the middle of the ocean means that it usually endures higher winds and heavier rains than along the coast. This was considered when completing the Hazard Profile in Section 3.

A natural hazard is an event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm of loss. A natural hazard can also be exacerbated by societal practices, such as building in a floodplain, along a sea cliff, or on an earthquake fault. Natural disasters are inevitable, but the impacts of natural hazards can, at a minimum, be mitigated or, in some instances, prevented entirely (RIEMA, 2014).

## 4.1 Hazard Identification

The Town of New Shoreham identified natural hazards, assessed the degree of vulnerability to those hazards, considered the potential impacts posed by those hazards, and assessed future risk. The appendices provide maps showing the locations of critical facilities and areas of the island most at risk from natural hazards.

The New Shoreham Hazard Mitigation Plan addresses natural hazards and not man-made hazards such as structural fires, hazardous materials, chemical spills, or weapons of mass destruction.

### *Hazard Identification in State Hazard Mitigation Plan*

Rhode Island's State Hazard Mitigation Plan (2014) identifies the following categories of natural hazards in order of frequency and impact: (1) wind-related hazards; (2) winter-related hazards; (3) flood-related hazards; (4) wildfire; (5) geologic-related hazards (Earthquake) and (6) drought and extreme heat. These have the potential to cause fatalities, injuries, property and infrastructure damage, agricultural loss, damage to the environment, interruption of business, or other types of harm or loss.

| Wind Related Hazards | Winter Related Hazards | Flood Related Hazards | Geologic Related Hazards | Additional Hazards |
|---|---|---|---|---|
| Storm Surge | Snow | Riverine Flooding | Earthquakes | Wildfire |
| Hurricanes | Ice | Flash Flooding | | Drought |
| Tornadoes | Extreme Cold | Urban Flooding | | Extreme Heat |
| High Winds | | Coastal Flooding | | |
| | | Climate Change and Sea Level Rise | | |
| | | Coastal Erosion | | |
| | | Dam Breach | | |

### *Hazards Excluded from Risk Assessment*

The State Hazard Mitigation Plan notes other potential natural hazards that are not addressed in the Plan due to the lack of frequency in which they occur, the minimal probability of their occurrence, and the State's lack of resources to conduct research into the potential for occurrence. Until resources and expertise are available to conduct such studies, or until the state or region is impacted by such a hazard, Rhode Island does not have plans to address these low risk hazards. Volcanoes, Tsunamis, Landslides, Land Subsidence, Avalanche, Expansive soils, and Hail are not included in New Shoreham's plan.

## 4.2 Hazard Profiles

The following section presents a description of each type of natural hazard Block Island may expect to experience as determined by the Hazard Mitigation Plan Committee. The Hazard Profile Summary, found in Table 1, lists the specific hazards identified for New Shoreham along with specific details with regard to frequency of occurrence, magnitude in terms of the percent of the community affected, speed of onset (and subsequent warning time available), seasonal pattern, possible effects on the community, and risk priority.

### 4.3 HAZARD PROBABILITY

In order to comprehensively assess the relative risk posed by hazards, the Town of New Shoreham utilized a model that considers both the frequency and vulnerability to identified natural hazards. The following model was utilized as it was identified as a best practice by nearby communities during their plan development. The objective of the rating system is to identify which hazards pose the greatest risk to Block Island.

The model deals with hazards and risk in a relative manner and the risk rankings are to be considered within this context. Frequency and vulnerability were given equal weighting. Specifically, the model uses the following simplified equation:

**Risk = Frequency x Vulnerability Factor**

**Frequency**
The hazard frequency was determined for each hazard using a 1-4 scale:
1) Hazard is unlikely to ever occur on Block Island
2) Hazard may occur every ten to fifty years
3) Hazard may occur between two and ten years
4) Hazard will occur with some regularity

**Vulnerability Factor**
A vulnerability factor was used to address the various vulnerabilities and the severity of a hazard. The built environment, systems (transportation, utilities, economy,

etc.), natural systems, the human population and severity were each assigned a value of zero to three. In order to equally weight frequency and vulnerability, the average of the vulnerabilities provided a "vulnerability factor." The vulnerability ratings used the following equation:

**Vulnerability Factor = (Human + Built + Natural + Systems + Severity)/5**
The vulnerability factor was then classified on a 1-4 scale:
1) The vulnerable population or system will not be affected
2) Event causes some mild disturbances to some systems, buildings, natural environment or populations
3) Event causes some mild disturbances to all systems, buildings, natural environment or populations OR event causes severe disturbance to some systems, buildings, natural environment or populations
4) The entire island is significantly affected by the event

Due to the variability inherent in each of the hazards and the rating system, the hazards were divided into general categories of low, moderate and high-risk hazards based on their relative risk score.

| Table I. Hazard Profile Summary | | | | | | |
|---|---|---|---|---|---|---|
| Hazard | Frequency* | Magnitude** | Speed of Onset | Seasonal Pattern | Possible Effect | Risk Priority |
| STORM SURGE | Likely | Catastrophic | 24+ hrs. | June-Nov. with Aug. & Sept. most likely | Flooding, downed trees, power outages, property damage, loss of life | High |
| HIGH WINDS / THUNDERSTORMS | Highly likely | Catastrophic | 12-24 hrs. | Any Season | Property damage, power outages, downed trees/ limbs | High |
| HURRICANE | Likely | Catastrophic | 24+ hrs. | June-Nov. with Aug. & Sept. most likely | Flooding, downed trees, power outages, property damage, loss of life | High |
| HEAVY RAINS / FLOODING | Highly likely | Limited | 12-24 hrs. | Spring and Summer | Flooding, property damage, roads closed, dams breached | Moderate |
| SEVERE WINTER WEATHER | Highly likely | Catastrophic | 12-24 hrs. | Winter | Power outages, poor travel conditions, schools/businesses closed | Moderate |
| COASTAL EROSION | Highly likely | Limited | Minimal | Any | Property damage, environmental damage | Moderate |
| DAM BREACH | Possible | Limited | Minimal | Any Season | Flooding, property damage, roads closed | Moderate |
| SEA LEVEL RISE | Possible | Critical | Minimal | Any Season | Flooding, roads closed, environmental & property damage | Moderate |
| DROUGHT | Unlikely | Unlikely | Minimal | Any Season | Environmental & property damage, water infrastructure compromised | Low |
| EARTHQUAKE | Possible | Critical | Minimal | Any Season | Loss of life, property damage, power outage | Low |
| TORNADO | Unlikely | Limited | 12-24 hrs. | Spring | Property damage | Low |
| WILDFIRE | Unlikely | Unlikely | Minimal | Any Season | Property damage, environmental damage | Low |
| * *Highly likely=near 100% probability within the next year; Likely=between 10% and 100% probability within the next year or at least one chance in next 10 years; Possible=between 1% and 10% probability within the next year or at least one chance in next 100 years; Unlikely=less than 1% probability in next 100 years* | | | | | | |
| ** *Catastrophic=more than 50% of community affected; Critical=25% to 50% affected; Limited= 10% to 25% affected; Negligible=Less than 10% affected.* | | | | | | |

# 4.4 Natural Hazard Profiles

## *4.4.A Storm Surge*

### Description

Storm surge is the abnormal rise in water level caused by the wind and pressure forces of a hurricane or Nor'easter or severe winter weather. A number of factors contribute to storm surge, but the fundamental mechanism is wind and the frictional stress imposed on the water surface. Winds blowing over the water surface generate horizontal surface currents flowing in the direction of the wind. These create subsurface currents which may extend from one to several hundred feet below the surface when combined with the intensity and forward speed of a hurricane or Nor'easter. If the currents are in the onshore direction, water is impeded by the shoaling continental shelf, and the water surface rises. This "dome of water" increases shoreward, reaching a maximum height at the shoreline or at some distance inland.

### Location

Storm surge most often occurs in and around Block Island's two harbors and impacts the island's roadway system that connects Old Harbor and New Harbor and commercial establishments with the outlying residential areas. Recurring damage has occurred to Corn Neck Road as a result of storm surge impacts.

### Extent

Storm surge is by far the most disruptive force acting on the Block Island coast. Storm surge heights in Rhode Island range from a few feet higher than normal tides during Nor'easters to more than 10 feet during hurricanes. The breaking wave height is related to water depth. As water depth increases with storm surge, larger waves are generated.

In the Atlantic Basin as a whole, there has been a shift toward category 4 and 5 storms, with fewer category 1 and 2 storms. The trend toward higher sea levels and greater severity of storms will result in greater coastal flooding and erosion, and as a result more widespread property and infrastructure damage on Block Island.

### Previous Occurrences and Probability of Future Events

The probability of the storm surge event is relative to the probable occurrence of

hurricanes, tropical storms, severe winter weather and Nor'easters. Probability: New Shoreham is *highly likely* to be impacted by storm surge over the next five years.

### 4.4.B. High Winds and Thunderstorms

**Description**

Wind is the movement of air caused by differences in pressure from one place to another. Local wind systems are created by the immediate geographic features of a given area, such as mountains, valleys, or large bodies of water. Wind effects can include blowing of debris, interruptions in power and communications utilities, and intensification of the effects of other hazard related to winter weather or severe storms.

Thunderstorms are formed when atmospheric conditions combine to provide moisture, lift, and warm unstable air that can rise rapidly. The hazard may occur at any time of day and in all months of the year, but are most common during summer afternoons and evenings and in conjunction with frontal boundaries. A thunderstorm is considered severe if it produces winds of 58 mph or greater, a tornado, or hail at least one inch in diameter. Thunderstorms affect an isolated area, but can be dangerous and destructive. Thunderstorms can form in less than 30 minutes, allowing for very little warning. They have the potential to produce lightning, hail, tornadoes, powerful winds, and heavy rains that may lead to flash flooding.

Although neither the National Climate Data Center nor the National Weather Service lists any specific lightning events for Block Island, these events have occurred on Block Island in the past. Areas abutting the Block Island Water Company have been struck by lightning several times, once resulting in a devastating fire. Other strikes on the island have caused residential damage including house fires and well pump damage. Lightning can cause power failure, fires, and disruption of water service, as well as communication failures if phone lines or the public safety communication tower is struck.

Severe wind poses a threat to New Shoreham in many forms, including that produced by severe thunderstorms and tropical weather systems. In some instances, these events have been associated with weakening tropical weather systems, including downgraded tropical and sub-tropical storm systems.

**Location**

Given the island's location and amount of ocean fetch with easterly storms, high wind events and thunderstorms affecting the island generally impact the entire island and are more intense than for mainland Rhode Island locations.

High winds also contribute to storm surge and increased wave action, resulting in coastal erosion and minor flooding in low-lying areas nearby the Harbor areas, as well as causing island roads to be blocked or breached by water. The narrow northern neck of the island, Corn Neck Road, is especially vulnerable being cut off from the rest of the island.

## Extent

Wind events are the most common risk Block Island faces throughout the year. These include Nor'easters in the winter and hurricanes and thunderstorms in the summer.

High winds can cause power outages, damage to buildings and property, and can suspend ferry and air service, consequently secluding the island from the mainland. Much of the island vegetation is maritime scrub comprised of smaller, brittle trees with shallow roots, unable to withstand sustained winds. As a result, windstorms can have a significant negative impact on the island's habitat and natural environment.

## Previous Occurrences and Probability of Future Events

*Significant wind storms are shown in Table 2.*

**Table 2 – Significant Wind Storms for Block Island**

| Date | Magnitude (mph) | Comments |
|---|---|---|
| August 21, 1997 | 60 mph gusts | High winds caused 16' waves |
| February 5, 1998 | 60 mph gusts | Minor beach erosion |
| December 17, 2000 | 60 mph | Strong winds cancelled at least one Ferry run |
| January 23, 2005 | 85 mph gusts** | Snowstorm with 85 mph wind gusts |
| November 10, 2005 | n/a | Sustained gale-force winds, no ferry service |
| December 9, 2005 | 68 mph | |
| February 1, 2008 | 58 mph | |
| March 5, 2008 | 85 mph | |
| January 12, 2011 | 63 mph | |
| November 2, 2014 | 59 mph | |
| December 9, 2014 | 60 mph | ferry service cancelled |

*Sources: National Climate Data Center, Weather Station at BI Water Company, and Block Island Times*

Over the past century, 15 tropical cyclones (Category H1-H5) have directly hit or passed near Rhode Island. Numerous other subtropical and tropical storms/depressions pass through Rhode Island each season generating large swells, storm surges and high winds causing varying degrees of damage to property.

The Transfer Station is located in the northern part of the island, which is bounded on two sides by the ocean. This area usually takes the brunt of storms. During the most recent storm on December 26, 2010, vehicles that had been buried at the Transfer Station for decades were unearthed due to erosion resulting from the storm.

The December 26, 2010 storm, with some residents reporting 90 mph gusts, caused scattered power outages. Some properties did not have power for four days. The ferries were cancelled for two consecutive days. The high winds caused minor property damage, including fallen trees and broken windows.

A lightning strike on July 5, 2009 knocked out the apparatus for the municipal fire alarm service operating out of the Police Station. This required complete replacement of the system.

Probability: New Shoreham is *highly likely* to be impacted by high wind events and thunderstorms over the next five years.

### *4.4C. Hurricanes*

**Description**

A hurricane is a tropical cyclone with rotating winds of at least 74 mph, and is usually accompanied by heavy rain, thunder, and lightning. Tornadoes and storm surge may also result. These seasonal storms are spawned by low-pressure depressions moving over warm, tropical waters and occur over the Atlantic Ocean between June and October. Tropical cyclones are among the most powerful and destructive meteorological systems on earth.

There are three categories of tropical cyclones:

1. TROPICAL DEPRESSION: MAXIMUM SUSTAINED SURFACE WIND SPEED LESS THAN 39 MPH.
2. TROPICAL STORM: MAXIMUM SUSTAINED SURFACE WIND SPEED FROM 39-73 MPH.
3. HURRICANE: MAXIMUM SUSTAINED SURFACE WIND SPEED EXCEEDING 73 MPH.

Hurricanes are measured on the Saffir/Simpson Hurricane Intensity Scale (see Table 3 below) with ratings determined by wind speed and central barometric pressure. Hurricane categories range from 1-5, with 5 being the strongest (winds greater than 155 mph). This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures.

A hurricane watch is issued when hurricane conditions could occur within 36 hours. A hurricane warning indicates that sustained winds of at least 74 mph are

expected within 24 hours or less. While strong winds from hurricanes can pose a threat to life and property, the greatest threat posed by hurricanes in Rhode Island is generally heavy rainfall and severe flooding caused by storm surge. Storm surge is water that is pushed toward the shore by the force of the winds swirling around the storm. When coupled with normal tides, storm surge can raise the mean water level 15 feet or more. Storm surge and hurricanes can also greatly contribute to coastal erosion, and cause downed power lines and structural damage.

The counterclockwise rotation of a hurricane's wind field in combination with the forward motion of the hurricane typically causes the highest surge levels to occur to the right of the hurricane's forward track. This phenomenon has been observed in regions where the shoreline is typically straight, not fragmented by large inlets and bays, and when a hurricane travels perpendicular to the shore. In Rhode Island, the increased wind stress from the rotational wind field has a large effect on the level of surge. The contribution to surge generation from the forward motion of the storm can be greater than the contribution made by an increase in hurricane intensity. Storms passing to the west raise the highest storm surges for Rhode Island. The 1938 hurricane made landfall west of Rhode Island as a Category 3 hurricane with a forward speed in excess of 50 mph. Since the center of the storm made landfall in Connecticut, the Rhode Island shoreline experienced the highest storm surge levels.

The reduction of atmospheric pressure within the storm system results in another surge-producing phenomenon known as the "inverted barometer" effect. Within the region of low pressure, the water level rises at the approximate rate of 13 inches per inch of mercury drop. This can account for a rise of one to two feet near the center of the hurricane. This is considered to be a more important factor in the open ocean where there is no depth-related restrictions to water flow.

## Location

The New England District of the U.S. Army Corps of Engineers, using data from the National Hurricane Center, developed maps depicting the worst case scenario for hurricane surge inundation for Category 1 through 4 hurricanes striking the coast of Rhode Island. Hurricane surge values were developed using the Sea Lake and Overland Surge from Hurricanes (SLOSH) model, which estimates storm surge heights through hypothetical measures of pressure, size, forward speed, track and winds.

The entire state of Rhode Island is vulnerable to hurricanes and tropical storms. New Shoreham's location in the middle of the ocean and low elevation makes it particularly susceptible to hurricane-related hazards, and the town's small size means that the majority of properties are vulnerable to hurricane impacts to some degree.

Utilizing GIS, the Town of New Shoreham mapped Hurricane Inundation layers and determined that there are an estimated 117 structures located within Hurricane Inundation Zones on Block Island including critical facilities such as pump stations, the power company, cell tower, State Highway Garage, and the Day Care Center.

## Extent

Besides the flooding damage from storm surges, the wind from hurricanes can knock down structures or rip off roofs. Even Category 1 or 2 hurricanes produce storm surges that inundate large areas of town. Hurricanes also cause erosion. High winds cause damage to power lines, structural damage to buildings and component parts (gutters, shingles, decking, windows, etc.). Accompanying wind-driven rains enter windows, doorways, and roof vents causing damage to the interior of buildings and critical facilities. Hurricane and gale-force winds can block roadways with debris or water, making them impassable. This poses a danger especially for those requiring emergency services or medical attention. In short, the island's beaches, habitat, historic and critical structures and facilities are all in peril during a hurricane.

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

Shoreline flooding and increased wave action contribute to the erosion of bluffs and dunes along the island's shores. This poses a risk to residences perched atop bluffs, and the island's lighthouses. In 1993, the Southeast Lighthouse was lifted and moved 300 feet back from the eroding bluff edge. On April 10, 2001 a private

property lost 1/3 of an acre of land when it succumbed to erosion on the South side of the island. Trails at Clayhead Trail, at the Northeast of the island, have also had to be moved back from the cliff's edge due to dangerous conditions caused by erosion, and the steps leading the DEM property at Mohegan Bluffs have required reconstruction for the same reason.

Since 2006, the island has worked with RIEMA to assure that plans are in place and revisited each hurricane season, with necessary adjustments made or long-term planning initiated. The town also runs advertisements each summer in the newspapers advising all readers about hurricane preparation techniques and evacuation procedures.

## Previous Occurrences and Probability of Future Events

Table 4 lists significant previous hurricanes which impacted Block Island.

**Table 4– Significant Hurricanes**

| Date | Name | Category[1] | Winds[1] (mph) | Property Damage[2] ($million) | Deaths[3] |
|---|---|---|---|---|---|
| September 21, 1938 | N/A | 3 | 121 | 308 | 600 |
| September 14, 1944 | N/A | 3 | 134 | 100 | 46 |
| August 31, 1954 | Carol | 3 | 80-100 | 461 | 60 |
| September 11, 1954 | Edna | 3 | 80-100 | 40 | 20 |
| September 12, 1960 | Donna | 2 | 95 | 387 | 50 |
| September 27, 1985 | Gloria | 2 | 98 | 900 | 8 |
| August 19, 1991 | Bob | 2 | 103 | 680 | 6 |
| August 26-27, 2011 | Irene | 1 | 76 | 1,000 | 41 |
| October 22-29, 2012 | Sandy | 1 | 80 | 50,000 | 147 |

Sources: "Southern New England Tropical Storms and Hurricanes, A Ninety-eight Year Summary 1909-1997", by David R. Vallee and Michael R. Dion, National Weather Service, Taunton, MA. http://www.nhc.noaa.gov/outreach/history; http://www.nhc.noaa.gov/data/tcr/AL092011_Irene.pdf ; http://www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf

[1]Sustained winds [2]Property damage in U.S. [3]Casualties in U.S.

*Two recent events are detailed below.*

## Tropical Storm Irene, 2011

In late August 2011, this destructive and costly tropical storm, which made landfall in the Outer Banks of North Carolina, and in New Jersey and Brooklyn, New York days later, and eventually became a tropical cyclone in New Hampshire and Vermont, caused widespread wind damage and power outage throughout much of Rhode Island, particularly Aquidneck Island (Newport). The storm passed Block Island, which was spared power outage and only lost ferry service for a day. High

winds did cause some tree damage and there was excitement from large waves rolling in from the south which swept over the east section of the breakwater in Old Harbor. However, there was no permanent damage to any roads or structures, nor to any vessels due to early preparation by the Harbors Department. The west side of the island was subjected to some erosion.

## Hurricane Sandy, 2012

Hurricane Sandy, also referred to as a "super storm", was the most destructive storm of the Atlantic 2012 season. It affected the entire eastern seaboard in the last days of October, most dramatically the New Jersey shore, which took a direct hit, and New York City, which experienced significant storm surges. In Rhode Island most of the damage was along the south coast where fifteen to thirty foot seas pounded the coast over two days, destroying dunes and causing significant flooding and property damage. The duration lasted through multiple tide cycles; storm surges of four to five feet on top of high tide resulted in a storm tide high of over eight feet above mean low tide, as recorded in Newport.

Although the storm did not hit Rhode Island directly, it produced significant damage to the southern coastline. On Block Island, the storm pummeled the eastern side of the island, including Old Harbor and Crescent Beach. Corn Neck Road, which parallels the beach and connects the harbor and village area to the north part of the island, was significantly damaged for a length of 1,800 feet, isolating one business, restricting access to a number of residences and requiring travelers along the remainder of Corn Neck Road to use an alternate route (Ocean and Beach Avenues). A shorter section of Spring Street, leading out of town south of Old Harbor, and also paralleling close to the shore, was damaged. Both roads were rebuilt as part of a $3.1 million emergency repair contract (funding by US DOT), with construction completed in March, 2013. The town beach pavilion also suffered damage, including structural damage. The cost of these repairs was $160,000, and the pavilion was opened for business in June, 2013. A private residence on the shoreline lost approximately 50 feet of its ocean frontage during the storm, and the septic system had to be relocated further inland.

In Old Harbor, the bait dock on the east side of the Inner Basin was destroyed. The Army Corp East Dock sustained significant damage. The recently constructed town docks and the ferry dock withstood the storm. However, Ballard's, a large restaurant and bar located on what is essentially a coastal feature between the harbor and the beach, sustained significant damage; waves washed through the building, destroying the easterly wall and filling the first floor with sand. The Town's bait dock was rebuilt in 2013, at a cost of $200,000.

In New Harbor, there was no structural damage, only localized flooding due to the storm surge that entered the Great Salt Pond. Under the direction of the harbormaster, the harbor had been almost entirely emptied of recreational boats in preparation for the storm. The harbor and marinas had minimal traffic because

the storm hit after Columbus Day. The marinas all took precautions to secure their facilities. The few boats that remained in New Harbor weathered the storm without damage, as they had been thoroughly secured in locations most favorable for the wind direction.

Outside of the harbors area, there was considerable beach erosion and damage to the dune system, particularly along Crescent Beach. The Block Island Conservation Commission responded with a plan to install snow fencing to capture the sand, allowing the dunes to rebuild in a cost-effective and sustainable manner. The Conservation Commission, together with the BI Residents Association, purchased (with donations) 90 rolls of fencing and installed it along several access paths to the beach during three community work days in late March and early June 2013, events which attracted a total of over a hundred and fifty volunteers. Beach grass or beach roses are to be planted later as the dunes re-establish. Signs were installed to remind people to stay off the dunes.

The National Hurricane Center uses satellite imagery, radar, and weather balloons to spot conditions that could trigger a hurricane. Information is gathered and analyzed by computer models that estimate the storm's strength, rate of development, path, and estimated storm surge. Based on this information, a tropical storm warning, a hurricane watch, or a hurricane warning are then issued.

A tropical storm warning is issued if winds of 39 to 73 mph are expected. A hurricane watch is issued for coastal areas when tropical storm or hurricane threatens within 24 to 36 hours. A hurricane warning is issued for specific coastal areas when hurricane-force winds are expected to strike within 24 hours or less.

According to the National Hurricane Center, approximately six Atlantic tropical storms mature into hurricanes in an average year. The Rhode Island State Hazard Mitigation Plan indicates that Rhode Island is particularly vulnerable to hurricanes due to its geographic location and features such as Narragansett Bay, which can act as a funnel for hurricane surges. The State plan indicates that in any given year, the probability of a hurricane reaching Rhode Island is six percent.

Probability: New Shoreham is *likely* to be impacted by a hurricane during the next 5-years.

## 4.4D. Heavy Rains and Flooding

### Description

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

Floodplains are low, flat, periodically flooded lands adjacent to rivers, lakes and oceans and are subject to geomorphic (land-shaping) and hydrologic (water flow) processes. These areas form a complex physical and biological system that supports a variety of natural resources and also provides natural flood and erosion control. In addition, the floodplain represents a natural filtering system, with water percolating back into the ground and replenishing groundwater.

A flash flood occurs when heavy rains collect in a stream or gully, turning the normally calm area into an instant rushing current. Any flood involves water rising and overflowing its normal boundaries. Flash floods result from heavy rainfall concentrated over one area. Most flash flooding is caused by thunderstorms or heavy rains from hurricanes and tropical storms.

Coastal flooding is typically a result of storm surge and wind-driven waves, which erode the coastline. These conditions are produced by hurricanes (tropical storms) during the summer and fall, and Nor'easters and other large coastal storms (extra-tropical storms) during the fall, winter and spring. Storm surges may overrun barrier islands and push sea water up coastal rivers and inlets, blocking the downstream flow of inland runoff.

### Location

Given the fact that Block Island is surrounded by water, heavy rains and resulting floods are serious risks to the community. Many times when inland locations are receiving snow, the island receives a large amount of rain due to its location in the warmer ocean waters. Furthermore, there are 365 freshwater ponds on the island that can swell over their banks and create flooding problems for property and business owners. Several streets on the island are also susceptible to flooding or

washouts due to poor drainage or road makeup (i.e. dirt or gravel road) including Ocean Ave, Beach Ave, and Corn Neck Road.

Located within flood hazard areas are the following municipally-owned structures: the North Light; Beach Pavilion; Harbormaster's Shack; and former Coastguard Station.

## Extent

In March 2010, heavy rains (5.55 inches in Washington County) caused the level of Sands Pond to rise to 133.5 feet above sea level. The Water Company 's electrical boxes that service the reservoir pumps, backwash holding tanks were submerged and damaged. The flood also posed a threat to water treatment equipment. There are a dozen residential properties surrounding the pond and nearby yards were submerged.

## Previous Occurrences and Probability of Future Events

Table 5 lists previous significant rainfall and flooding events for Block Island.

**Table 5 – Significant Heavy Rain/Flooding for Block Island**

| Date | Rainfall (inches) | Comments |
|---|---|---|
| October 11, 1998 | 4.84" | Three-day rain event, no flooding resulted |
| March 31, 2001 | 4.37" | Minor flooding |
| Oct.13-15, 2005 | 13.1" | Rain, flooding in poor drainage areas & flood prone properties |
| November 22, 2005 | 4.26" | |
| February 13, 2006 | 6" | No major damage |
| May 15, 2006 | 4.13" | No major damage |
| June 24, 2006 | 4.57" | |
| August 28, 2006 | 3.31" | |
| April 15-16, 2007 | | Coastal flood, new moon combined with storm surge resulted in moderate erosion along beaches |
| August 29, 2009 | 2.50' | |
| October 3, 2009 | 3.28" | |
| March 28-31, 2010 | 8" | Rain, widespread flooding, major property damage |

*Sources: National Climate Data Center and National Weather Service; Weather Station at BI Water Company, and The Block Island Times*

Probability: New Shoreham is *highly likely* to be impacted by heavy rains and flooding over the next 5 years.

### *4.4.E. Severe Winter Weather*

**Description**

A heavy snow is generally defined as having more than eight inches of accumulation in less than 24 hours. Heavy snow can bring a community to a standstill by inhibiting transportation, downing trees and utility lines, and by causing structural collapse in buildings due to the weight of the snow. Repair and snow removal costs can be significant and surpass annual municipal snow removal budgets.

The term "ice storm" is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain, which is rain that becomes super-cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. If extreme cold conditions are combined with low/no snow cover, the cold can better penetrate downward through the ground and potentially create problems for underground infrastructure as well. When utilities are affected and heaters do not work, water and sewer pipes can freeze and even rupture.

Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold can lead to hypothermia and frostbite, which are both serious medical conditions. What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Rhode Island, extreme cold usually involves temperatures below zero degrees Fahrenheit.

The wind chill index attempts to quantify the cooling effect of wind with the actual outside air temperature to determine a wind chill temperature that represents how cold people and animals feel, based on the rate of heat loss from exposed skin. A wind chill index of -5 indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five (5) degrees below zero (0), even though the actual temperature could be much higher. The NWS issues a wind chill advisory when wind chill temperatures are potentially hazardous and a wind chill warning when the situation can be life-threatening.

## Location

Nor'easters, while often less dramatic than a hurricane, are far more frequent in Rhode Island, and can produce considerable damage. On average, one to two Nor'easters per year affect Rhode Island with a storm surge equal or greater than two feet. The duration of high surge and winds during a Nor'easter can last from 12 hours to three days, while the duration of hurricane conditions generally last only 6 to 12 hours. Although its coastal location makes it somewhat less prone to frequent heavy snowfall than inland communities, when conditions and storm track are right, Block Island is vulnerable to severe winter storms and Nor'easters. Although the island climate is tempered by the surrounding ocean waters, late winter weather delivers its fair share of snow. Typical heavy, wet snows can cause tree limbs and branches to break and produce power outages. Island storms tend to be accompanied by strong winds. Depending on the severity of the storm, ferry service to and from the island can be interrupted for one or two days at a time.

## Extent

Winter storms are a regular occurrence on Block Island, with snowfall ranging from a few inches to several feet, and including sustained winds or gusts 35 mph or greater, considerable drifting, loss of power, and damage to structures. New England's "Nor'easters" can at times be more destructive than hurricanes. This is due, in part, to their large size and slow speed, and also because they can form with little advanced notice, which limits time to prepare. Typically occurring between November and March, Nor'easters bring high winds and heavy prolonged precipitation. Howling winds associated with Nor'easters also have the potential to produce significant storm surge, similar to that of a Category 1 hurricane. In addition, they can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall, ice buildup, tree and structural damage, and power outages. Nor'easters pose a threat to compromised structures. If a major snowfall accompanies the heavy wind, snow drifts can block roads for days. Other wind hazards include downed power and cable lines, cutting off power, telephone and Internet communications. Other impacts are severe beach erosion, large waves, flooding, and injury or loss of life.

## Previous Occurrences and Probability of Future Events

Winter weather events in Rhode Island can be described as unpredictable. Snowfall and rainfall vary; however, Rhode Island residents can expect to experience several Nor'easters per year, which usually bring coastal erosion and a possibility for heavy rain or blizzard conditions depending upon the time of year and temperature. Table 6 details historic winter storms in Rhode Island.

| Table 6 – Significant Snowstorms for Washington County | | |
|---|---|---|
| **Date** | **Snowfall (inches)** | **Comments** |
| January 7, 1996 | 12”-24” | Schools closed, transportation systems disrupted |
| February 2, 1996 | 6”-8” | Difficult travel |
| February 16, 1996 | 5”-7” | Highway travel disrupted |
| March 2, 1996 | 6”-11” | Many minor accidents reported |
| April 9, 1996 | 6”-10” | Heavy wet snow with scattered power outages |
| April 1, 1997 | 4”-7” | Heavy wet snow with scattered power outages |
| February 25, 1999 | 9”-12” | Hazardous travel, schools closed |
| March 15, 1999 | 11” | Poor travel conditions, schools closed |
| December 5, 2002 | 6” | No storm damage or injuries reported |
| February 7, 2003 | 6”-8” | No major problems reported |
| February 17, 2003 | 15”-20” | Storm fell on President’s Day, only minor accidents reported |
| March 6, 2003 | 6”-10” | Dozens of minor accidents |
| December 5, 2003 | 10”-20” | Major disruption to transportation due to poor visibility |
| January 27, 2004 | 6” | No major problems reported |
| February 18, 2004 | 6” | Coastal storm, heavy snow and strong winds |
| January 23,2005 | 18 -21” | Widespread power outage, travel disrupted |
| February 13, 2005 | 6” | No major damage |
| February 21, 2005 | 6” | No major damage |
| February 25, 2005 | 6” | No major damage |
| December 20, 2009 | 18” | Power outages, travel disrupted |
| December 26-27, 2010 | 18” | Wide-spread power outages, gale force winds, trees knocked down, erosion, no ferry service |
| February 8-9, 2013 | 12-24” | Extensive power outages, high winds and heavy snow caused coastal erosion |
| January 1-2, 2014 | 7-8’’ | Heavy snow across Washington County |
| January 21-22, 2014 | 3-10’’ | Heavy snow across Washington County |
| February 15-16, 2014 | 6-9’’ | Heavy snow across Washington County |
| January 26-28, 2015 | 12’’ | Historic regional winter storm, one foot of snow fell on Block Island, heavy winds |
| March 5, 2015 | 8-12’’ | Snowstorm with heavier totals along coastal Rhode Island, SE Mass, Cape Cod and islands |

*Sources: National Climate Data Center and National Weather Service; Weather Station at BI Water Co., and The Block Island Times*

The worst Nor’easter to affect Rhode Island in the last 100 years was the Blizzard of 1978. Snow accumulation reached 4 feet, and wind speeds exceeded 60 mph.

On Block Island, a Nor’easter on December 26, 2010 caused damage to part of the sidewalk on Ocean Avenue, adjacent to the Great Salt Pond. The earth underneath the concrete eroded and was washed away by the storm. This caused the sidewalk to become detached. It also added to the ongoing erosion along Corn Neck Road.

The February 2013 severe snowstorm affected all of New England. High winds and heavy snow caused damage to dunes and resulted in extensive power outages.

An historic winter storm brought heavy snow to southern New England with blizzard conditions to much of Rhode Island and eastern Massachusetts, beginning during the day on Monday, January 26 and lasting into the early morning hours of Tuesday, January 27, 2015. At its peak, snowfall rates of 2 to 3 inches per hour were common. Approximately one foot of snow fell on Block Island.

The National Climatic Data Center (NCDC) suggests that Rhode Island can anticipate between two and six significant winter weather events per season. Probability: New Shoreham is *highly likely* to be impacted by severe winter storms or Nor'easters over the next 5 years.

### *4.4.F. Coastal Erosion*

**Description**

Coastal zones are dynamic areas that are constantly undergoing change in response to a multitude of factors, including sea level rise (SLR), wave and current patterns, hurricanes, coastal flooding and human influences. High winds and associated marine flooding from storm events such as hurricanes, Nor'easters, flooding and SLR, all increase the risk exposure along developed coastal lands. In addition to the natural processes that cause erosion, human alterations are affecting erosion rates.

Erosion has been wearing away bluffs and moving beaches and barriers along the coast from the powers of flooding, storm surge, rising sea levels, and high surf. As shorelines retreat inland, waterfront homes, public infrastructure such as roads, bridges, wastewater treatment facilities, and stormwater drainage systems, eventually become severely damaged.

Beaches and coastal bluffs are the basis for the tourism industry in Block Island. The beaches, barrier spits and coastal bluffs of Rhode Island, and particularly of Block Island, are vital economic, environmental, and cultural resources. A healthy, wide sandy beach provides protection against the effects of storm surge, coastal flooding, and high surf impacts. The beach and barrier environment provides habitat for marine and terrestrial organisms with beach dependent life stages and is home to species of indigenous and endemic Rhode Island plants.

High winds and associated marine flooding from storm events such as hurricanes, Nor'easters, flooding and SLR, all increase the risk exposure along developed coastal lands.

**Location**
Most of the damage will occur in low-lying areas – areas also subject to the highest risk of flooding. Additional damage will also occur along coastal bluffs as waves reach higher on the shoreline and erode the toe of the bluff and gravity takes its course.

**Extent**
Storm impacts and long-term erosion threatens developed areas with potential loss of life and billions of dollars in property damage. The beaches, barrier spits and coastal bluffs of Rhode Island, and particularly of Block Island, are vital economic, environmental, and cultural resources. Acceleration coastal erosion could have a significant impact on the local economy and natural environment.

**Previous Occurrences and Probability of Future Events**
Coastal erosion is an ongoing process, however, it can be assumed that some previous significant storm events such as high winds, flooding, hurricanes, Nor'easters, have contributed to coastal erosion or have increased the risk of future coastal erosion. New Shoreham is *highly likely* to be impacted by coastal erosion over the next 5 years.

### *4.4.G. Dam Breach*

**Description**

Dam failures due to natural events such a prolonged periods of rainfall and flooding can result in overtopping, which is the most common cause of dam failure. Overtopping occurs when a dam's spillway capacity is exceeded and portions of the dam which are not designed to convey flow begin to pass water, erode away, and ultimately fail. Dam failures can create the most damaging flash flood events. When a dam or levee breaks, a large quantity of water is suddenly let loose downstream, potentially destroying anything in its path.

**Location**

The State of Rhode Island created an inventory of dams in Rhode Island when it instituted Dam Safety Regulations in 2007 through the Rhode Island Department of Environmental Management. There are only two dams located in New Shoreham, identified as State ID # 424 and #765. (A third, identified as #470 was determined not to be present, and was removed from the inventory.) Both dams are in the location of Mill Tail Brook near the Town Hall.

**Extent**

DEM has classified both of the dams in New Shoreham as "Significant Hazard." The hazard classification relates to the probably consequences of failure of the dam; it does not relate to the current condition or the likelihood of failure of the dam. "Significant Hazard" means "a dam where failure or misoperation results in no probable loss of human life but can cause major economic loss, disruption of lifeline facilities or impact other concerns detrimental to the public's health, safety or welfare. Examples of major economic loss include washout of a state or federal highway, washout of two or more municipal roads, loss of vehicular access to residences, (e.g. a dead end road whereby emergency personnel could no longer access residences beyond the washout area), or damage to a few structures." (RI State Hazard Mitigation Plan, 2008, page 41).

**Previous Occurrences and Probability of Future Events**

Rhode Island has experienced many dam failures, mainly resulting from major flood events. The probability of future dam failure events is not easily measured, but correlates to some extent with the probability of future major flood events coupled with preventative measures, including the routine inspection, maintenance, repair, and proper operation of dams. It is *possible* that a dam breach could occur on Block Island over the next 5 years.

### *4.4.H. Sea Level Rise*

**Description**

Changes in the climate, or alterations in the earth's overall weather trends, including air temperatures, length of seasons, annual precipitation and sea levels, is a scientifically documented fact. Governments at all levels will ultimately be forced to address the myriad negative impacts, particularly on the built environment.

The main issues surrounding climate change are rising global temperatures, and the resulting increase in weather extremes such as more frequent floods, droughts and rising sea levels. Climate change and sea level rise also has the potential for displacement of coastal populations and threatened infrastructure.

According to the Rhode Island Coastal Resources Management Council (CRMC), potential effects of a rise in sea level include:

1. INCREASED EXTENT OF FLOOD DAMAGE AND GREATER VULNERABILITY TO STORM SURGES IN LOWER ELEVATIONS;
2. GREATER RISK TO INFRASTRUCTURE—ROADS, SEWERS, STORMWATER FACILITIES, UTILITIES—IN AREAS MORE PRONE TO FLOODING;
3. SALTWATER INTRUSION INTO AQUIFERS CONTAMINATING WATER SUPPLIES;

4. HIGHER WATER TABLES RESULTING IN SUBSURFACE ISSUES SUCH AS WET BASEMENTS;
5. A SIGNIFICANT INCREASE IN INCIDENCE OF EXTREME HIGH TIDE LEVELS;
6. MORE COASTAL LANDS BECOMING SUSCEPTIBLE TO EROSION DUE TO INCREASED INTENSITY AND FREQUENCY OF STORMS;
7. A NET LOSS OF COASTAL MARSHES THAT BECOME INUNDATED AT A GREATER RATE, RESULTING IN A LOSS OF SALT MARCH VEGETATION AND AN ALTERATION OF HABITAT TYPES.

Sea level rise, a result of thermal expansion and melting of the glaciers in Greenland and Antarctica, is occurring at an accelerating rate. In the northeast over the past half century, sea levels have been increasing three to four times faster than the global average rate, resulting in a 6 inch rise between 1970 and 2012. By 2050, sea level rise is Rhode Island is projected to increase by one foot or more above 1990 levels, and by 2100, by three to five feet.

## Location

In 2013, the Town conducted a Sea Level Rise Adaptation Study which identified potential strategies the town can implement to prepare for and mitigate potential impacts of sea level rise. Inundation mapping conducted as part of the study shows land, docks, and roadways surrounding the Great Salt Pond as being either inundated by sea level rise or more susceptible to flooding during extreme storm conditions as a result of sea level rise. Specific strategies to mitigate the impacts of sea level rise include the raising of roadbeds and flood-proofing of pump stations.

Preliminary project mapping was prepared by the New Shoreham GIS Department applying the digital elevation model of coastal Rhode Island made available through the Rhode Island Sea Grant Program. These maps show the impact of one, three and five foot sea level rise, as well as the areas inundated by the Hurricane of 1938, on the entire island, with more detail focused on the area between Old Harbor and New Harbor. The model uses elevations of the coastal areas of the state based on the consolidation of a number of digital elevation data sources, including bathymetric data, and tidal conditions as measured by the Newport tide gage. This elevation model has been used around the state to show the dramatic impacts of various sea level rise scenarios on the landscape and built environment.

A goal of this project is to verify and improve the level of detail provided by these preliminary maps, and to show the various degrees of inundation that will occur under various sea level rise and storm surge scenarios. Of particular interest are impacts on the Old Harbor breakwater, the docks, the ferry landing and staging area, the land areas and adjoining docks at New Harbor, and many of the roadways in between and leading to other parts of the island.

A second set of maps was generated using data from the statewide LiDAR survey of 2011. This more accurate depiction of elevations on the island, along with 2011 aerial photography, provided valuable information for education and public discussion.

Additionally, sea level rise inundation mapping conducted as part of the local Comprehensive Plan update indicates that portions of Corn Neck Road (5 sections), Ocean Avenue (5 sections) and Beach Avenue (2 sections) are projected to be inundated as a result of 3 to 5 feet of sea level rise.

### *Impacts of Sea Level Rise as Mapped*

The maps showed cumulative impacts of four inundation scenarios: the elevation of mean higher high water (MHHW) plus one foot sea level rise (SLR); three foot SLR; one foot plus three foot storm surge; and five foot SLR. These same scenarios are presented in additional maps breaking the project area into three sections for greater detail: Old Harbor, Village and Corn Neck Road; Ocean and Beach Avenues; and New Harbor. For ease in understanding the cumulative impacts at each level of sea rise, the study area is shown as impacted by just one foot SLR, three foot SLR, and five foot SLR.

#### Old Harbor and Marine Facilities

Preliminary mapping showed that under the most extreme scenario, five foot SLR, the breakwater that forms the harbor of refuge would be partially inundated, along with up to half of the ferry landing area. The updated project mapping shows significant inundation impacts on the breakwater, particularly the west and north sections. Dramatic results will occur as sea level rise reaches three feet, when these sections of the breakwater will be entirely submerged. The eastern section of the breakwater will be narrowed under three foot SLR and significantly compromised under five foot SLR. A portion of the beach area between Ballard's and the south end of the eastern breakwater will be submerged under five foot SLR. These scenarios show that, as sea level rises, the breakwater as currently constructed would be expected to provide only marginal protection to the inner harbor area, and certainly would be breached by waves on top of storm surge generated by tropical and extra-tropical storms.

#### North and West Sections of Old Harbor Breakwater

As sea level rise reaches three feet, some of the marine facilities and shore-side areas of Old Harbor will become flooded. The town dock and adjoining landside area, including the harbormaster's building, will all be inundated, as will the area alongside the ferry docks and the ferry office and ticket building. A three foot storm surge on top of one foot SLR will flood a significant portion of the area, impacting all of the buildings except the freight office. As sea level rise reaches five feet, Old Harbor will become a much different place than it is today, as most of the landing area will be inundated, including all the buildings and about half the parking and queuing area. The natural shoreline (small beach area) west of the

ferry site will eventually loose area to inundation because of its lower elevation. Given the possibility of stronger storm surges, the impacts from rising sea level will be quite dramatic long before the five foot scenario occurs.

ROADWAYS BETWEEN OLD HARBOR AND NEW HARBOR

Access out of Old Harbor includes a number of roads – Spring Street, High Street, Old Town Road – that lead to the central and southern parts of the island. These all rise in elevation and are not subject to any foreseeable inundation scenarios. However, as climate changes, some roads will be subject to more severe and frequent storm induced erosion damage. The section of Spring Street (not included in this study) damaged by Super Storm Sandy adjoins a bluff that was undercut by wave action. The narrow part of Corn Neck Road was damaged by waves accompanying the storm surges of Sandy. While the actual loss of the road to the rising sea appears to be many years away, it will be subject to storm erosion in the meantime.

For the village area road system, the impact of sea level rise will be increased flooding and the eventual submergence of some sections. The two bridges – Beach Avenue, near its intersection with Corn Neck Road, and Ocean Avenue, approaching New Harbor – are vulnerable as well. The roads and bridges connecting Old Harbor to New Harbor include many areas that are vulnerable to flooding from the large inland water bodies tidally connected to the Great Salt Pond – Harbor Pond and Trim's Pond. As sea level rises, the geography of the area connecting the harbors will be dramatically impacted, requiring that alternatives to the present roadway configuration be developed.

The impacts will be noticeable as sea level rise reaches three feet. Ocean Avenue, between the intersection with Corn Neck Road (Bridge Gate Square) and Beach Avenue, will be inundated in a couple of areas, including its intersection with Connecticut Avenue, which connects with Old Town Road to the south and is an access to the center of the island. Beach Avenue, west of its intersection with Ocean Avenue and another important access to the center of the island, will be inundated due to flooding associated with a large wetland system behind the Block Island power plant. Most dramatically, the section of Ocean Avenue between the Hog Pen and Payne's Dock, including its intersection with West Side Road, the major road connecting New Harbor with the outlying residential areas, will be completely flooded on an average high tide.

As sea level rise reaches five feet, the flooded areas described above will be enlarged significantly; most of Ocean Avenue between Bridge Gate Square and Beach Avenue will be inundated, as will both approaches to the Beach Avenue Bridge, cutting off connection to Corn Neck Road. Corn Neck Road will be flooded along its west side from a rising Trim's Pond. At its present elevation, the Ocean Avenue Bridge will be lost, as will a small complex of buildings on the west side of Ocean Avenue just south of the bridge.

With no changes to infrastructure, the result of three foot SLR, and eventually five foot SLR, will be the isolation, in terms of public roadway access, of a number of areas in and around the village and New Harbor. This includes residential and commercial areas adjoining most of Ocean Avenue west of Bridge Gate Square. When the bridges are damaged or become impassable, the peninsula that separates the east portion of Trim's Pond from Harbor Pond, traversed east-west by Beach Avenue, will be cut off from both Corn Neck and New Harbor, and from the remainder of the island by flooding along Beach Avenue to the west and that described along Ocean Avenue. This area includes a number of residences and some inns, but most significantly, the public safety buildings – the police station, and next door, the fire station which also houses the island's ambulance services.

NEW HARBOR

In New Harbor, all the marine facilities will eventually sustain impacts to some degree. The shoreline areas alongside the three dock structures will eventually succumb to higher sea levels, requiring adjustments. The buildings associated with Champlin's Marina, and with the Boat Basin, including a commercial building and a popular restaurant, appear to be protected by elevation. However, the dock at Champlin's, and more significantly, Payne's Dock, show inundation as sea level rise reaches three feet. A large wetland system lying between Champlin's and the Boat Basin can absorb a lot of the eventual flooding impact. However, as sea level rises, the impacts of storm surges will become more significant and as it reaches five feet, the Boat Basin complex will be cut off from West Side Road.

More significant is the permanent loss of a large low-lying area between Payne's Dock and the Hog Pen on both sides of Ocean Avenue, which as stated above, will be completely inundated at three foot SLR. On the west side it includes a cottage associated with the Narragansett Inn property, a mostly hilly parcel which lies between the Boat Basin and Payne's Dock and fronts a small beach (unaltered shoreline). On the east side of Ocean Avenue the doomed area supports a large restaurant, a small residence and the BI Maritime Institute building which also houses a restaurant. At five foot SLR more of this area will be inundated, as will the Ocean Avenue Bridge (at its present elevation).

This inundation scenario indicates an opening between two sections of Trim's Pond near its inlet with the Great Salt Pond by the submergence of a significant area of low-lying land. This will result in the creation of a small island in the middle of an enlarged Trim's Pond; if the Ocean Avenue Bridge is abandoned, it will have no roadway connection to the rest of the island. This small area is partially developed, used for marina and boat rental activities and the storage of individual oil tanks, but with no permanent structures. The complete inundation of the lower section of Ocean Avenue will mean that someday the only way to connect New Harbor with the rest of the island, including Beach Avenue, will be by West Side Road.

SEWER LINES AND PUMP STATIONS

The village area subjected to the impacts of climate change and sea level rise is also associated with the Town's water and sewer districts. The Town's sewage treatment processing facility is located just south of the Old Harbor village area on Spring Street and does not appear vulnerable to either storm surges or sea level rise. It also has two diesel generators, used to run the sewage treatment plant during the summer season as an alternative to the high cost of electricity on the island.

Sewer lines run along all of the streets in the village area and a short distance along Corn Neck Road. Ocean Avenue has sewer lines for its entire length; this line which continues along West Side Road, provides sewer services to all of the marine businesses – Payne's Dock, the Boat Basin and Champlin's Marina. There are a number of pump stations, five shown within the study area.

## Extent

Block Island is one of the most susceptible communities in the State to impacts from projected rises in sea level. Recent NOAA scenarios project 2 meters (6.6 feet) of sea level rise by 2010.

As a result of sea level rise, both hurricanes and Nor'easters will be more damaging to property on Block Island, and coastal flooding effects will be felt farther inland. For instance, storm surge heights will increase as sea level rises, resulting in many more properties being damaged or destroyed during a storm. Residential and commercial structures, roads, and bridges will be more prone to flooding. Sea level rise will also reduce the effectiveness and integrity of existing seawalls and revetments, designed for historically lower water levels.

*The combination of higher sea levels and high tides, along with increased frequency of more severe storms will result in greater coastal flooding and erosion, and more widespread property and infrastructure damage.*

Sea level rise, even if not immediately threatening in the form of inundation to a particular coastal site, has a negative impact in other ways. The elevation of a spring high tide today could be the equivalent of a daily high tide in the future, and surges during storms, especially in conjunction with a high tide, will be greater in intensity. The shoreline will also be subject to greater storm induced erosion.

## Previous Occurrences and Probability of Future Events

Climate change and sea level rise are not issues to address in the distant future but something already present and recordable, requiring Block Island to take

action now to mitigate potential impacts. In Rhode Island, as in the other New England states, there has been a documented increase in the average annual air temperature, as well as the temperature of Narragansett Bay. The amount of precipitation has increased gradually over the past 100 years, which has resulted in more intense storms with greater flooding, although there is less snow in the winter. The intensity of hurricanes has increased, and sea level rise is evident; as measured at tide gages in Newport, sea level has increased 8.7 inches since 1930.

Probability: It is *possible* that a sea level rise could impact Block Island over the next 5 years.

*The following hazards profiled are of low priority.*

### *4.4.I. Drought and Extreme Heat*

**Description**

Drought is characterized as a continuous period of time in which rainfall is significantly below the norm for a particular area. The American Meteorology Society defines drought as a period of abnormally dry weather sufficiently long enough to cause a serious hydrological imbalance. Drought differs from other natural hazards in that it is not something that occurs suddenly. Rather, a drought evolves over months or even years and, while causing very little structural damage, can have profound economic, environmental, and social impacts.

Four methods are used to define the severity of drought: meteorological, hydrological, agricultural, and socioeconomic. Meteorological drought refers to a reduction in the normal rainfall for a given geographic area. This is area-specific, as the average rainfall can vary greatly in different areas.

Hydrological drought is based on the amount of surface and groundwater relative to normal levels. Agricultural drought pertains to the amount of moisture in soil available for plants. Socioeconomic drought measures the impact of any or all of the first three on people and businesses.

Drought levels are measured using several major hydrologic indices; precipitation, groundwater, and surface water are evaluated in terms of departure from normal. Normal is defined as the statistical average of the data for the period of record. The time of year may influence this process. Groundwater and reservoir data are also used in conjunction with statewide data to determine drought levels.

The Rhode Island Drought Steering Committee assigns drought levels for the seven designated drought regions in the state, based on hydrological indices such as precipitation, groundwater, stream flow, and the Palmer Drought Index (PDI),

as well as local supply indices such as static groundwater and reservoir levels. Normal, Advisory, and Watch levels are issued statewide. Warning and Emergency levels are issued on a regional basis and consider local conditions, source of water supply, and water storage capacity issues.

## Location

Block Island's groundwater supplies are finite, irreplaceable, and essential to the town's quality of life and economic wellbeing. The island's freshwater ponds are vital elements in the island's environmental system. Two of them, Sands Pond and Fresh Pond, are parts of the community's sole source aquifer upon which both public and private water supplies depend. The Rhode Island Department of Environmental Management (DEM) has classified the groundwater under all of Block Island as "GAA," the highest classification, which, in most communities, is limited to highly selective areas. Because the water supply is replenished only by rainfall, a drought would have a significant impact on all aspects of the island's wellbeing.

Block Island's municipal water system relies on five active wells located in the Sands Pond wellhead protection area. Fresh Pond serves as an auxiliary reservoir. In addition, there are 26 "non-community" groundwater supplies operated by marinas, restaurants, inns and hotels, located in the 1200 acre Harbor wellhead area near the downtown commercial district. More than 90 percent of island residents rely on private wells.

## Extent

With a large percentage of Block Island residents dependent on private wells for drinking water, a prolonged drought would pose a major health hazard if its effects on the water supply were not mitigated with preventive measures. Additionally, a drought would have a negative economic impact.

The Water District has planned for emergencies, including drought, and has a system of primary sources with redundant back-up sources in the event of emergency need. When installed, the individual water supply systems distributed across the island typically are designed with location and depth that should assure continued adequate supply even in droughts of historic severity.

With or without drought conditions, New Shoreham encourages water conservation measures, and publishes public service announcements educating residents and visitors and encouraging them to conserve water and other natural resources. The Town does not have any plans in place to address water shortage.

The Palmer Drought Severity Index (PDSI), shown in Table 7 below, was devised in 1965. It was the first drought indicator to assess moisture status

comprehensively. It uses temperature and precipitation data to calculate water supply and demand, incorporates soil moisture, and is considered most effective for unirrigated cropland. It primarily reflects long-term drought and has been used extensively to initiate drought relief.

| Table 7 - Palmer Drought Severity Index | |
|---|---|
| ***Severity*** | ***Index Value*** |
| Extreme Drought | -4 or less |
| Severe Drought | -4 to -3 |
| Moderate Drought | -3 to –2 |
| Mild Drought | -2 to –1 |
| Incipient Dry Spell | -1 to –0.5 |

### Previous Occurrence and Probability of Future Events

Extended droughts are rare in Rhode Island with a record of six major droughts (those lasting more than one year) since 1929. The longest and most severe drought occurred in 1963-1967, and affected most of the northeast. Water shortages affected most communities in Rhode Island and several municipal supply wells were drilled to augment declining public supplies.

The current and future demand for water in New Shoreham is a function of the population growth. Since the population is expected to grow only slightly during the next 25 years, water needs are not expected to increase significantly.

Probability: New Shoreham is *unlikely to be impacted by a drought or extreme heat* over the next 5 years.

## *4.4.J. Earthquakes*

### Description

An earthquake is caused by a sudden displacement within the earth. Strong and destructive earthquakes usually result from the rupturing or breaking of great masses of rocks far beneath the surface of the earth. All earthquakes produce both vertical and horizontal ground shaking. This begins at the focus or hypocenter, deep in the earth, and spreads in all directions. The felt motion is the result of several kinds of seismic vibrations. The primary, or P waves are compressional. The secondary, or S waves have a shear motion. These body waves radiate outward from the fault tot eh ground surfaces where they cause ground shaking.

The fast moving P waves are the first to cause the vibrations of a building. The S waves arrive next and may cause a structure to vibrate from side to side. Rayleight and Love waves (surface waves), which arrive last, cause low-frequency vibrations and are more likely to cause tall buildings to vibrate. Surface waves decline less rapidly than body waves, so as the distance from the fault increases, tall buildings located at relatively great distances from the epicenter can be damaged.

Geologists have found that earthquakes tend to reoccur along faults, which reflect zones of weakness in the Earth's crust, a theory known as plate tectonics. Earthquakes beneath the ocean floor sometimes generate immense sea waves or tsunamis. These waves travel across the ocean at speeds as great as 597 mph, and may be 49 feet high or higher by the time they reach the shore. Liquefaction, which happens when loosely packed, water-logged sediments lose their strength in response to strong shaking, causes major damage during an earthquake.

## Location

New Shoreham, Rhode Island is located in a region of the North American tectonic plate and falls within seismic Zone 2A with 8-16% ground acceleration, which translates to a "moderate" seismic hazard. People may experience moderate intensity shaking that can lead to slight damage during an earthquake event. There are no significant geologic fault lines in New Shoreham or the surrounding regions of Rhode Island or New England, and the USGS Earthquake Hazards Program identifies all of Rhode Island as a low seismic risk area. Earthquakes occur infrequently in Rhode Island and surrounding New England, but historically earthquakes originating in other states have been felt in various parts of Rhode Island.

## Extent

The severity of an earthquake can be measured in terms of both intensity and magnitude. Intensity is based on the observed effects of ground shaking on people, buildings, and natural features. The scale currently used in the United States is the Modified Mercalli Intensity (MMI) Scale (See Table 8). This scale is composed of 12 increasing levels of intensity, ranging from imperceptible shaking to catastrophic destruction, and is an arbitrary ranking based on observed effects. Magnitude is a measure of the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on instruments which have a common calibration, called seismographs, using the Richter Magnitude Scale (See Table 8). The Richter scale does not express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does no damage. Large magnitude earthquakes occurring beneath the ocean may not even be felt by humans.

Events with magnitudes of 4.5 or greater are strong enough to be recorded by sensitive seismographs. Great earthquakes have magnitudes of 8.0 or higher. On average, one earthquake of such size occurs somewhere in the world each year. Only two earthquakes of MMI Scale V (five) or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake, with magnitude 4.6 on the Richter scale.

Impacts from earthquakes can be severe and cause significant damage. Ground shaking can lead to the collapse of buildings and bridges and damage to gas and electric lines, phone service, and other critical utilities. Death, injuries, and extensive property damage are possible. Secondary hazards resulting from earthquakes include fire, hazardous material spills, landslides, flash flooding, avalanches, tsunamis, and dam failure.

Despite the low probability of a high impact earthquake, some physical characteristics in Rhode Island may increase the vulnerability to earthquakes. These include New England's hard base rock, which increases the conduction of seismic energy; the soft soil present in New England's coastal regions, which can magnify an earthquake's effects; the large number of older, unreinforced masonry structures in New England, which make them very vulnerable to seismic forces; and low public awareness of earthquake threat or preparation for this hazard.

If Block Island experienced a strong earthquake, critical facilities and services, town buildings, and residences could be impacted with potential structural damage. The effects could impact transportation, communications, power, and emergency capabilities.

| Table 8- Richter Magnitude Scale and the Modified Mercalli Intensity Scale | |
|---|---|
| ***Richter Magnitude Scale*** | ***Modified Mercalli Intensity Scale*** |
| 1.0 to 3.0 | I |
| 3.0 to 3.9 | II |
| 4.0 to 4.9 | IV to V |
| 5.0 to 5.9 | VI to VII |
| 6.0 to 6.9 | VII to IX |
| 7.0 and Higher | VIII or Higher |
| **Defined Modified Mercalli Intensity Scale Rating** | |
| I | Not felt except by a very few under especially favorable conditions |
| II | Felt only by a few persons at rest, especially on upper floors of buildings |
| III | Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. |
| IV | Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windos, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. |
| V | Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop. |
| VI | Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. |
| VII | Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. |
| VIII | Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, wallks. Heavy furniture overturned. |
| IX | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. |
| X | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. |
| XI | Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. |
| XII | Damage total. Lines of sight and level are distorted. Objects thrown into the air. |

## Previous Occurrences and Probability of Future Events

Rhode Island is not prone to major earthquakes; however, they are not unknown to the area, although usually felt only as a slight rumble lasting seconds. As Table

6 shows, Block Island has experienced the effects of several earthquakes in the past.

The most recent earthquake centered in Rhode Island was near Exeter in December of 2012, measuring 1.0 on the Richter Scale. Most quakes felt in Rhode Island are centered in surrounding states (See Table 9). Therefore, earthquakes should be considered a hazard to Block Island, but with low priority.

Earthquakes are impossible to predict with any degree of accuracy. Rhode Island is located in an area of moderate seismicity and high risk. Seismic risk applies to the seismic hazard, location demographics, and regional economics to the vulnerabilities of the structure or lifeline on the site. Seismologists have estimated that there is about a 50% probability of a very damaging magnitude 5.0 earthquake occurring anywhere in New England in a 50 year period.

Probability: New Shoreham is *unlikely to be impacted by an earthquake* over the next 5 years, however, it is *possible*.

| Table 9 – Significant Earthquakes in Region | | |
|---|---|---|
| **Date** | **Point of Origin** | **Impact on RI** |
| February 28, 1925 | St. Lawrence River region | Intensity V affects felt on Block Island and in Providence. Intensity IV effects felt in Charlestown |
| November 19, 1929 | Grand Banks of Newfoundland | Moderate vibrations felt on Block Island and in Chepachet, Newport, Providence and Westerly |
| November 1, 1935 | Quebec, Canada | A magnitude of 6.25 with intensity IV felt on Block Island and in Providence and Woonsocket |
| December 20 & 24, 1940 | Lake Ossipee, NH | Intensity V affects knocked pictures off walls in Newport. Intensity IV effects were felt at Central Falls, Pascoag, Providence and Woonsocket. Intensity I-III effects were felt at Kingston, New Shoreham and Wakefield. |
| September 4, 1944 | Massena, NY | Intensity I-III reported in Kingston, Lonsdale, Providence, Wakefield and Woonsocket |
| October 16, 1963 | Coast of Massachusetts | A magnitude 4.5 quake caused Intensity V to be felt in Chepachet with reports of some cracked plaster. There were also reports of rattling windows and dishes and rumbling earth sounds. Other Northern RI locations felt the tremor, but with less intensity. |
| December 7, 1965 | Unknown | Windows and doors shook in Warwick and furniture and small objects moved in Bristol. |
| February 2, 1967 | Unknown | A magnitude 2.4 created intensity V effects in Middletown, Newport, North Kingstown and Jamestown. No damage reported. |
| February 3, 1973 | Unknown | Explosion like or sonic boom noises were heard throughout RI and houses and windows shook, but nothing was reported by seismographs. |
| June 14, 1973 | Western Maine | Intensity IV effects felt at Charlestown and Intensity I-III felt at Bristol, E. Providence, Harmony and Prov. |
| October 6, 2003 | West Warwick | A magnitude of 1.8 caused minor shaking in the community, no damage reported |
| November 2007 | West of Warwick, RI | Unknown |
| August 2011 | Near South Kingstown, RI | 0.9 magnitude earthquake |
| December 2012 | Near Exeter, RI | 1.0 magnitude earthquake |

*Source: US Geological Survey; Earthquake History of Rhode Island*

## 4.4.K. Tornadoes

### Description

A tornado is a violently rotating column of air in contact with and extending between a cloud and the surface of the earth. Winds in most tornadoes are 100 mph or less, but in the most violent, and least frequent tornadoes, wind speeds can exceed 250 mph. Tornadoes typically track along the ground for a few miles or less and they measure less than 100 yards wide, though some can remain in contact with the earth for well over fifty miles and exceed one mile in width.

Several conditions are required for the development of tornadoes and the thunderstorm clouds with which most tornadoes are associated. Abundant low level moisture is necessary to contribute to the development of the thunderstorm and a "trigger" (perhaps a cold front or other low level zone of converging winds) is needed to lift the moist air aloft. Once the air begins to rise and becomes saturated, it will continue rising to great heights and produce a thunderstorm cloud, if the atmosphere is unstable. An unstable atmosphere is one where the temperature decreases rapidly with height. Finally, tornadoes usually form in areas where winds at all levels of the atmosphere are not only strong, but also turning with height in a clockwise direction.

A tornado begins in a severe thunderstorm called a super cell. A super cell can last longer than a regular thunderstorm. The wind coming into the storm starts to swirl and forms a funnel. The air in the funnel spins faster and faster and creates a very low pressure are that sucks more air (and sometimes objects) into it. The severe thunderstorms that produce tornadoes form where cold dry polar air meets warm moist tropical air. This is most common in a section of the United States called Tornado Alley.

Tornadoes can form at any time during the year, but most occur in May, although northern areas experience the peak tornado season later. Tornadoes are measured by the damage they produce and the wind speed they generate. The Storm Prediction Center issues tornado and severe thunderstorm watches. A tornado watch does not indicate an imminent tornado, but rather an advisory to be alert and prepared to seek shelter. If a tornado has been detected, or if Doppler radar identifies a thunderstorm circulation capable of spawning a tornado, a tornado warning is issued by the local National Weather Service (NWS) office.

### Location

New Shoreham is located outside of Tornado Alley, which extends from Texas to the Dakotas. However, tornadoes may occur in Rhode Island including New Shoreham at any time. These can be dangerous because Rhode Island tornadoes

are rare, residents do not expect them, and are ill-prepared to respond to a tornado. In New Shoreham, tornadoes are considered to be low frequency, high-impact events.

## Extent

The immediate threat of a tornado is danger to life and property from wind and large debris carried by wind. Other vulnerabilities include electrical utilities, gas lines, and communications infrastructure, and also water mains and sewer systems. A tornado has the potential to cause outages for residents, businesses, and critical facilities, as well as danger to personal safety. Downed wires and lightning strikes can also start fires. Human vulnerability is dependent upon early warnings of tornadoes, and access to adequate shelter. Indoor shelter on the lowest floor of a substantial building away from windows is the best protection from bodily harm.

Table 10 below describes the Fujita Tornado Damage Scale, a set of wind estimates based on damage.

**Table 10 - Fujita Tornado Damage Scale**

| Scale | Wind Estimate (mph) | Typical Damage |
|---|---|---|
| F0 | < 73 | Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged. |
| F1 | 73-112 | Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads. |
| F2 | 113-157 | Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground. |
| F3 | 158-206 | Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown. |
| F4 | 207-260 | Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated. |
| F5 | 261-318 | Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yds); trees debarked; incredible phenomena will occur. |

**Previous Occurrences and Probability of Future Events**

While uncommon, tornadoes in New England can inflict substantial damage. From 1950 to present, approximately 20 tornadoes were reported in or near Rhode Island, but none as devastating as the tornado that hit Worcester Massachusetts on July 9, 1953, leaving 90 killed and 1,300 injured. The strongest tornado on record in Rhode Island occurred on August 7, 1986, in the Providence, Cranston area, causing 20 injuries, and significant property damage. A powerful series of tornadoes occurred on June 1, 2011 spanning southwest and south-central Massachusetts and southern Maine. Four tornadoes touched down in Massachusetts, resulting in three deaths, over 200 injuries, and $140 million in property damage. On July 28, 2014, a tornado touched down in the coastal community of Revere, Massachusetts. At least 65 buildings were destroyed or damaged, and over 2,800 residents lost power. Block Island has no record of tornadoes, but it is possible for one to occur.

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 on Block Island would be a very rare event; however it cannot be ruled out because the conditions that generate tornadoes can happen anywhere.

Probability: New Shoreham is *unlikely* to be impacted by a tornado during the next 5-years.

### *4.4.L. Wildfires*

**Description**

Wildfires are fueled by natural cover, including native and non-native species of trees, brush, grasses, and crops, along with weather conditions and topography. While fuel, topography, and weather provide the conditions that allow wildfires to spread, most wildfires are caused by people, through criminal or accidental misuse of fire.

Wildfires pose serious threats to human safety and property in rural and suburban areas. They can destroy crops, natural resources, recreation areas, and critical wildlife habitat. Wildfires are commonly perceived as hazards in the western part of the United States; however, wildfires are a growing problem in the wildland/urban interface of the east, including Rhode Island.

Climatic and meteorological conditions that influence wildfires include solar insulation, atmospheric humidity, and precipitation, all of which determine the moisture content of wood and leaf litter. Dry spells, heat, low humidity, and wind increase the susceptibility of vegetation to fire. In Rhode Island, common factors leading to large fires include short-term drought, humidity below 20%, and fuel type.

Various natural and human agents can be responsible for igniting wildfires. Natural agents include lightning, sparks generated by rocks rolling down a slope, friction produced by branches rubbing together in the wind, and spontaneous combustion. Human=caused wildfires are typically worse than those caused by natural agents. Arson and accidental fires usually start along roads, trails, streams, or at dwellings that are generally on lower slopes or at the bottom of hills and valleys. Nurtured by updrafts, these fires can spread quickly uphill. Arson fires are often set deliberately at times when factors such as wind, temperature, and dryness contribute to the spread of the fire.

## Location

Approximately 45% of Block Island's 6,000 acres is conserved or regulated open space. Much of this land is critical habitat for the many protected and endangered species on the island. Although these large areas of open space contribute to the island's rural character, they also provide fuel that could raise the potential risk of wildfires. Many of these undeveloped natural areas are not easily accessible for firefighters and fire protection equipment, further increasing risk and vulnerability.

New Shoreham, like the rest of Rhode Island, generally experiences a humid continental climate, with hot, rainy summers and cold winters. This results in a low or medium (Class 1 or 2) fire class rating. However, dry, windy weather does occur, and drought can exacerbate fire conditions. The peak fire season in Rhode Island is typically between March and May. During this time, there is no leaf canopy, so the sun can dry out grasses and fallen leaves. Windy conditions and the low humidity of spring further contribute to an increased fire risk. Although less common, wildfires may be a risk during the summer and fall, particularly if drought conditions occur.

## Extent

Wildfires have the potential to destroy valuable natural resources, damage real estate property, and threaten people's lives and livelihoods. Predicting of the potential risk of a wildfire, and the forewarning of wildfire conditions can help to reduce the incidence and seriousness of wildfires. It can also provide firefighters with the critical time needed for readiness and preparation, and also assist decision makers in limiting public activities to aid in prevention.

The U.S. Forest Service has established the national Fire Danger Rating System (NFDRS) to determine the daily risk of fire for different regions of the country. The fire indexes are grouped into five classes, based on severity and an associated fire risk level. Class 1 has no rating, and the remaining classes progress from low to extreme danger.

## Previous Occurrences and Probability of Future Events

Though wildfires are not especially common in Rhode Island, they do occur, and their effects can be devastating. In 1894 a large woodland fire burned along Post Road (Route 1) between Wakefield and Westerly and destroyed timber supplies and Charlestown as well as several farmhouses. In 1930 and 1942, major forest fires swept through western Rhode Island burning tens of thousands of acres of timber.

There is no recorded history of major brush fires on Block Island. However, the potential exists, especially on the west side of the island where vegetation is lush. A fire in this area would be very difficult to control due to the lack of fire hydrants and terrain that makes access by emergency vehicles difficult.

Probability: New Shoreham is *unlikely* to be impacted by a significant wildfire over the next 5 years.

# 4.5 Vulnerability

As identified in Section 3.2, New Shoreham is vulnerable to a number of natural hazards, with the potential for substantial loss of life and damage to people, property, and natural resources. Vulnerability includes all populations and assets (environmental, economic and critical facilities) that may be at risk from natural hazards. Vulnerability is a function of the built environment, local economy, demographics, and environmental uses of a given region. Vulnerability analysis measures the level of assets, populations, and resources within New Shoreham. This section examines the vulnerability of the populations exposed to hazards, and whether shelter capacity is sufficient. It examines the vulnerability of the built environment, as well as environmental vulnerability. Referencing this plan and its mitigation initiatives in the Comprehensive Plan will benefit the community by reducing human suffering, damages, and costs of recovery, and also help to maintain the long-term sustainability and economic health of the town.

## 4.5.A. Community Assets

New Shoreham's community assets include its people, the local economy, the build environment, and the natural environment. By examining the vulnerabilities of each of these assets, the town will be better prepared to respond to natural hazards, and protect these assets.

### *People*

New Shoreham's Census 2010 year-round population is 1,051, projected to grow steadily, but only slightly, from 1,116 in 2015 to just under 1,400 in 2040. The largest age demographic, according to Census 2010, is those ages 35-50 (330) and 55-74 (329). In contrast, the statewide population is expected decline slightly by 2040, and trend toward an older age demographic. Not measured in the census is Block Island's seasonal population, approximately 15,000 – 20,000 on any given day from June through September. Depending on the time of year, there are potentially two populations at risk. During peak season, in addition to residents, summer "cottagers," weekly house renters and hotel guests, there are daily visitors who arrive in the morning on ferries, planes, and private boats, and leave at day's end. These "day trippers" would not have ready shelter should it be needed. As mentioned in Section 1.2.c., the island's primary shelter is the Block Island School. An American Red Cross trailer near the school holds the supplies needed to furnish the shelter. The Medical Center, located next door, is the smaller, secondary shelter, if needed. These shelters are adequate to serve the year-round population, but inadequate for the larger summer population.

With an impending hazard, such as a hurricane, it is likely that thousands of people could be stranded on the island with inadequate shelter. New Shoreham has an evacuation procedure in place to address this concern. The procedure uses the June 2013 FEMA Hurricane Evacuation Zone Map (Risk Map 4) for New Shoreham, found in Appendix A. With advance warning of a Category 1 or 2 Hurricane or above, visitors would be notified and advised to evacuate the island as soon as possible and prior to the time when ferry service would be cancelled. Zone A includes those housed on the entire shoreline perimeter of the island, and especially those on "the Neck" of the island and on Coast Guard Road, who could be isolated from the rest of the island due to storm surge and flooded roads. Zone B includes residents in the Old Harbor area of town, and those located just south of Dorry's Cove Road on the island's west side. For Category 1, 2 or above, residents in Zone A are advised to move inland and stay with inland residents or move to the island's shelters. For Category 3 or above, residents in Zone B are also advised to move inland and seek shelter. For lesser storms, the town has a mobile emergency unit that is put in place to cover "the Neck" portion of the island.

### *Economy*

According to the town's Comprehensive Plan, updated in 2015, "the economy of Block island is fundamentally shaped by its resort/vacation economy. There is little in the island economy that is not directly or indirectly reliant on that seasonal activity for its financial base." Additionally, fewer than 2% of the island's residents work off-island. The island's economy, and the livelihood of its residents would be devastated in the event of a natural disaster with significant damage. Unfortunately, hurricane season coincides with the peak tourist season. Disruption to the steady flow of tourists visiting the island would have significant negative impact on businesses and the island's economy.

New Shoreham is especially dependent upon the summer season for economic sustainability. In addition, New Shoreham's economy is constrained by its island geography, small land mass, finite commercially zoned property, high land costs, and small year-round population. In recent years, the main components of the economy have been businesses serving residents and visitors to the town, including recreation and leisure services, boating and marine services, retail shops, restaurants and inns, and construction. The Town of New Shoreham is the largest single employer on the island, including municipal and school employees. In addition to the continuation of these essential services, the commercial area of New Shoreham is the most vulnerable to a natural disaster. Any disruption to this area would have a severe negative impact to town residents. Damage to these businesses could cause major economic and social hardship.

In New Harbor, there are five marinas, five restaurants, four hotels, and two seasonal fuel stations to serve the marinas. Old Harbor supports over 50

businesses, including inns, hotels, restaurants, a grocery store, an auto repair shop, a gas station, and a movie theater.

### *Structures*

Block Island consists of residential homes, historical buildings, and hotels/inns that are vulnerable to the effects of natural disasters. The island school also functions as the town's primary shelter. The medical center doubles as a secondary shelter. Other critical facilities at risk are the water, sewer and power plants that serve the island, the town hall, which contains vital documents and records, the fire/rescue building, the post office, library, community and daycare center, post office, transfer station, highway garages, public beach pavilion, gas station, grocery store, telephone company, and the airport and ferry docks. In total, there are 15 municipal buildings with a value of $38,328,413. Critical infrastructure includes bridges, cell towers, sewer and water distribution lines. Damage to these facilities would be detrimental to the residents since these services are not accessible elsewhere, and no neighboring community exists where residents could access alternative services.

New Shoreham's building and zoning codes reflect efforts by the town to be proactive in reducing potential risks from disasters; however, some properties are located in known risk areas.

**Table 11 – FEMA NFIP Insurance Report**

| Community | V-Zone Policies | A-Zone Policies | Total Premium | Total Coverage | Total Claims since 1978 | Total Payments since 1978 |
|---|---|---|---|---|---|---|
| New Shoreham | 10 | 42 | $227,941 | $30,347,900 | 17 | $346,761 |

Source: FEMA NFIP Insurance Report, December 2014

There have also been occasions where properties have been damaged by high winds, but no dollar amount is available for these damages.

### *Infrastructure*

The town's infrastructure is vulnerable to the effects of a natural disaster. This includes the public water supply and wastewater treatment facility. The Block Island Water Company is located on Sands Pond on the south side of the island. Water supply comes from well fields adjacent to Sands Pond. The water company serves the commercial district in Old Harbor, which provides 50% of the island's water demand in July and August with about 300 customers. The treatment plant uses a reverse osmosis membrane treatment system, with Fresh Pond as an emergency backup. Block Island has been designated a sole source aquifer. Approximately 90% of the residents are on private wells.

The town's Wastewater Treatment Plant is located in the commercial district on Spring Street, and provides primary and secondary treatment for waste from its downtown service area. This area extends from the Block Island School and Spring House on the south through both Old and New Harbor Commercial districts and along Corn Neck Road to the Beachhead Restaurant. The configuration of the Water District and the area serviced by sewerage differ, with only a small area served by both. The Water District extends beyond sewerage to the south, while sewerage extends further than the Water District to the north. The Sewer District services New Harbor, but not the Water District. In addition to processing most of the sewage from the Water District, the plant also processes waste from the hotels, marinas and public facilities at New Harbor, waste pumped by contractors from Individual Sewer Disposal Systems, and waste from the pump out boats in the Great Salt Pond.

The privately owned Block Island Power Company (BIPCo) services virtually all of the electric power demand on the island, with a few individual property owners opting to use their own generators, solar panels, and wind energy conversion systems (WECS). Generation consists exclusively of diesel-fired generators. The company is a regulated utility subject to the oversight of the RI Public Utilities Commission (PUC) but exempt from the competitive initiatives introduced on the mainland due to the geographic isolation of its electric power generation and distribution system. BIPCo serves approximately 1,780 customers, ¾ of which are residential. The largest single customer is the town. Due to the seasonal disparity, the company's challenge is to maintain sufficient capacity to meet peak summer demand while running just a single generator to serve the winter population.

The use of diesel fuel to run the generators at the power plant is in the range of 1 million gallons per year, or about one hundred 10,000 gallon tank trucks transported to the island each year by ferry. The handling and storage of this volume of fuel carries the risk of a mishap that could jeopardize the island's aquifer, its sole water source, as well as marine life and other natural resources. The use of diesel fuel as the generation source also requires significant emissions controls to meet current EPA requirements, as well as the transport of urea to the island, which poses its own environmental risk.

The distribution system consists of six 2.4 kilovolt circuits with about fifty miles of lines, the majority of which are overhead lines. The distribution system on Block Island is outdated and inefficient, resulting in large line losses, frequent power supply interruptions, brownouts and damage to appliances and equipment. The system requires upgrading to provide more reliable service. Placing the distribution system underground would keep utilities out of high wind, ice, and the corrosive salt of the island environment, thereby reducing vulnerability to natural hazards, power loss, and fire.

### *Transportation*

Block Island's roads consist of both state and local roads. The town and state have a cooperative agreement, whereby some routine maintenance tasks are covered by the local department and reimbursed by the state. Major repairs and improvements to state roads are contracted by the state.

Block Island's two harbors, Old Harbor and New Harbor, are an important component of the town's infrastructure which are highly vulnerable to natural hazards. Docks and marinas are located in both harbors and are critical transportation infrastructure connecting residents and freight to the mainland.

### *Critical Facilities*

New Shoreham's critical facilities are shown on the map in Appendix A. They include the following:

BLOCK ISLAND SCHOOL (AND PRIMARY SHELTER)
BLOCK ISLAND MEDICAL CENTER (AND SECONDARY SHELTER)
TOWN HALL
POWER COMPANY
POLICE, FIRE AND RESCUE STATION
WATER PLANT
WATER DISTRIBUTION LINES
SEWER PLANT
SEWER PUMP STATIONS
SEWER LINES
STATE HIGHWAY GARAGE
TOWN HIGHWAY GARAGE
TRANSFER STATION
FERRY DOCKS (OLD AND NEW HARBORS)
BLOCK ISLAND AIRPORT
COMMUNITY CENTER/DAYCARE FACILITY
LIBRARY
HISTORICAL SOCIETY
POST OFFICE
CELL TOWER (COMMUNICATIONS)
BRIDGES
OLD TOWN ROAD SLUICE

### *Historic and Cultural Resources*

New Shoreham's historic and cultural resources are integral to its tourism-based economy and economic survival. These include the town's Native American and

agricultural past. Protection of these resources, particularly those listed below, is critical, especially when threatened with natural hazards. The town's historic and archeological resources are well documented to allow the town and private entities to make optimal decisions about property management and preservation. Some of the town's historical and cultural resources have been placed in the National Register of Historic Places.

BLOCK ISLAND HISTORIC DISTRICT
NATIONAL REGISTER DISTRICT
GREAT SALT POND ARCHAEOLOGICAL DISTRICT
NORTH LIGHT
SOUTHEAST LIGHT
BLOCK ISLAND HISTORICAL SOCIETY

### *Future Development*

New Shoreham's Comprehensive Plan cites a basic policy to ensure that future residential growth is compatible with the island's traditional landscape. One of the main goals cited in the Plan is to maintain the current balance of protected land, limited residential development and concentrated commercial and institutional development on the island, and to ensure that its land use policies and regulations, as well as infrastructure and services, support this balance.

The Comprehensive Plan cites a community goal to protect 50% of the island's total land area from development. Currently, approximately 45% of the island's land area is protected from development, including open space, and lands protected by wetland and coastal features controls. Regulations confine businesses to the downtown district, and three-acre lots are required elsewhere on the island.

New Shoreham presently has 1680 housing units. Of those, less than one-third are year-round homes. Since 2006, there were 89 new permits for single-family dwellings. There is the potential for approximately 500 additional new single family homes within the next few decades. The majority of these buildable acres are outside of New Shoreham's flood zones. As previously stated, Block Island's population is projected to increase to 1,400 by 2040 from its current population of 1,050.

The town will need to address the structure that houses the Fire Department in the next few years, and is currently taking steps to renovate the town beach pavilion. The town intends to pursue grant funds to complete these projects.

Block Island has taken steps to incorporate alternative energy into its municipal buildings, including solar electric systems in the new Town Hall, Rescue building and the Block Island School. The community will continue to pursue opportunities for wind power and other alternative energy technologies to reduce the town's

reliance on the present power system, and provide backup sources of power. While these new technologies will alleviate certain risks, they may create new ones, in terms of potential damage to these new systems and equipment.

A 30 megawatt windfarm (5 6-watt turbines) off the coast of Block Island is currently under construction. The New Shoreham "Broadband Working Group", established in 2014, has identified options for improving internet reliability through better or alternative broadband access from the mainland. One opportunity includes leasing fiber from a cable running to the offshore wind farm. The work is ongoing and a solution will be found as reliable high speed internet is critical to the school, the medical center, public safety operations and the economy as a whole.

### *Water Resources*

The environmental and economic values of wetlands are critical on Block Island. Wetlands play an important role in flood control. Wetlands collect and detain flood waters, reducing their force and destructiveness. They also provide a valuable natural service regarding water quality. Wetlands absorb and filter pollutants that could otherwise degrade the quality of water in the island's ponds. Wetlands provide necessary spawning/rearing habitat and food supply for freshwater fish. Wetlands also provide the critical habitat for most waterfowl and other animals and plants. Additional benefits of wetlands include groundwater recharge, erosion control, land formation, and recreation.

Block Island's coastline is one of its most valuable natural resources. In addition, to its coastal features, the Great Salt Pond, connecting ponds and marshes, shellfish habitat and fisheries add to the salt water resources of the island.

The island also boasts hundreds of freshwater bodies. The Sands Pond watershed supplies wells for the municipal water supply. The town is reliant upon surface and ground water for drinking water. Local water resources must, therefore, be protected to ensure a continued source of safe drinking water.

### *Environment and Protected Natural Areas*

Arguably Block Island's most important assets are its natural features and conserved lands. In 1991, The Nature Conservancy (TNC) selected Block Island as one of its 12 initial "Last Great Places" in the northern hemisphere, primarily due to its ecological significance. TNC considers Block Island an internationally significant biodiversity reserve due to the presence of rare and endemic species and habitats and because of the concentrations of songbirds, shorebirds, and raptors that migrate through it. At least 15 rare, threatened or endangered federal or state listed species, including birds, insects, mammals and plants reproduce on the island. Many additional rare birds pass through during migration. The U.S. Fish & Wildlife Service called Block Island "one of the most

important migratory bird habitats on the East Coast." The natural features of the island, including its morainal topography, groundwater supply, freshwater ponds and emergent wetlands, mud flats, salt marshes, sandy dunes and beaches, sea cliffs, and upland shrub habitat and other vegetation provide critical habitat and resources for the species it sustains. Should any of these be contaminated or damaged by natural hazards, whether directly or indirectly, there would be serious repercussions for the island, both ecologically and economically. The Natural Hazards Risk map displays the approximately 45% of Block Island which is protected from development.

## 4.5.B. Risk Analysis & Assessment Matrix

The New Shoreham Hazard Mitigation Committee assessed the town's risks to natural disasters in terms of population, property, economic resources, and probability of occurrence. The committee considered public health and safety, structural damage, area or town-wide evacuation, and economic effects. The committee also identified specific needs and projects that would help mitigate natural disasters.

### Methodology

Vulnerable areas were determined by considering past and potential natural hazards that pose a threat to the population, property, and economic resources of the town. Historical data was reviewed, and more recent hazard events considered. Examining past events helps to some degree in predicting the probability of a similar event occurring in the future.

The benefit of implementing each mitigation action was also considered carefully. Benefits included public safety and protection, economic stability, and continuity of essential services.

### Exposure Analysis

A second criteria in evaluating the risks of New Shoreham to natural hazards is the area of impact. Some hazard events impact only a small area, while others can affect the entire region. Historical data was used to evaluate damage and loss records from previous hazard events to estimate the amount of property damage that might occur from future events.

### Historical Analysis

Priority projects were identified by considering the historical or potential occurrence of natural disasters, the effects on the town, and the benefit that would result if the mitigation action was implemented. Table 7 summarizes the town's risks to natural disasters as a Risk Assessment Matrix.

**Repetitive Loss Properties**

Repetitive loss properties are those for which two or more losses of at least $1,000 each have been paid under the National Flood Insurance Program (NFIP) within any ten year period since 1978. A severe repetitive loss property (SRL) is a structure having a minimum of four claims, each over $5,000, cumulatively adding up to $20,000 or more. New Shoreham has 17 repetitive loss properties (9 non-residential and 8 residential). There are no severe repetitive loss properties.

## 4.5.C. Vulnerability Summary

### *Hurricanes*

New Shoreham is particularly vulnerable to tropical storms. This is due, in part, to the geography of southern New England in relation to the Atlantic seaboard. This places Rhode Island in direct line of any storm that moves northward on a track that parallels the eastern seaboard maintaining a slight north-northeast direction.

A second factor in New Shoreham's vulnerability to hurricanes is due to the significant increases in forward speed by the time the hurricane makes its way northward. Although hurricanes tend to weaken with northward movement, the increase in speed can often compensate with the surge flooding, wave effects, and high winds that accompany a faster moving though weaker hurricane. This means that the effects from a Category 2 hurricane traveling at 60 mph could be worse than those from a Category 4 hurricane moving at 20 mph.

Vulnerability from the impact of a hurricane is affected by the ability to evacuate in advance, storm surge and coastal flooding, and shelter capacity. Damage to power lines of communication towers are some additional effects.

### *Tornadoes*

Tornadoes are a high-impact, low-probability hazard for New Shoreham, whose effect depends upon the intensity and degree of development in its path. Although there have been none documented on Block Island, the entire state of Rhode Island is considered uniformly vulnerable to tornadoes. The type and age of construction affects the vulnerability of facilities to tornadoes. In general, concrete, brick and steel-framed structures tend to fare better in tornadoes than older, wood-framed structures.

### *Thunderstorms and High Winds*

Wind vulnerability is based in large part on building construction and standards. Other factors, such as location, condition, and maintenance of trees also plays an important role in determining vulnerability. If a structure is located on a hilltop, is tall, has other tall structures nearby, or has large exposed windows, it is subject to damage during a strong storm. Communications and power supplies may be compromised, and critical facilities that are not equipped with a backup power source are vulnerable. Because of its open ocean location, Block Island is extremely vulnerable to the effects of strong storms.

### *Winter Related Hazards*

Severe winter storms can cripple New Shoreham. Electrical utilities and communications, and infrastructure are especially vulnerable.

### *Flood Related Hazards*

All areas of Rhode Island are vulnerable to flooding and the impacts associated with it. Local land use regulations and ordinances have done much to control unregulated development within flood hazard areas.

### *Coastal Erosion*

New development along coastal areas in New Shoreham is regulated by CRMC and the town. One regulation requires a Coastal Buffer Zone, or a "land area adjacent to a shoreline (coastal) feature that is vegetated with native shoreline species and which acts as a natural transition zone between the coast and adjacent upland development" on property within 200 feet of the inland edge of a coastal feature. The benefits of the Coastal Buffer Zone include protection of water quality, coastal habitat, scenic and aesthetic quality, erosion and flood control.

### *Dam Breach*

RIDEM has the responsibility to inspect dams and determine their condition on a five year schedule. Two dams on Block Island have been identified as significant hazards.

### *Wildfire*

Although wildfire is not a significant risk on Block Island, precautions are needed to monitor conditions and vulnerabilities.

### *Geologic Related Risks*

Though the projected economic impacts resulting from simulations of the annualized economic losses based on earthquakes for Newport County, Rhode Island, are low ($183,329), the potential economic impact must be considered.

Although New England is considered to have a moderate seismic risk, in general it has a high seismic vulnerability because of the built environment.

In Rhode Island, there is little public recognition of earthquake threat, and no established system to educate the public of the threat or how to prepare or respond to an earthquake. Therefore, it is anticipated that higher losses will occur than in other regions of the country.

### *Drought*

The entire state of Rhode Island is susceptible and vulnerable to the occurrence of a drought. New Shoreham is particularly vulnerable to the effects of drought due to its sole source aquifer designation and the increased demand for water from the large summer population. Because droughts are a normal part of any climate, it is important to have a plan in place providing for response actions.

| Risk Assessment Matrix | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Vulnerable Areas** | **Location** | **Ownership** | **Natural Hazard** | **Primary Problem** | **Mitigation Objective** | **Risk - Historic or Potential** |
| **1** | **Natural Environment** | Island-wide | Town | Coastal Erosion; Hurricane; Wind Storm; Storm Surge ; High Winds; Drought; Wildfire | Recent storm damage uncovered old landfill; further erosion will result in contamination of beach and water | environmental quality; scenic quality; mitigate coastal erosion | Historic & Potential |
| **2** | **Dams & Bridges** | Old Town Road; Mill Tail Brook near the Town Hall | Town / State | Hurricane; Heavy Rains / Flooding;Winter Storm; Sea Level Rise; Dam breach | Major evacuation route; cannot support emergency vehicles; property downstream subject to flooding | maintain evacuation route; ensure public safety; prevent property damage from flooding | Historic |
| **3** | **Critical Roads** | Corn Neck Road, Beach Avenue, Ocean Avenue | Town / State | Hurricane; Wind Storm; Sea Level Rise; Storm Surge | Residents vulnerable from being cut off from the rest of the island and emergency services; single road access is susceptible to inundation | public safety for the residents of the northern end of the island | Historic & Potential |
| **4** | **Essential Services** | Island-wide | BIPCO/Town | Hurricane; Severe Winter Weather; Earthquake; Flooding; Storm Surge; High Winds | Loss of power from downed power lines; flooding of public water facility and equipment; fire station in need of upgrade | maintain electric power; public safety; reduce loss and damge of facility and equipment | Historic & Potential |
| **5** | **Residential and CommericalLand Uses** | Island-wide | Private | Flooding; Storm Surge; High Winds; Severe Winter Weather; Coastal Erosion; Sea Level Rise | Structural damage from flooding | prevent property damage from flooding | Historic & Potential |

** The Town focused on the highest risk hazards when developing the Risk Assessment Matrix. Lower risk hazards with less predicable impacts and locations such as drought, wildfire, tornado and earthquake are not included.*

# 5. CAPABILITY ASSESSMENT

The following section details the town's hazard mitigation capabilities. The town has the capability to implement and institutionalize hazard mitigation through its human, legal, and fiscal resources, and intergovernmental coordination.

New Shoreham has a variety of planning and support capabilities to apply toward its hazard mitigation activities. The business owners, residents, and visitors all contribute to promote growth and stability in town. The following sections provide an overview of the critical capabilities within the town and how they play a role in the mitigation effort.

The public services and facilities provided by the town of New Shoreham are crucial resources for preparation for natural hazard events, as well as the response to and mitigation of such events. There are also several state agencies that share responsibility for natural hazard preparation and response.

## *5.1 Form of Government*

Established in 1664 and incorporated by Home Rule Charter on October 30, 1672, the Town of New Shoreham has a Council-Manager form of government. The Town Council is comprised of a First Warden, Second Warden and three Town Councilors, elected each even numbered year for a two-year term. The Town Council appoints a Town Manager to be responsible to the Town Council for the administration of all town affairs. The Town Manager is responsible for the appointment of department heads and with overall supervision of the town departments.

In addition to the town employees serving in the town departments, a number of boards and commissions are active in mitigation activities, including the Planning Board, Zoning Board of Review, Harbors Committee, Board of Assessment Review, Conservation Commission, and Water and Sewer Commission.

## *5.2 Planning, Building, Housing – Community Development*

The New Shoreham Land Use Department provides professional planning and community development services for the town, including administration of land

use regulations, ongoing planning programs, coordination with federal and state agencies, and coordination with town boards, departments and agencies.

## 5.3 Transportation

The New Shoreham Highways Department, in cooperation with the Rhode Island Department of Transportation, is responsible for maintaining roadways in town.

The Harbors Department is responsible for regulating and managing the waters of New Shoreham.

## 5.4 Emergency Management

Emergency Management in New Shoreham is made up of several town and state departments and agencies. Locally, emergencies are coordinated among the New Shoreham Emergency Management Officer, New Shoreham Police Department, Block Island Bulletin Board, Senior Advisory Committee, New Shoreham Volunteer Fire Department and Rescue Squad.

When warning of a natural hazard comes from RIEMA, a team of town authorities, consisting of the Emergency Management Director, Town Manager, Police Chief, and any other necessary personnel, meet in advance to prepare and implement response plans utilizing existing resources, policies, and programs.

Resources, policies and programs to address various hazards are in place, including flood hazard mapping, an emergency notification system to alert residents to imminent emergencies and evacuation orders, shelter procedures, procedures for the mobile unit for Corn Neck, backup generators, power company personnel to address outages and downed lines.

Although it has no formal debris plan, the Highways department employs debris management strategies designed to promptly address debris or tree limbs accumulating on roads during or after a wind or other hazard event.

If the need for a shelter is anticipated, a team of personnel exists to set up and staff the shelter.

### 5.5. Public Safety

Block Island's public safety buildings – the police station, built in 1970, the attached fire barn, built in 1972, and the newer rescue barn, built in 2007, all are located on the same parcel on Beach Avenue in the village near New Harbor.

As of 2015, the Block Island Police Department has five full-time officers, including the chief, as well as four full-time and two part-time dispatchers. Eight additional officers, as well as three community service officers (bicycle patrol) and one police dog (K-9) work seasonally to handle the extra demand during the busy tourist season. During the months of July and August there is also a Rhode Island State Trooper presence on the island Friday through Sunday.

The Block Island Volunteer Fire and Rescue protects life and property on the island and provides assistance in medical emergencies. Fire and Rescue is staffed by about 75 volunteers. The rescue squad maintains its status as a volunteer organization with the exception of a twelve-week period in the summer when people are paid to be on call in order to avoid any serious lapse in caring for the community and its visitors.

### 5.6. GIS – Geographic Information Systems

New Shoreham has GIS software, data and professional capabilities to assist the Town in hazard mitigation planning, storm preparation and post disaster analysis. The town maintains its own data layers including but not limited to parcels, zoning, utilities, open space, and house identification numbers and utilizes data layers maintained by RIGIS (Rhode Island Geographic Information System) and federal agencies. Recent GIS Mapping produced by the Town includes Sea Level Rise mapping conducted as part of the Sea Level Rise Study, Comprehensive Plan mapping, and the mapping of all shoreline access points on the island. Maps are available on the town's website including FEMA DFRIRM flood maps.

## 5.7 Integration with Existing Plans and Local Processes

Local town plans and policies were consulted for the creation of this Hazard Mitigation Plan, including the Harbor Management Plan (2013).

The Town of New Shoreham is in the process of finalizing an update to its Comprehensive Plan. This plan describes the vision of the community and sets forth actions designed to achieve that vision. Items such as land use, housing,

economic development, natural and cultural resources, open space, services and facilities are addressed in the plan. The Comprehensive Plan identifies the need for the town to continue growing while at the same time preserving the unique characteristics of the community. Much information and many elements from the Comprehensive Plan helped to inform the Hazard Mitigation Plan. The updated 2016 Hazard Mitigation Plan will be referenced in the new Comprehensive Plan.

# 6. MITIGATION STRATEGY

New Shoreham's approach to mitigation is primarily comprised of public information and outreach and incentive programs; reinforcing and upgrading the town's built environment, including enhancing protection and hazard resilience for municipal and critical facilities and systems; incorporating hazard resilience into town planning and regulations, as well as post-disaster recovery and rebuilding.

New Shoreham coordinates the efforts of town authorities, including Emergency Management Director, Town Manager, Town Planner, Town Engineer, Police, Fire and Rescue chiefs, Town Highway Supervisor, Harbormaster, and Water and Sewer Superintendents, Building Official, as well as School, Medical Center, and Power Company administrators in the effort to accomplish mitigation actions.

Hurricanes, heavy wind, and flooding are New Shoreham's most frequent and serious hazards, and thus the focus of mitigation efforts. For new buildings and infrastructure, the Building Official ensures that building projects on the island meet or exceed building code requirements. Special attention is given to construction techniques (such as hand nailing roofing material) needed in a region prone to hurricanes and high winds. Contractors from outside Rhode Island meet with the Building Official and are informed of Rhode Island building codes. Each of the five actions or projects identified in the Actions Table mitigate the effects of those hazards on new buildings or infrastructure.

In updating the risk and vulnerability analysis, the New Shoreham Hazard Mitigation Committee considered actions that would reduce New Shoreham's vulnerability to the profiled hazards. The Risk Assessment Matrix presented in Table 8 is the basis for the Mitigation Actions Table presented in Section 5.5.

In accordance with the FEMA requirements, an emphasis was placed on the importance of a cost-benefit analysis in determining project priority. STAPLEE is an acronym for a general set of criterion common to public administration officials and planners. It stands for the Social, Technical, Administrative, Political, Legal, Economic, and Environmental criterion for making planning decisions. The Town of New Shoreham ranked each of the mitigation strategies by utilizing the STAPLEE criterion. The questions were considered and answered in order to determine the acceptability of the proposed mitigation action when being viewed in terms of six distinct criteria.

## STAPLEE Criteria for Selecting Mitigation Actions

| | |
|---|---|
| Social | Is the proposed action socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly? Will the action cause social disruption? |
| Technical | Will the proposed action work? Will it create more problems than it solves? Does it solve a problem or only a symptom? Is it the most useful action in light of the community goals? |
| Administrative | Can the community implement the action? Is there someone to coordinate and lead the effort? Is there sufficient funding, staff, and technical support available? Are there ongoing administrative requirements that need to be met? |
| Political | Is the action politically acceptable? Is there public support both to implement and to maintain the project? Will the Town Manager, Town Council and other decision-making political bodies support the mitigation measure? |
| Legal | Is the community authorized to implement the proposed action? Is there a clear legal basis or precedent for this activity? Is enabling legislation necessary? Are there any legal side effects (e.g. could the action be construed as taking)? Will the community be liable for action or lack of action? Will the activity be challenged? |
| Economic | What are the costs and benefits of this action? Does the cost seem reasonable for the size of the problem and the likely benefits? Are maintenance and administrative costs taken into account as well as initial costs? How will this action affect the fiscal capability of the community? What burden will this action place on the tax base or the local economy? What are the budget and revenue effects of this action? Does the action contribute to other community goals, such as capital improvements or economic development? What benefits will the action provide? |
| Environmental | Sustainable mitigation actions should not have an adverse effect on the environment, they should comply with federal, state, and local environmental regulations and should be consistent with the community's environmental goals. |

New Shoreham's preparations are based on experience with previous hazard events. Of course, each event brings a different set of challenges, and the team is always working to improve and learn from past experiences, adapt based on

lessons learned, and improve to the best of its ability with the resources it has available.

When funding becomes available for mitigation actions, either through grants or town allocation, the responsible departments are prepared to implement identified actions.

## Mitigation Actions

*Presently, the town does not foresee that any of the recommended action items would be able to receive funding to implement them through the town budget, but rather would require bonding and/or grant funding.*

Short-term = 0 to 6 Months
Medium-term = 6 to 18 Months
Long-term = 18 Months to 5 Years

### *Action 1: Mitigate Beach Erosion at Old Landfill*

**Project Description:** Recent storms have eroded the beach and caused the closed landfill to be uncovered. Debris has migrated onto the beach and into the ocean. This issue if not corrected has the potential to cause significant negative impacts on the surrounding natural resources in the area. A concern also exists for the people and wildlife coming into contact with the exposed debris. Design work has been completed to construct a revetment from the shoreline to minimize ongoing erosion. The Town has received a CDBG-DR grant for construction but is in search of additional sources of funding to close an estimated $1,000,000 funding gap.

**Action Type:** Structural Project, Post-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** New Action
**Lead:** Town Manager
**Supporting:** Engineering
**Time Frame:** Medium-term (6 to 18 months)
**Cost:** $2.8 million
**Finance Options:** CDBG-DR; FEMA
**Benefit:** Environmental, Aesthetic and Public Health

### *Action 2: Old Town Road Sluice/Bridge*

**Project Description** Upgrade the culvert and sluice, construct the bridge/roadway capable of serving as an evacuation/rescue route. Old Town Road serves as a main route connecting Old Harbor with the airport and points west of town. The portion of road containing the bridge also serves as a connector from the Police/Fire/Rescue Building with the school and the medical center. At this time, the roadway over the sluice is unable to support trucks or rescue vehicles.

The bridge also serves as a culvert, directing drainage from Mill Tail Pond to Harbor Pond and, ultimately, the Atlantic Ocean. Malfunction of the dam/sluice would put the road and downstream properties at risk from flooding. Also downstream is Ocean Avenue, a heavily-traveled connecting road from Old Harbor to the Police and Fire/Rescue Building and New Harbor locations. Also located on Ocean Avenue, just below the overflow from the dam/sluice is the sewer pump station. This pump station is at risk of flooding if the dam fails.

**Action Type:** Structural Project, Pre-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** 1.4 in 2006 Plan
**Lead:** Highway Department
**Supporting:** Engineering
**Time Frame:** Long-term (18 months – 5 years)
**Cost:** $975,000
**Finance Options:** RIDOT
**Benefit:** Public Safety, Emergency Access, Flooding Prevention

### *Action 3: Back-up Power for North End of Island*

**Project Description:** Purchase and install a 500 kw generator and portable fuel storage tank at the Transfer Station, which will be attached to the power grid and provide back-up power if the integrity of the grid is compromised. This will mitigate the potential danger to residents and damage to property by quickly providing power in the event of disruption.

The north end of the island is vulnerable to being cut off from the rest of the island. Corn Neck Road, the only road connecting north to south could be breached by wave action during a hurricane or winter storm, or might be washed out by heavy rain. This would place residents on the north end of the island at risk of having no power or access to town and supplies. Historically, storms have flooded and damaged the road at its narrowest point, demonstrating the potential of isolating the north end.

**Action Type:** Emergency Services, Pre-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** 3.1 in 2006 Plan
**Lead:** Emergency Management
**Supporting:** Fire
**Time Frame:** Medium- term (6-18 months)
**Cost:** $109,850
**Finance Options:** RIEMA; FEMA
**Benefit:** Public Safety, Power

### *Action 4: Bury Power Lines*

**Project Description:** Bury critical lines along the east side of the island. The Old Harbor section on the eastern coast of the Island has been assessed as susceptible to high winds during much of the year and as highly susceptible during high winds or a hurricane, ice, or snow. Many of the town's critical facilities are in this area of the Island including the Library, Town Hall, Community/Day Care Center, Post Office, and Sewer Treatment Plant and would be susceptible to power failure caused by downed power lines. Area businesses acknowledge the importance of insuring the integrity of power service by burying lines and have contributed approximately $12,000 toward this project to date.

**Action Type:** Structural Project, Pre-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** 3.2 in 2006 Plan
**Lead:** Town Manager; Block Island Power Co. (BIPCO)
**Supporting:** Engineering; Highway Department
**Time Frame: Medium-term (**18 months to 5 years)
**Cost:** $2.1 million
**Finance Options:** BIPCO, Private Organizations
**Benefit:** Public Safety, Power, Aesthetic

### *Action 5: Sand's Pond Drainage Project*

**Project Description:** Complete drainage project to divert excess water from Sand's Pond. The flood of March 2010 caused rapid elevation of the water level in Sand's Pond. The resulting overflow encroached upon the electrical boxes which service the Water Company's reservoir pumps. These were damaged, and the underground backwash holding tanks were submerged underwater. Neighboring

properties were also compromised. Flooding of this equipment causes damage, which in turn, compromises the operation of the Company and its ability to provide safe drinking water to its users.

Re-establish the natural drainage to the South that was blocked about 50 years ago. A structural design would have to be implemented that would be in compliance with RI Department of Environmental Management and Coastal Resource Management Council. Easements would have to be given from neighboring property owners.

**Action Type:** Structural Project, Pre-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** New Action
**Lead:** Town Manager
**Supporting:** Engineering; Water Company
**Time Frame:** Medium-term (6-18 months)
**Cost:** $500,000
**Finance Options:** RIDEM
**Benefit:** Property Protection, Essential Services, Environment and Water Quality

### *Action 6: Raising or Relocation of Corn Neck Road*

**Project Description:** Planning, design and construction of relocation or raising of roadbed for segment of Corn Neck Road (near Beachead restaurant to Beach Ave) to address ongoing inundation due to storm surge and the potential permanent inundation due to projected sea level rise. This road serves as an evacuation route and is the only connection many homes on the northern end of the island have to the rest of the island. Storm surge from Hurricane Sandy caused substantial damage to Corn Neck Road. The Town received emergency repair funding in the amount of $3.1M in order to repair Corn Neck Road and a shorter section of Spring Street which also suffered damage.

**Action Type:** Structural Project, Pre-Disaster
**Priority:** High
**Change in Priority since 2006 Plan:** New Action
**Lead:** Town Manager; RIDOT
**Supporting:** Engineering; Highway Department
**Time Frame:** Long-term (18 months -5 years)
**Cost:** Unknown
**Finance Options:** RIDOT; FEMA, RIEMA
**Benefit:** Decreased cost of post-disaster clean-up; increased public safety; effective evacuations; emergency access

### *Action 7: Town Hall Generator*

**Project Description:** Purchase and install generator at the New Shoreham Town Hall to provide back-up during times of outages. This will allow essential government services to continue during times of emergencies and loss of power.

**Action Type:** Emergency Services, Pre-Disaster
**Priority:** Medium
**Change in Priority since 2006 Plan:** New Action
**Lead:** Town Manager
**Supporting:** Facilities Manager; Emergency Management
**Time Frame:** Long-term (18 months – 5 years)
**Cost:** $85,000
**Finance Options:** FEMA, RIEMA
**Benefit:** Power, Essential Services

### *Action 8: Back-up Power for Sewer Pump Stations*

**Project Description:** Purchase a generator and portable fuel storage tank which will provide back-up power for sewer pump stations. This will mitigate the potential danger to residents and damage to property by quickly providing power in the event of power disruption. This action item is partially completed as the Town purchased one portable generator for this purpose. The goal of the Town is to acquire an additional portable generator so the Town has access to two portable generators for the purposes of restoring power to sewer pump stations during times of outages.

**Action Type:** Emergency Services, Pre-Disaster
**Priority:** Medium
**Change in Priority since 2006 Plan:** 1.3 in 2006 Plan (partially completed)
**Lead:** Emergency Management; Town Manger
**Supporting:** Facilities Manager
**Time Frame:** Long-term (18 months -5 years)
**Cost:** $109,850
**Finance Options:** RIEMA; FEMA
**Benefit:** Public Safety, Power

### *Action 9: New Fire Station*

**Project Description:**

**Action Type:** Structural Project, Pre-Disaster
**Priority:** Low
**Change in Priority since 2006 Plan:** 2.2 in 2006 Plan (partially completed)
**Lead:** Town Manager; Fire
**Supporting:** Facilities Manager
**Time Frame:** Long- term (18 months – 5 years)
**Cost:** $1,500,000
**Finance Options:** Town
**Benefit:** Public Safety, Essential Services

### *Action 10 Participate in the FEMA National Flood Insurance Program's Community Rating System*

**Project Description:** Gain entrance into the Community Rating System (CRS) which is a voluntary part of the National Flood Insurance Program that seeks to coordinate all flood-related activities, reduce flood losses, facilitate accurate insurance rating, and promote public awareness of flood insurance by creating incentives for a community to go beyond minimum floodplain management requirements. The incentives are in the form of insurance premium discounts for property owners based upon the community's CRS score.

**Action Type:** Property Protection and Incentives Program
**Priority:** Low
**Change in Priority since 2006 Plan:** New Action
**Lead:** Building; Planning
**Supporting:** Town Manager; GIS
**Time Frame:** Long - term (18 months – 5 years)
**Cost:** Staff Time
**Finance Options:** Town Budget
**Benefit:** Property Protection, Reduced flood insurance premium for Block Island property owners

**Table 13: Mitigation Actions**

| Action # | Vulnerable Area | Project Name | Priority | Location | Owner | Hazard Type | Mitigation Objective | Cost Estimate | State or Federal Resource | Existing or New Action |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Natural Environment | Beach Erosion at Old Landfill Site | High | West Beach Road | Town | Hurricane, Wind Storm | Terrace and create a new rip rap slope at edge of land impacted by storms | $2.8 million | CDBG & FEMA Hurricane Sandy Disaster Funds | New |
| 2 *(1.4 in 2006 Plan)* | Dams & Bridges | Old Town Road Sluice / Bridge | High | Old Town Road | Town & State | Flooding, Hurricane, Wind Storm | Upgrade bridge/culvert; engineering design, DEM permits, etc. | $975,000 | RIDOT/Design Section / Bridges | Existing |
| 3 *(3.1 in 2006 Plan)* | Essential Services | Back-up Power for Northern End of Island | High | Transfer Station on West Beach Road | Town | Flooding, Hurricane, Winter Storm | Purchase 500 kw generator for Neck use; fuel storage unit | $109,850 | RIEMA & FEMA | Existing |
| 4 *(3.2 in 2006 Plan)* | Essential Services | Bury Power Lines | High | Water St., Corn Neck, Spring St. | Town, State, BIPCO | High Winds, Ice, Snow, Hurricane | Bury critical lines along east side of island | $2.1 million | Public Utilities Commission/ RIDOT | Existing |
| 5 | Residential & Commerical Land Uses | Sand's Pond Drainage Project | High | Sand's Pond Road | Town | Flood | Divert water from the pond to the ocean when the pond nears flood stage | $500,000 | RIEMA/FEMA/ CRMC/RIDOT/ | New |
| 6 | Critical Roads | Partial Raising or Relocation of Corn Neck Road | High | Corn Neck Road | State | Storm Surge, Hurricane, Winter Storm | Planning, design and construction of relocation or raising of roadbed for segment of Corn Neck Road subject to storm inundation and damage | Unknown | RIDOT / RIEMA / FEMA | New |
| 7 | Essential Services | Town Hall Generator | Medium | Town Hall located on Old Town Road | Town | Power Failure | Maintian critical services during times of power outages | $85,000 | RIEMA / FEMA | New |
| 8 2006 Plan 1.3 | Essential Services | Back-up Power for Sewer Pump Stations (Partially Completed - Town aquired 1 portable generator) | Medium | 5 sites in Old and New Harbors | Town | Flooding, Power Failure | Purchase two portable generators, maintain critical services during times of outages, minimize risk to environment | $800,000 | RIEMA / FEMA | Existing |
| 9 | Essential Services | New Fire Station | Low | Existing Location - Ocean Avenue | Town | Flooding | Construct a new fire station at current location | $1.5M | Town | Existing |
| 10 | Residential & Commerical Land Uses | Participate in FEMA's Community Rating System | Low | not location specific | N/A | Flooding | Initiate additional flood mitigation efforts; save property owners on costs associated with flood insurance premiums | Staff Time | Town | New |
| 1.1 in 2006 Plan | New Town Hall and Fire-Proof Records Vault (COMPLETED 2007) | | | Old Town Road | Town | Flooding, Hurricane | Protect vital records, provide for continuity of local government | | | |
| 1.2 in 2006 Plan | Block Island Water Company Sprinkler System (COMPLETED 2010) | | | Payne Road | Town | Flood, Fire, Lightning | Install lightning protection to mitigate an occurrence of fire and damage to equipment that ensures safe drinking water | | | |
| 2.1 in 2006 Plan | Old Harbor Dock Rebuilt (COMPLETED 2011) | | | Water Street | Town | Hurricane, Winter Storm | Replace & repair bulkheads, replace decking to secure the sole access for year-round ferry service | | | |
| 2.2 in 2006 Plan | New Fire / Rescue Building (RESCUE BUILDING COMPLETED 2009) | | | Beach Avenue | Town | Hurricane, Winter Storm, Fire | Construct building with 2 bays for rescue vehicles, training area, and area for filling oxygen tanks (with sprinkler system & rated to withstand high winds) | | | |

# 7. Moving Toward a Safe, Resilient & Sustainable Community

The Town of New Shoreham and the Hazard Mitigation Committee realize that successful hazard mitigation is an ongoing process that requires implementation, evaluation, and updated revisions to the Plan. It is intended that this plan and the ongoing efforts of the Hazard Mitigation Committee will preserve and enhance the quality of life, property and resources for the Town of New Shoreham.

While addressing the above action items will help mitigate the impact of natural hazards, minimize damage to people, and property, and speed recovery following an event, the availability of public funding will influence which action items may be implemented by the town. Fortunately, since the adoption of the previous Hazard Mitigation Plan, New Shoreham has been successful in completing several of the previous action items. This was due, in part, to the implementation and funding of projects outlined in the Town's Capital Improvement and operating budgets.

Coastal erosion caused by recent storms, including Hurricane Sandy, in 2012, unearthed long-buried landfill debris causing it to spill onto the beach below. This prompted the Committee to add an action item to the Hazard Mitigation Action Table to mitigate the effects of this erosion and the consequent damage it caused.

With continued effort, cooperation, and funding, New Shoreham is moving toward enhancing its status as a safe, resilient and sustainable community.

# REFERENCES

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New Shoreham Harbor Management Plan 2013.

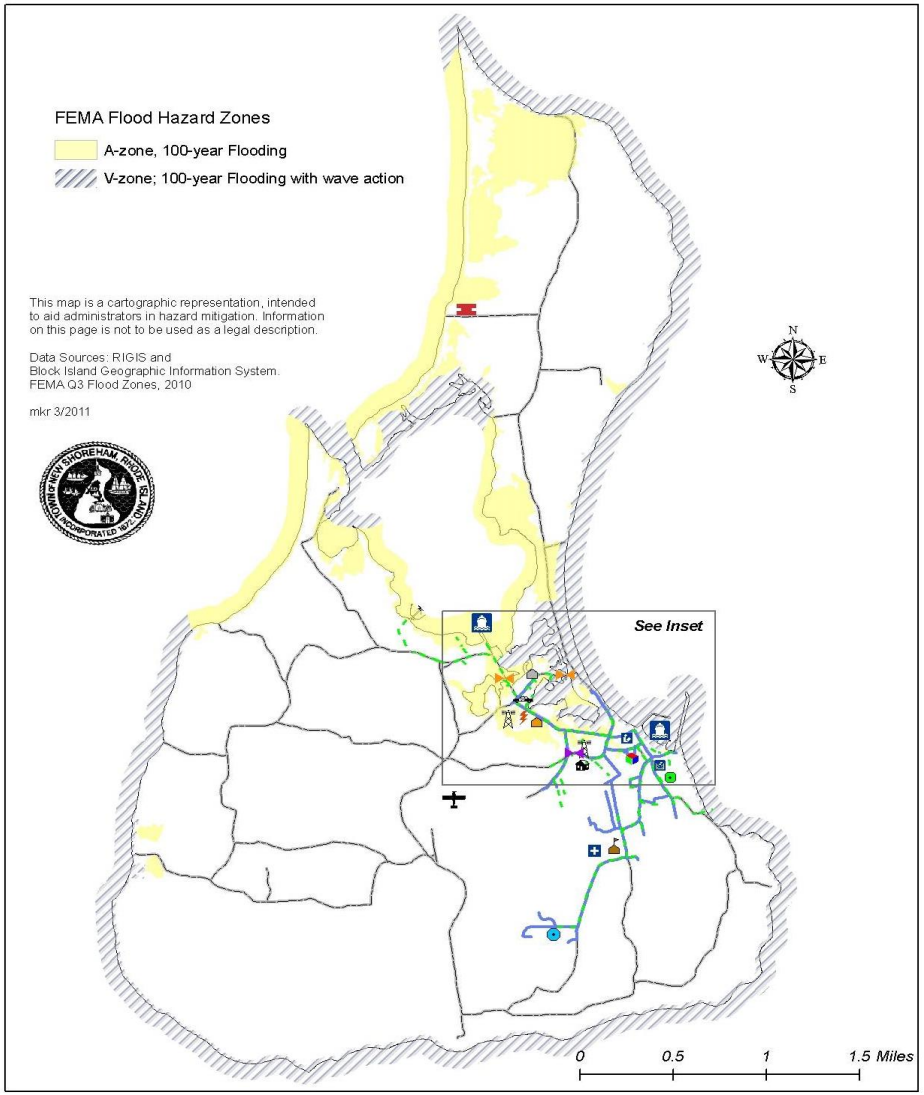
National Climate Data Center. National Oceanic and Atmospheric Administration. National Climatic Data Website – www.ncdc.noaa.gov.

Rhode Island Hazard Mitigation Plan, 2014 update. RIEMA.

State and Local Mitigation Planning How-To Guides. FEMA.
FEMA 386-2, August 2001. FEMA 386-3, April 2003. FEMA 386-4, April 2003.

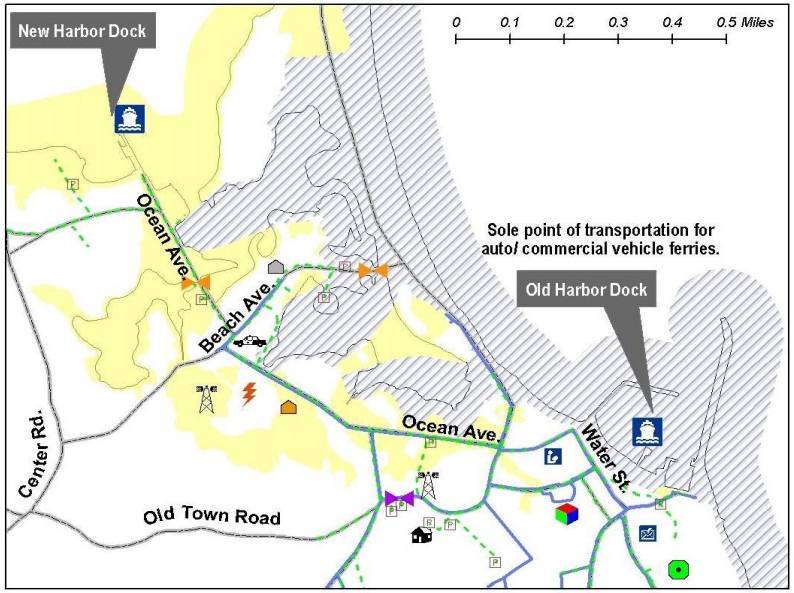
Town of New Shoreham Emergency Operations Plan, 2011.

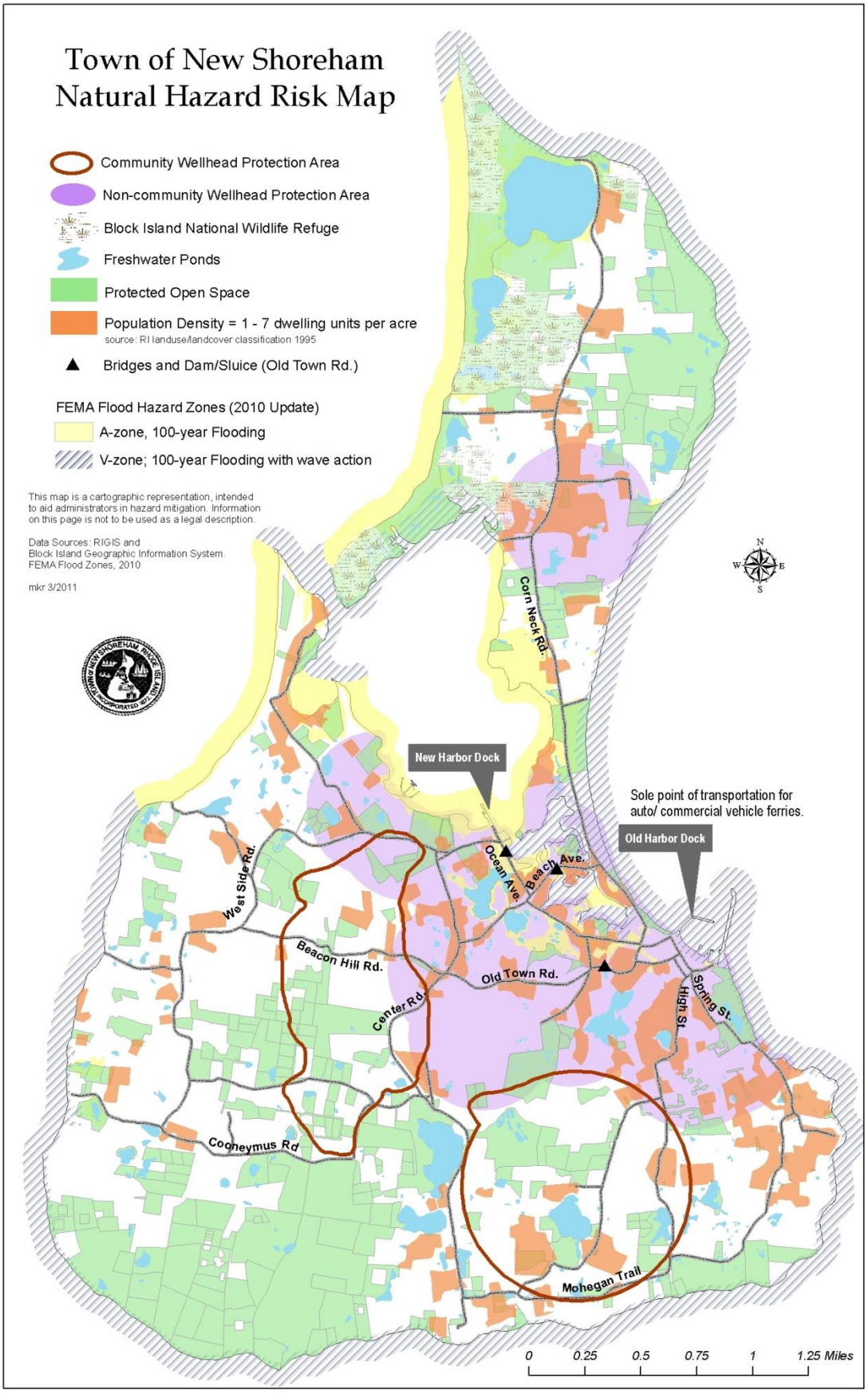
# APPENDIX A
# Risk Maps



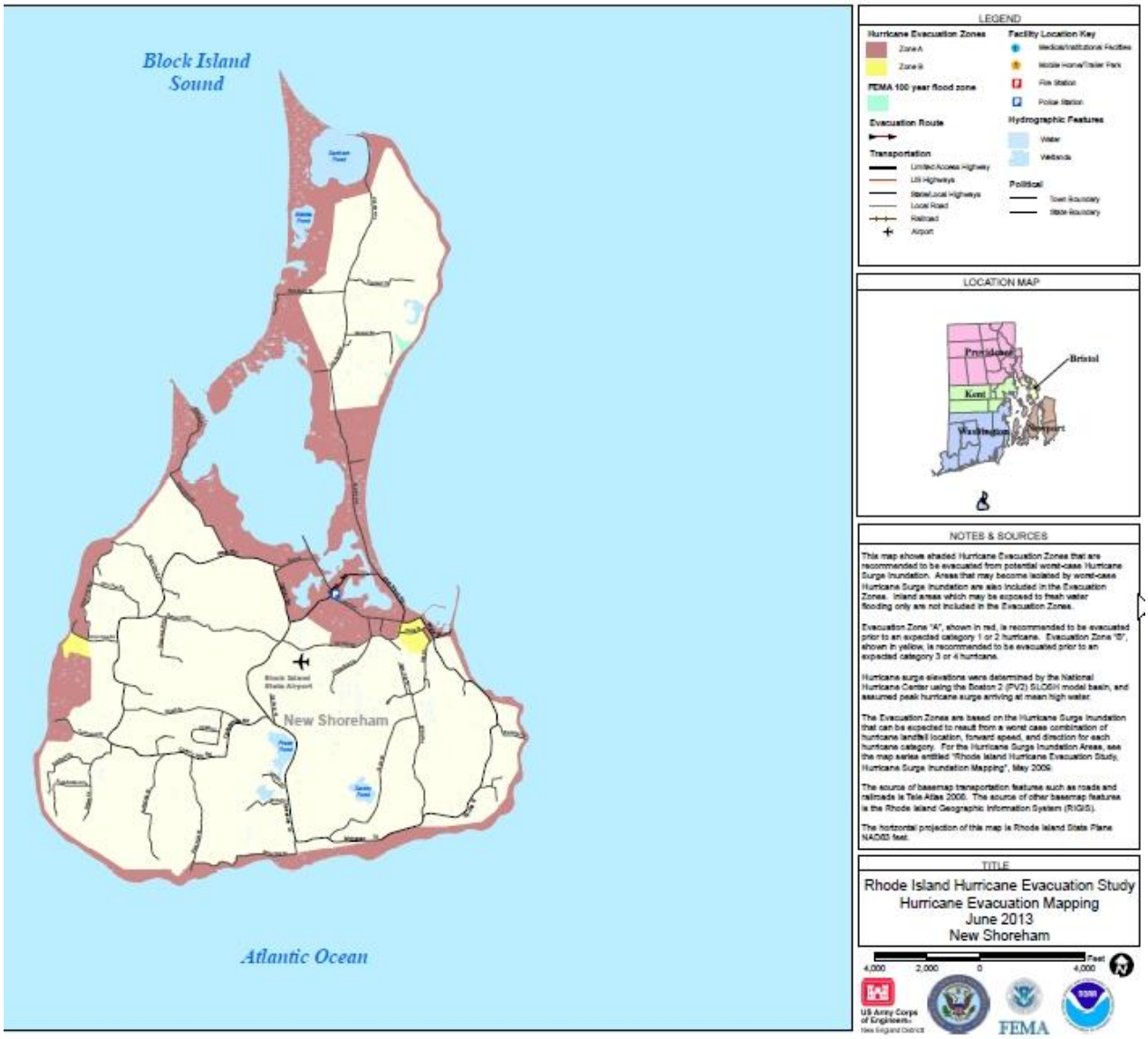

# Town of New Shoreham
# Critical Facilities

- Airport
- BI School
- Community Ctr/Day Care
- Library
- Medical Center
- Ferry Docks
- Town Hall
- Police, Fire, Rescue
- Post Office
- Cell Tower
- Old Town Rd Sluice
- Bridge
- State Highway Garage
- Town Highway Garage
- Transfer Station
- Sewer Plant
- Sewer Pump Stations
- Sewer Lines
- Water Company
- Water Distribution Lines
- Power Company




Town of New Shoreham
Natural Hazard Risk Map
Community Wellhead Protection Area
Non-community Wellhead Protection Area
Block Island National Wildlife Refuge
Freshwater Ponds
Protected Open Space
Population Density = 1 - 7 dwelling units per acre
source: RI landuse/landcover classification 1995
Bridges and Dam/Sluice (Old Town Rd.)
FEMA Flood Hazard Zones (2010 Update)
A-zone, 100-year Flooding
V-zone; 100-year Flooding with wave action
This map is a cartographic representation, intended to aid administrators in hazard mitigation. Information on this page is not to be used as a legal description.
Data Sources: RIGIS and Block Island Geographic Information System. FEMA Flood Zones, 2010
mkr 3/2011
N
W
E
S
Corn Neck Rd.
New Harbor Dock
Sole point of transportation for auto/ commercial vehicle ferries.
Old Harbor Dock
Ocean Ave.
Beach Ave.
West Side Rd.
Beacon Hill Rd.
Old Town Rd.
Center Rd.
High St.
Spring St.
Cooneymus Rd
Mohegan Trail
0 0.25 0.5 0.75 1 1.25 Miles

## Hurricane Evacuation Map FEMA 2013



# APPENDIX B
# Block Island Harbors Sea Level Rise Adaptation Study 2013

***The following is the Public Information pamphlet produced as an outcome of the Block Island Harbors Sea Level Rise Adaptation Study completed in 2013.***

**SEA LEVEL RISE ON BLOCK ISLAND**
**HOW WILL IT AFFECT YOU?**

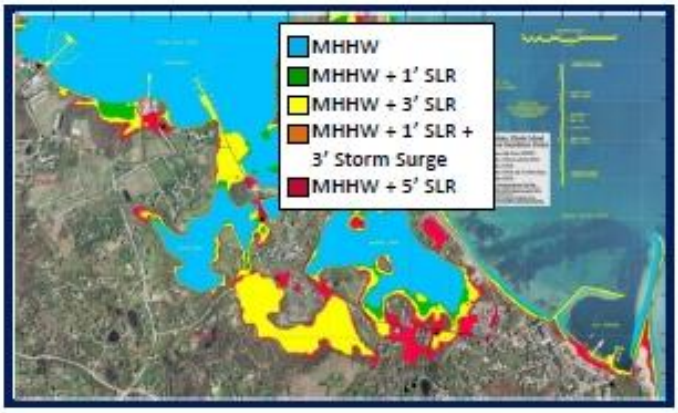
Our climate is changing. Rhode Island is experiencing warmer air temperatures, increased Bay temperatures, more extreme weather events and accelerated sea level rise. Since 1930, sea level rise as measured by tide gages in Newport has risen at a rate of about 1 inch every 10 years, but this rate is increasing. In another 20 years it is probable the sea level will rise several more inches. This heightened sea level means higher high tides and greater storm surges. The result will be greater coastal flooding and erosion, and more widespread property damage.

Owing to its geographical location, Block Island is vulnerable to hurricanes, coastal storms and nor'easters. The community is dependent on privately owned ferry and airline companies for transport to and from the mainland. The island's residents must plan for inevitable long term impacts that a rising sea will have on its two harbors and village roads. Residents and visitors alike must prepare for the next inevitable coastal storm on the scale of a Super Storm Sandy, which caused significant damage to roads, buildings and marine facilities due to wave action, storm induced erosion and flooding.

Damage to Corn Neck Road from Super Storm Sandy October 2012

A 2013 study* of the impact of sea level rise on the Block Island harbors and connecting roadways included preparation of maps illustrating areas predicted to be inundated under various scenarios. The maps demonstrate vulnerable flood damage areas that result as sea levels rise over the long term. Under extreme storm conditions in the near term, certain roads, bridges and marine areas, particularly Old Harbor and the ferry landing site and the roads leading into New Harbor, are also vulnerable to flooding and damage. This will result in some areas of the island becoming temporarily isolated. Ferry travel to and from the island may be disrupted beyond the anticipated normal storm duration. This information is important both for emergency planning purposes, and for scheduling and designing major infrastructure replacement.

***Public Information pamphlet (continued)***




**Inundation zones depicted for sea level rise (SLR) scenarios**

There are many things that Block Island officials, conservation organizations, residents, vacationers and visitors can do to prepare for climate change and sea level rise.

**Maintaining public infrastructure:**

* Plan for sea level rise and storm flooding when designing upgrades to marine facilities, roadways, bridges, and pump stations

**Learning about and adapting to climate change impacts:**

* Assist the organizations and agencies monitoring the impacts of climate change with efforts such as documenting and photographing high tide events, storm flooding impacts, bluff erosion and changes in species composition in the ocean and coastal pond, etc
* Be aware of vulnerable areas when using and developing property and designing buildings
* Focus land acquisition efforts on flood-prone areas most susceptible to damage
* Follow only pathways to the beach, and stay off the dunes, which serve to protect inland areas against wave erosion and flooding

**Emergency procedures in advance of a major coastal storm or hurricane:**

* Renters and visitors should leave the island when directed to do so
* Recreational boaters should leave for their home ports when instructed by the harbormaster
* Residents should follow the procedures for hurricane planning established by the emergency management director, and be aware of island roadways subject to temporary inundation

# APPENDIX C
# Technical and Financial Assistance for Mitigation

## State Resources

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

**Coastal Resources Management Council**
Stedman Government Center
4808 Tower Hill Road
Wakefield RI 02879
(401) 222-2476

**RI Department of Administration**
Division of Planning
One Capitol Hill
Providence RI 02908
(401) 222-2635

**RI Department of Environmental Management**
**Division of Parks & Recreation**
2321 Hartford Avenue
Johnston RI 02919
(401) 222-2635

**RI Department of Transportation-**
**Design Section/Bridges**
2 Capitol Hill, Room 231D
Providence RI 02903
(401) 222-2053

**RI Banking Commission/**
**Associate Director**
233 Richmond Street
Providence RI 02903
(401) 222-2405

**RI Builders Association –New Address**
Terry Lane, The Terry Lane Corporation
Gloucester RI 02814
(401) 568-8006

**RI Department of**
**Business Regulations**
233 Richmond Street
Providence RI 02903
(401) 222-2246

**RI Emergency Management Agency**
645 New London Avenue
Cranston RI 02920
(401) 946-9996

**Public Utilities Commission**
89 Jefferson Blvd
Warwick, RI 02888
(401) 941-4500

**State Fire Marshal's Office**
118 Parade St
Providence RI 02909
(401) 222-2335

**RI Building Committee Office**
Building Commissioner's Office
One Capitol Hill
Providence RI 02903
(401) 222-3529

# Federal Resources

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

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

**U.S. Department of Housing and Urban Development**
Comm. Development Block Grants
Region I-O'Neill Federal Building
10 Causeway Street
Boston, MA 02222
(617) 656-5354

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

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

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

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

**U.S. Department of the Interior**
**National Park Service**
River & Trail Conservation Program
Regional Office
15 State Street
Boston, MA 02109
(617) 223-5203

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

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

**U.S. Geological Society**
12201 Sunrise Valley Drive
Reston, VA

# Other Resources

**The Association of State Floodplain Managers (ASFPM)**
Professional association with a membership of almost 1,000 state employees that assists 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 publication. 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) (formerly 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**
Organization, 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 organization, 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 world wide web home 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. NEFSMA home page is accessible at http://www.seacoast.com/~nefsma.

# APPENDIX D
# Existing Protection Systems

## State

**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 that the proposed projects 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 the RIEMA at (401) 946-9996.

**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).

**Evacuation Plans and Systems**
The 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. The 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 the 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 (On-Site Wastewater Treatment Systems)**
Areas in the community not served by a public sewer system are affected by State septic system regulation in terms of 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. See Town of New Shoreham OWTS Ordinance.

**Warning Systems and Emergency Operations Plans:**
The community may have a flood warning system in place and should have a plan for response to flooding.

# Federal

**Community Rating System (CRS)**
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 conducting 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.

**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 required by FEMA and is extremely helpful in meeting the states' 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 to certain nonprofit organization 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 recreations 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.

Two programs that have been authorized under the National Flood Insurance Reform Act of 1994 include the Flood Mitigation Assistance (FMA) program and a provision for increased cost of compliance (ICC) coverage. FMA 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. 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. 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 the RIEMA at (401) 946-9996.

**National Flood Insurance Program (NFIP)**
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:

- Adopt the flood insurance rate maps as an overlay regulatory district
- 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
- 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.

# APPENDIX E
# Public Notices

PUBLIC NOTICE

The Town of New Shoreham is in the process of updating its 2006 Hazard Mitigation Plan. Members of the public are encouraged to participate. Copies of the Plan are available at the Town Hall and Library or can be downloaded from the Town's website. The next meeting is scheduled for Thursday, November 18, 2010 @ 8:00 a.m. at Town Hall.
Posted:
11/8/10
sjg

PUBLIC NOTICE

The Town of New Shoreham is in the process of updating its 2006 Hazard Mitigation Plan. Members of the public are encouraged to participate. Copies of the Plan are available at the Town Hall and Library or can be downloaded from the Town's website. The next meeting is scheduled for Thursday, December 16, 2010 @ 3:00 p.m. at Town Hall.
Posted:
12/8/10
sjg

# APPENDIX F
# Mitigation Action Progress Form

**MITIGATION ACTION PROGRESS REPORT FORM**

**Report Date:**

**Action or Project Title:**

**Project Status:**

**Anticipated Completion Date:**

**Comments:**