

TOWN OF BARRINGTON, RI HAZARD MITIGATION PLAN



2017 Update



FEMA

AUG 28 2017

Peter T. Gaynor, CEM, Director
Rhode Island Emergency Management Agency
645 New London Avenue
Cranston, Rhode Island 02920

Dear Mr. Gaynor:

We would like to acknowledge the Town of Barrington and the State of Rhode Island for their dedication and commitment to mitigation planning. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I Mitigation Planning Team has completed its review of the Town of Barrington, RI Hazard Mitigation Plan and determined it meets the requirements of 44 C.F.R. Pt. 201.

With this plan approval, the Town of Barrington is eligible to apply to the Rhode Island Emergency Management Agency for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements identified for each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding; even eligible mitigation activities or projects are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at <http://www.fema.gov/national-flood-insurance-program-community-rating-system>, or through your local floodplain administrator.

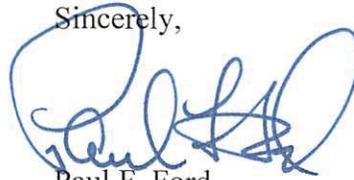
The Town of Barrington, RI Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of August 21, 2017** in order to maintain eligibility for mitigation grant funding. We encourage the Town to continually update the plan's assessment of vulnerability, adhere to its maintenance schedule, and implement, when possible, the mitigation actions proposed in the plan.

Peter T. Gaynor
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Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Melissa Surette at (617) 956-7559.

Sincerely,

A handwritten signature in blue ink, appearing to read "Paul F. Ford", with a large, stylized flourish above the name.

Paul F. Ford
Acting Regional Administrator

PFF: ms

cc: Samantha Richer, Planning Branch Chief, RI Emergency Management Agency

Enclosure

2017 Barrington Hazard Mitigation Plan

Town of Barrington, Rhode Island

June 5, 2017

ACKNOWLEDGEMENTS

This Plan was made possible through the commitment of the Barrington Hazard Mitigation Committee and leadership and support from the Barrington Town Manager and Town Council.

Barrington Town Council

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Steven Boyajian
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Barrington Hazard Mitigation Committee

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Mr. Hervey and Ms. Jacobs were the principal authors of this Plan. Maps and Plan format by Mr. Hervey. Vanasse Hangen Brustlin also provided support.



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Executive Summary

In 1995 the Federal Emergency Management Agency (FEMA) enacted a National Mitigation Strategy, which promoted the partnership of government and the private sector to effectively “build” safer communities. The strategy encourages the identification of natural hazards that may affect individuals or communities and thereupon take action to reduce the associated risk (FEMA. National). The subsequent passage of the Disaster Mitigation Act of 2000 provided the legal basis for FEMA to require mitigation planning at both the State and local level as a condition of mitigation grant assistance (FEMA. Disaster). The Town of Barrington, Rhode Island Hazard Mitigation Plan was prepared pursuant to these requirements and conforms to 44 CFR Parts 201 and 206 Hazard Mitigation Planning and Hazard Mitigation Grant Program; Interim Final Rule.

The Town of Barrington, in recognition that pre-disaster planning and investments in preventative measures can significantly reduce the impact of natural hazards events and improve post-disaster recovery, reconvened the Hazard Mitigation Committee in 2015. The Committee was tasked with comprehensively evaluating the potential threats from natural hazards that could result in life and property loss to our community. The Committee identified and qualified the potential impacts from a number of potential natural hazards, including flood-, wind-, and winter-related, which were considered to pose the greatest threat to Barrington.

Major Findings

With an extensive coastline and significant sections of town within low-lying areas near the shore, Barrington is one of Rhode Island’s most vulnerable communities to natural hazards. The community’s vulnerability will increase in the coming decades with sea level rise; the National Oceanic and Atmospheric Administration predicts as much as 9.8 feet of sea level rise for Rhode Island by 2011.

Major findings of this Plan include:

The Hazard Mitigation Plan provides guidance for town-wide natural hazards mitigation, enabling Barrington to continue to work toward building a safer, disaster resilient, and sustainable community.

- Barrington’s infrastructure – roads, bridges, sewer pump stations – will be at risk from rising sea levels, including Wampanoag Trail (Route 114), a major evacuation route for the town and the East Bay.
- The Town has vulnerable populations located in areas at risk from flooding and storm surge, specifically residents of two elderly housing complexes in West Barrington.
- Major hurricanes pose a significant threat to impact large sections of Town. For a Category 4 hurricane, five of six public schools, three private schools, and the Public Safety Building on Federal Road are at risk from storm surge impacts.
- Buildings valued at approximately \$275 million (principal structures) are located within the 100-year and the velocity flood zones. Another \$250 million in principal structure building value is within the 500-year flood zone, as mapped by FEMA.
- Over time, higher sea levels could significantly increase the amount of property at risk from flooding and storm surge.
- The Town has opportunities to mitigate impacts from natural hazards and sea level rise through measures that protect the built environment and preserve and restore natural areas that serve as a buffer against coastal flooding.

Assessment

To determine how to mitigate impacts from these threats it was first necessary to understand Barrington’s com-

munity profile and evaluate the Town's vulnerable community assets. As it was also essential to understand what measures the Town already implements in terms of hazard mitigation, a capability assessment was undertaken. Many of the Actions outlined in the 2010 Hazard Mitigation Plan have been implemented and have contributed to reducing the Town's potential risks from various natural hazards. Adoption of the 2010 Plan made Barrington eligible for federal grants available through FEMA's Hazard Mitigation Assistance Program. In 2014 the Town successfully applied for and was awarded a \$644,871 FEMA Hazard Mitigation Grant on behalf of six property owners who were seeking assistance to elevate their houses out of the flood zone.

In accordance with 44 CFR S 201.6(d)(3), to maintain eligibility for mitigation project grant funding, the Town's Hazard Mitigation Plan needs to be updated and resubmitted for approval on an on-going 5-year cycle. In undertaking this Update to the 2010 Plan, the Hazard Mitigation Committee revisited the original documentation and assessed the status of the 2010 Actions to determine relevance for continued inclusion. Advances in the ability to predict the occurrence and effects of natural disasters, including model simulations and GIS data and mapping capabilities, provided the Town with improved opportunities to better prepare for these risks. The 2017 Update was restructured and streamlined with sections of the original Plan eliminated or revised and some new sections added in order to reflect the most current understanding of natural hazards that pose significant threats to Barrington and how the Town has and can effectively continue to mitigate these threats.

Goals

Included in this Update is relevant information from the Town's Comprehensive Community Plan, specifically the Natural Hazards element. To maintain consistency, the Hazard Mitigation Committee adopted the goals from the 2015 Comprehensive Community Plan Natural Hazards element as the 2017 Mitigation Strategy Goals:

- Goal 1: Reduce current and future risk of natural hazards and sea level rise to the built environment.
- Goal 2: Preserve and enhance the capacity of the natural environment to improve Barrington's resilience against impacts of natural hazards.

- Goal 3: Reduce flood risk and the cost of flood insurance within Barrington.
- Goal 4: Improve the community's awareness of threats to minimize risk to the public due to natural hazards.

Mitigation Actions

In support of these four Goals, the Committee developed approximately two dozen specific Actions to be considered for implementation by the Town over the ensuing five years. The Mitigation Actions include a mix of physical initiatives through capital improvement projects and programming, as well as passive initiatives through regulatory and policy measures. The Actions will be implemented through the Town's personnel, legal, and fiscal resources; intergovernmental coordination and communication; academic resources and analysis tools; and through the involvement of the Town's residents, business owners, and institutional leaders.

Adoption

Formal adoption of this plan by FEMA and the Town Council will provide guidance for town-wide natural hazards mitigation, enabling Barrington to continue to work toward building a safer, disaster resilient, and sustainable community through the implementation and maintenance of mitigation Actions. (The local Resolution Adopting the Town of Barrington Hazard Mitigation Plan, adopted by the Town Council on July 31, 2017, is included as Appendix 1.)

1 Introduction

The 2017 Hazard Mitigation Plan (HMP) is a critical planning document for Barrington, one of Rhode Island’s most vulnerable communities at risk of impact from natural hazards given its extensive coastline and floodplain areas. The potential impacts of natural hazards range from minor short-term events—street flooding and snowstorms— to catastrophic events, such as the Hurricane of 1938 (Figure 1.1) and Hurricane Carol (1954). Risk will continue to grow in the coming decades due to sea level rise and other anticipated deleterious effects of climate change. By planning ahead, Barrington can significantly reduce the damaging effects of future disasters, minimizing the economic and social disruption often caused when these events strike.

The Plan proposes to accomplish this through sustained actions intended to permanently reduce or eliminate long-term risks to people and property from the effects of natural hazards such as floods, hurricanes, and snowstorms. The Plan also will help enable a speedier recov-

ery through pre-planning, ongoing monitoring, and implementation.

1.1 PURPOSE AND MISSION STATEMENT

The purpose of this update to the Hazard Mitigation Plan is to identify natural hazards that have the potential to impact the community, determine the vulnerability of the community to these hazards, and establish clear goals and strategies that mitigate the risks from natural hazards. The Plan addresses additional risks related to climate change and sea level rise, a significant threat to the community given Barrington’s lengthy coastline on tidal waters and extensive coastal floodplain areas. The Plan’s purpose is captured in the following Mission Statement, adopted by the Hazard Mitigation Committee to serve as a framework for development of the plan:

MISSION STATEMENT: Reduce Barrington’s vulnerability to impacts of natural

Figure 1.1: Aftermath of the Hurricane of 1938



The Hurricane of 1938 washed out the Central Bridge, which carries Massasoit Avenue across the Barrington River. The 1938 Hurricane left widespread damage throughout Barrington.

Figure 1.2: Damage Post-Hurricane Irene (2011)



hazards through sustainable, cost-effective measures that limit risk and reduce potential loss from hazard events, including safeguarding against the increased threats from climate change and sea level rise.

Mitigation strategies include a mix of physical initiatives focusing on the built environment to limit the impacts of natural hazards, “soft” measures such as protection of critical open space, and regulatory/planning actions.

Formal adoption and implementation of this document will allow Barrington 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.

Adoption of this Hazard Mitigation Plan will make Barrington eligible for federal grants available through FEMA’s Hazard Mitigation Assistance Programs (HMA), including the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM), Repetitive Flood Claims, and Severe Repetitive Loss Claims. A description of FEMA’s HMA grant programs can be found at <https://www.fema.gov/hazard-mitigation-assistance>.

In addition, the Rhode Island Emergency Management Agency (RIEMA) gives funding priority to municipalities that have completed a hazard mitigation plan, which includes a risk assessment, mitigation strategy with detailed information on the cost, timeline, and municipal department responsible for completing proposed mitigation actions

2 Planning Process

2.1 HAZARD MITIGATION PLAN COMMITTEE

The Hazard Mitigation Plan Committee, an administrative committee formed by the Town Manager, consists of Town Manager James Cunha, Town Planner Philip Hervey, Fire Chief Gerald Bessette, Police Chief John LaCross, Public Works Director Joe Piccerelli, Recreation and Community Services Director Michele Geremia, Harbormaster Ray Sousa. Civil Engineer and Barrington resident Kim Jacobs served in an advisory capacity, including assisting with drafting the plan and GIS analysis. The Committee, originally established in 2009 to guide development of the 2010 update to the Hazard Mitigation Plan, reconvened in 2015 to work on the 2017 update.

Mr. Hervey served as the lead in charge of drafting the Hazard Mitigation Plan (HMP), generating maps and soliciting comments from the public, adjoining communities and other stakeholders. Ms. Jacobs, a local engineer, assisted with writing and editing the plan, gathering and analyzing data, and reviewing the Plan for consistency with FEMA requirements. The engineering firm VHB provided information on hazard profiles and assisted with final edits. During 2015 and 2016, Committee members were briefed at monthly staff meetings about the status of the HMP. The Committee met on June 5, 2017 to complete its review of the plan and evaluate public input, reaching consensus on the Mitigation Strategy, including the implementation schedule (meeting notes are included in Appendix 2).

During this process the Committee reviewed the actions included in the 2010 Plan. The efficacy of non-completed items was evaluated to determine their inclusion in this Update. New actions, some of which were propagated by community input, were identified. Local, state, and federal resources were used to assess risks, prioritize actions, and develop the mitigation strategy.

The Committee met in June 2017 (summary is included in **Appendix 2**) to complete its final review of the draft provided by the Planning Department. As part of this pro-

cess the Committee reached consensus on key decision points, including:

- The final wording of the Mission Statement;
- Planning of public outreach events;
- Incorporation of public input into the Plan;
- Development of strategies and actions;
- Assignment of responsibilities and priorities.

Numerous resources were referenced in the development of this Hazard Mitigation Plan including publications from the Federal Emergency Management Agency (FEMA) and the Rhode Island Emergency Management Agency (RIEMA), as well as the Town's 2015 Comprehensive Community Plan, zoning and building regulations and GIS data. A complete list of referenced material can be found on Pages 73-76.

2.2 COMPREHENSIVE PLAN: NATURAL HAZARDS/SEA LEVEL RISE

For the first time, the Town in 2015 included a Natural Hazards element in the Comprehensive Community Plan, bringing it in compliance with the State Comprehensive Planning and Land Use Regulation Act (RIGL Sec. 45-22.2), as amended in 2011. The Act now requires comprehensive plans to "include an identification of areas that could be vulnerable to the effects of sea-level rise, flooding, storm damage, drought, or other natural hazards. Goals, policies, and implementation techniques must be identified that would help to avoid or minimize the effects that natural hazards pose to lives, infrastructure, and property" (Rhode Island Comprehensive).

While this Plan draws heavily from the Comprehensive Plan's Natural Hazards element, other elements including Land Use, Natural and Cultural Resources, Economic Development, Circulation, and Housing & Neighborhoods were also evaluated in establishing this Plan's Mitigation Strategy (Section 6). To maintain consistency between the two planning documents, the four major goals of the Haz-

ard Mitigation Plan are the same as those of the Comprehensive Plan’s Natural Hazards element:

- **Comprehensive Plan Goal NH-1:** Reduce current and future risk of natural hazards and sea level rise to the built environment.
- **Comprehensive Plan Goal NH-2:** Preserve and enhance the capacity of the natural environment to improve Barrington’s resilience against impacts of natural hazards.
- **Comprehensive Plan Goal NH-3:** Reduce flood risk and the cost of flood insurance within Barrington.
- **Comprehensive Plan Goal NH-4:** Improve the community’s awareness of threats to minimize risk to the public due to natural hazards.

Additionally, this Plan includes the Objectives and Actions from the Natural Hazards element, as they were fully publicly vetted during the Comprehensive Plan process. The Comprehensive Plan implementation priority levels have been re-evaluated to consider additional public input during the development of the HMP, as well as to take into account new information and public input.

2.3 PUBLIC INPUT

2.3.1 Comprehensive Community Plan

The gathering of public input began with the development of the 2015 Comprehensive Community Plan, (2-Planning Process) including the new Natural Hazards element. During this time, from 2013 to late 2014, the Town’s Planning Board and Planning Department conducted a public process that included public meetings at the subcommittee and full Board level. The Town also provided the public opportunities to comment on the Plan as it was being drafted. From spring of 2014 through March 2015, the latest drafts were made available at Town Hall and the Public Library, as well as online at www.barrington.ri.gov. Comments were received at the Planning Department and shared with the Planning Board for consideration in finalizing the Plan.

A substantial public outreach effort was conducted in September 2014, when the Planning Board and Town hosted three public workshops on the Comprehensive Plan at locations in Hampden Meadows, West Barrington,

Figure 2.1: Comprehensive Plan Workshop, Sept. 2014



At a workshop held at Nayatt School in September 2014 (pictured above), members of the public used sticky dots to the “vote” on proposed goals and actions (yellow for actions they support; red for actions they do not support).

ton, and in the Nayatt area. To advertise the workshops, the Town mailed postcard invitations to every address in Barrington (a total of 7,014 mailings). More than 70 people attended these sessions. Examples of the outreach materials have been provided in **Appendix 2**.

As depicted in **Figure 2.1**, at the Comprehensive Plan workshops in 2014, attendees were provided an opportunity to review boards with goals and actions listed by element and indicate through the use of colored “sticky dots” which actions they supported.

Participants could each “vote” up to five times each to indicate support or opposition to the Planning Board’s recommended Comprehensive Plan actions, which totaled approximately 220 across all of the Plan elements including 24 actions in the Natural Hazards element.

Actions related to natural hazards that drew the strongest support included the following:

- Complete steps required to enroll in NFIP Community Rating System (8 votes);
- Assess potential impacts, physical and financial, of projected sea-level rise on publicly and privately

- owned buildings, sites, and infrastructure (4 votes);
- Establish an administrative team to meet quarterly to review progress on implementation of the Hazard Mitigation Plan and activities resulting in CRS credit (3 votes);
- Assess streams and dams and prioritize projects needed to maintain/improve water flow (2 votes); and
- Work with local land trust and other stakeholders to identify low-lying vulnerable land that could be designated as permanently protected open space (2 votes).

The public workshops were an asset to the planning process with valuable insight provided by attendees. Factoring in workshop feedback and written comments from the public and the State, the Planning Board identified several Natural Hazards Actions as “High Priority.” The Board gave a lower priority or, in some cases, eliminated, actions that received no sticky dot votes.

As part of the State approval process, the Town received input on the draft Natural Hazards element from State agencies in November 2014. In response, Town staff made final revisions to the Plan. A public hearing on the final Plan was held March 25, 2015, commencing with both the Planning Board and Town Council adopting the 2015 Comprehensive Community Plan. State approval, granted in May 2015, expires on May 10, 2025.

2.3.2 Hazard Mitigation Plan Survey

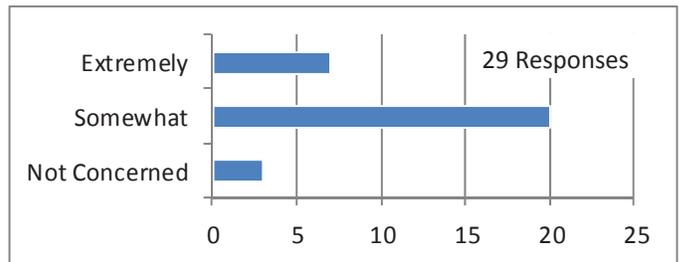
On June 26, 2015, the Town published an on-line survey hosted at www.SurveyMonkey.com. The survey provided the opportunity for the public to submit suggestions on how the Town should contend with impacts of natural hazards and sea level rise. A detailed summary of the survey, which generated 30 responses, has been provided in **Appendix 2**.

The survey indicated that residents considered the following hazards as the most significant threats to their neighborhoods. The first percent/number refers to respondents rating the hazard as the greatest threat; the second percent/number refers to those rating the hazard as the second greatest threat.

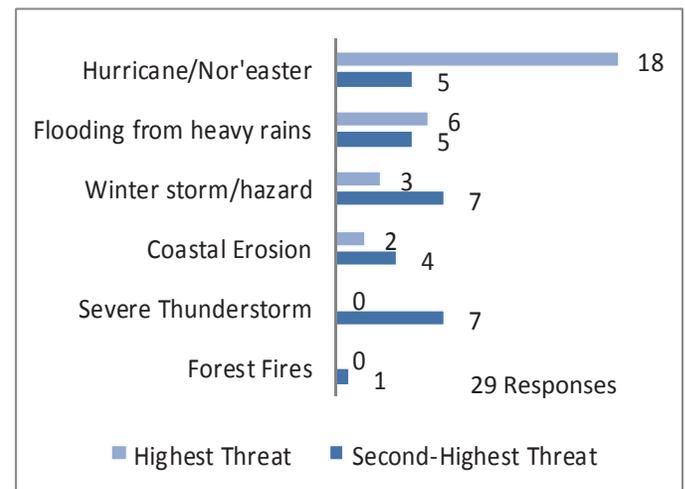
- Hurricane/Nor’easter: 62% (18) / 17% (5)
- Flooding from Heavy Rains: 21% (6) / 17% (5)

Figure 2.2: Barrington Hazard Mitigation Plan Survey Results

Question: How concerned are you about the possibility of the community being impacted by a natural disaster?



Question: Select the two hazards you consider the highest and second-highest threat to your neighborhood



Source: SurveyMonkey survey, June—September 2015

- Winter Storm/Blizzard: 10% (3) / 24% (7)
- Coastal Erosion: 7% (2) / 14% (4)
- Severe Thunderstorm/High Wind: 0% / 24% (7)
- Forest Fire: 0% / 3.5% (1)

Appreciative of the value of public input, the HMP Committee evaluated the community input and concurred with the survey results listing the most significant threats as: hurricanes and nor’easters, flooding, winter storms, and coastal erosion, with sea level rise and climate change identified as factors that will worsen these threats over time. The Mitigation Strategy places the most emphasis on mitigating these hazards.

In addition, the survey generated 35 suggestions, some of which have been provided below, in response to the following questions. Appendix 2 contains the entire com-

pilation of responses and a description of how this Plan addresses each comment.

- *What should the Town of Barrington do to mitigate natural hazards in the future?*

Responses included:

- ◇ Require new construction including additions and rehab to be well above flood levels, and consider roof lines and height limitations in high wind areas too. Improve natural and man made drainage.
 - ◇ Provide better maintenance of areas subject to flooding.
 - ◇ Prepare public shelters and other infrastructure to assist in relief and recovery processes. Encourage residents to be better prepared than we are at present.
 - ◇ Provide information about the risk of ice dams.
 - ◇ Educate the community and train volunteers as shelter workers.
 - ◇ Work with National Grid to keep power on; central resource to communicate re: natural disasters; and designate more shelters.
 - ◇ Be aggressive in determining which trees have a lot of rot and contact homeowners. Remove decaying street trees. Keep sidewalks and street drains clear.
- *What should the Town of Barrington do to prepare for impacts of future sea level rise?*
- Responses included:
- ◇ Rent or buy equipment to re-establish beach after severe storm erosion events (Florida-Siesta Key has done this regularly).
 - ◇ Require all new street paving to incorporate improved drainage (could be as simple as road side grassy swales).
 - ◇ All town planning should respect the 5 ft. sea level rise impact zone.
 - ◇ Consider changes to zoning code to protect coastal flood zones.
 - ◇ Improve and maintain walls for properties where town facilities have removed natural barriers to wave/tide action (e.g., properties fronting the Town Beach parking lot).
 - ◇ Limit coastal development. If it doesn't have a house on it by now, there is very likely a reason. New housing in high frequency flood zones should be elevated.

- ◇ Restrict further development in town, and construction in at-risk zones. Commission and then publicize results of hazard assessments that include predicted water level rise.
- ◇ Coastal experts and engineers should meet with appropriate town committees, and if necessary a task force should be formed. All meetings should be open to the public.
- ◇ Limit coastal building; plant grasslands; and curb carbon footprint.
- ◇ Retreat from shoreline and expanded coastal buffers

2.3.3 Hazard Mitigation Plan Community Outreach Events

The HMP public process included the opportunity for individuals to attend Hazard Mitigation Committee meetings and provide input on the Plan. Additionally, the latest drafts were made available at Town Hall and the Public Library, as well as on-line at www.barrington.ri.gov. Further, at the August 4, 2015 Planning Board meeting, a consultant hired by the Town gave a presentation on the Hazard Mitigation Plan Update, the minutes of which are included in Appendix 2.

In 2017, the Town, along with the Town of Warren, participated in the University of Rhode Island Coastal Institute's Climate Response Initiative, bringing together a team of experts to evaluate natural hazard threats, in particular sea level rise, coastal flooding and erosion and storm surge. On April 26, 2017, the team toured sites throughout Barrington that are susceptible to these impacts. About 30 people attended a Climate Response public workshop (see flyer in Appendix 2) on May 31, 2017 at Barrington Town Hall that focused on sea level rise in Barrington, including policies, on-line resources and strategies to evaluate and respond to the threat.

In the spirit of regional cooperation, this Plan was shared in May 2017 with adjacent municipalities—the Town of Warren and the City of East Providence (copies of the letters forwarding the Plan is included in Appendix 2). No comments were received from either municipality.

Finally, the HMP was presented to the Town Council on June 5, 2017. The Council voted 5-0 to submit the Plan (Appendix 1) to FEMA for review.

3 Community Profile

3.1 HISTORY AND GOVERNMENT

3.1.1 History

When the RI General Assembly established Barrington as an independent town in 1770 it was primarily a farming community with a few hundred residents. While the town remained largely agricultural into the early 20th century, manufacturing was introduced in Barrington in the mid-1800s, maintaining a modest presence into the 1900s. Manufacturing facilities – none of which are still in operation – included brickmaking at what is now Brickyard Pond, and mills in West Barrington (Mason).

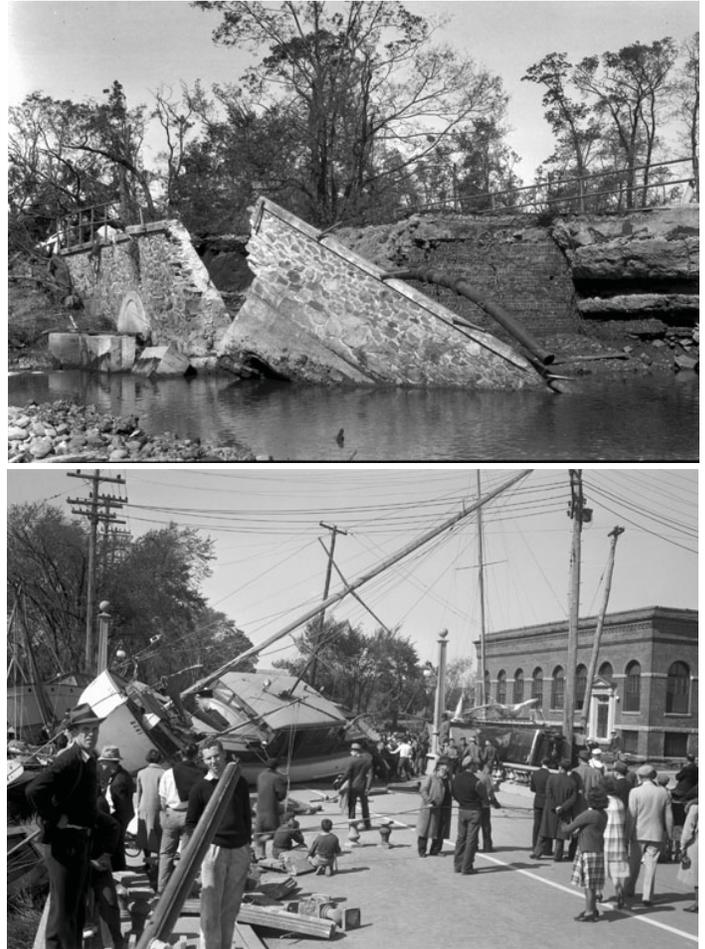
With the construction of the Providence, Warren & Bristol Railroad in the mid-1800s and the addition of trolley service around 1900, commuting from suburban Barrington to work in the state capital became more feasible (Mason). The town’s population began to soar, increasing from approximately 1,135 in 1900 to 8,250 in 1950, to around 16,300 today. Barrington had a population of just 6,231 in 1940, two years after the Hurricane of 1938 (Figure 3.1) left widespread damage throughout town (Rhode Island Population).

With this 15-fold increase in population, Barrington has changed from a primarily agricultural community with a small industrial base to a residential commuter suburb of Providence. The existing built environment was influenced by Barrington’s past: the densest residential neighborhoods are in the vicinity of the former manufacturing sites (West Barrington and Maple Avenue) and within proximity to the old railroad, now the East Bay Bike Path; and areas with the lowest density were where farming once was prevalent (such as Rumstick Point) or is still a significant land use (the George Street area in northern Barrington near the Massachusetts line).

3.1.2 Municipal Government

The Town operates under a charter form of government, which provides for a five-member Town Council that is

Figure 3.1: Photos of Aftermath of 1938 Hurricane



Hurricane of 1938: Bridge on Nayatt Road completely destroyed; boats and damaged utility lines on Barrington River Bridge.

elected at large, for staggered four-year terms, at the regular biennial elections. They are responsible for enacting local legislation, and an appointed Town Manager executes the laws and oversees the administration of the town government.

The Town provides the following major public services:

- Public Works - The Department of Public Works provides a full range of services including street maintenance, snow removal, and maintenance of Town property. The DPW is based at 84 Upland Way.

- **Public Safety** – The Town provides fire prevention and suppression, emergency medical rescue, police patrol, investigations, community education, animal control and waterways management. The Public Safety Building is located at 100 Federal Road.
- **Wastewater** - Barrington's sanitary sewerage is treated by the City of East Providence. The Town pays the City of East Providence a fee based on the amount of sewerage treated at the wastewater facility. Residents are billed annually by the Town of Barrington for sewer usage based on water consumption.
- **Public Water** - Bristol County Water Authority, which is headquartered in Warren, supplies residents of Bristol County with water. Customers are billed directly by this agency. Barrington appoints three directors to sit on the Water Authority Board, which oversees the Authority's budget.

3.1.3 School Department

A five-member School Committee that is elected at large for staggered four-year terms at the regular biennial elections, directs the general administration of the Barrington School Department. The School Committee determines and controls all policies affecting the administra-

tion, maintenance, and operation of the public schools in town, which consist of four elementary schools, one middle school and one high school.

The School Committee appoints a Superintendent as its chief administrative agent; submits a detailed budget of expenditures, and determines the allocation of the amount appropriated.

3.1.4 Budget

Annual Town and School budgets, including the capital budget (based on a recommendation by the Planning Board), are first developed by the Town Manager and School Superintendent, and then submitted to the Town Council and School Committee respectfully, for approval. The budgets then are forwarded to the Committee on Appropriations, which may make further revisions before making their final budget recommendation, which is voted on by Town residents at the Financial Town Meeting, generally held in May of each year.

3.2 GEOGRAPHY

Barrington is a coastal community located on the east side of Narragansett Bay in Bristol County, Rhode Island (Figure 3.2). The town has 19.6 miles of coastline—of which 11.5 miles are tidal shoreline—and occupies two peninsulas, bound by Narragansett Bay to the west and the Palmer and Warren Rivers to the east. Barrington's coastline meanders along Narragansett Bay, the Providence River as well as three tidal rivers – the Barrington, Warren, and Palmer Rivers – connected to the Bay. The town also has inland water bodies, most notably Brickyard Pond and Echo Lake, as well as other smaller ponds fed by creeks and streams. Overall, Barrington contains approximately 7.2 square miles of water, or 46.7 percent of the 15.4 square miles within Barrington. According to the 2015 Comprehensive Plan, inland water bodies in Barrington total 0.3 square miles (US Census Bureau. Rhode Island).

The Barrington River separates the two peninsulas, and Central Bridge (the “White Church Bridge”) and the Barrington River Bridge connect the two land masses. No location in Barrington is more than two miles from coastal waters. Barrington's western land mass is connected to East Providence along its northern municipal boundary. The western area includes the “Village Cen-

Figure 3.2: Location Map—Barrington



ter” business district located in the vicinity of County Road and Maple Avenue. Barrington’s eastern land mass, which includes the Hampden Meadows neighborhood, is connected to Swansea, Massachusetts along its northern municipal boundary.

3.3 LAND USE

Barrington is classified as a medium-density developed community, with significant areas of wetland, public open space, and recreation land. Based on data from the Land Use element within the Comprehensive Community Plan, Barrington is mostly residential, which comprises approximately 53 percent (2,844 acres) of total land area within the town (5,376 acres). Commercial land comprises roughly 2 percent (119 acres); institutions (including government, schools and churches) comprise 3 percent (148 acres); and transportation and utilities make up 0.6 percent (31 acres) of total land use.

Of the 6,199 housing units in the 2010 census count, approximately 90 percent were one-unit (single-family) structures; the remainder consisted of structures with two or more units. There are no mobile homes in Barrington; these are a prohibited use per the Zoning Ordinance (Sec. 185-12).

The most significant developed commercial area in Barrington is within the “Village Center” district (County Road/Maple Avenue area); this area has the highest con-

centration of impervious surface due to large parking lots in addition to buildings. Smaller commercial nodes are in the vicinity of Bay Spring/Washington Road and Sowams Road/Kent Street. Waterfront commercial areas (marinas and associated businesses) are located in Bay Spring on Bullock Cove and at Tyler Point at the confluence of the Warren and Barrington Rivers.

As described in Table 3.1, parks, conservation and other protected open space parcels, unprotected undeveloped properties, agricultural areas, and wetlands make up approximately 39 percent, or 2,011 acres, of the land area within town.

Less than 10 percent of the land within Barrington remains available for development. Future land use patterns are not predicted to change significantly, and the preservation of open space and limiting development to non-vulnerable environmental areas continues to be a priority.

3.4 POPULATION AND DEMOGRAPHICS

In 2010 Barrington was ranked 21st in population among the 39 cities and towns in Rhode Island. The 2010 census data indicate that Barrington’s population is aging, with the greatest population increase having occurred from 2000 to 2010 within the 80 years and older cohort.

According to the 2010 census, Barrington’s 16,310 residents were categorized demographically as follows: 94.7 percent white, 0.5 percent black, 2.8 percent Asian, and about 1.9 percent other. These are approximately the same percentages as all of Bristol County, but vary from those of the state, which has a lower percentage of white (81.4 percent). In addition, there are 333 people of Hispanic origin in Barrington, or 2.0 percent of the total population, which is almost double the number from 2000. Hispanics make up about 12.4 percent of the state’s population.

The town’s population is nearly a third of Bristol County’s but represents only 1.6 percent of the state’s population. In terms of its age distribution, the aging of the Baby Boomers is pushing up the town’s median age, from 40.2 years in 2000 to 44.1 years just 10 years later. The percentage of people 65 years and older in 2000 (14.7 percent) remained approximately the same in the 2010 census.

Barrington households have historically had income levels higher than both the surrounding county and the state.

Table 3.1 Barrington Land Use

Land Use	Acres	% of Total
Commercial/Mixed Use	119.31	2.2%
Institutional	148.28	2.8%
Residential	2,843.71	52.9%
Transportation	31.27	0.6%
Waste Disposal	13.36	0.2%
Developed Recreation	217.11	4%
Cemeteries	19.16	0.4%
Conservation/Open Space	644.61	12%
Undeveloped (unprotected)	509.04	9.5%
Agriculture	199.34	3.7%
Wetland	440.90	8.2%
Water (Inland)	190.05	3.5%
Total Acreage	5,376.15	100%

Source: RIGIS, 2015 Barrington Comprehensive Plan

Five-year estimates from the 2008-2012 American Community Survey, listed Barrington’s household median income as \$103,211, compared to \$56,102 statewide. Within Barrington, there is a significant gap in income for households in owner-occupied units compared to rental units. The 2010 census estimated household median income for 5,106 owner-occupied units in town as \$102,727, compared to \$41,646 for 680 renter-occupied units.

3.5 TRANSPORTATION

As described in the 2015 Comprehensive Community Plan, Barrington has approximately 110 miles of State- and Town-maintained roadways (Table 3.2). The town’s major artery is Route 114/103, a heavily traveled State road that links Barrington with other East Bay communities; it is the only direct route connecting Barrington with Warren to the south. Route 114/103 splits at the Wampanoag Trail in the northern portion of town, where Route 103 becomes an east-west route connecting to East Providence at Willett Avenue. Route 114 continues north as the major route for motorists traveling to other points in East Providence, Seekonk, Providence or beyond.

Barrington is largely dependent on the use of private vehicles. The 2008-2012 ACS indicated just 142 workers out of 7,513, or 1.9 percent, commute to work by bus. The same survey estimated that 279 households – 135 owner-occupied units (2.6 percent of total homeowner units) and 144 renter-occupied units (19 percent of total rental units) – had no vehicle at their home.

The Rhode Island Public Transit Authority (RIPTA) remains the only public transit system serving Barrington. RIPTA’s Route 60 serves Route 114 in Barrington as it travels between Providence and Newport, and is one of RIPTA’s most successful bus routes. There are about 14 bus stops located between Massasoit Avenue and the Warren

Table 3.2: Classification of Barrington Roads

Type	Miles	% of Total
Other Freeway/Expressway	2.34	2.1%
Principal Arterial	4.42	4.0%
Minor Arterial	7.49	6.8%
Major Arterial	13.59	12.4%
Local*	82.06	74.7%
Total	109.90	100%

Sources: 2015 Barrington Comprehensive Community Plan

Bridge. There are also a number of stops on Route 114 north of Massasoit, although recently installed guardrails make it difficult for bus riders to cross this highway.

Northbound bus shelters are located just north of Town Hall and at the White Church, and south bound bus shelters are located at the East Bay Mental Health Center and across from Police Cove. RIPTA’s Route 61X provides an additional three bus trips each day. In 2013 RIPTA discontinued Route 32, which provided twice daily bus service to West Barrington. According to RIPTA’s website, the closest bus route to West Barrington is Route 33, which runs between Riverside and Providence. The route terminates in Riverside at the Shaw’s plaza on Willett Avenue.

Senior Services, operated by the Barrington Senior Center, also offers transportation to and from the Center for residents aged 60 and above. Reservations must be made a day in advance.

3.6 ECONOMY

Most employment opportunities extend outside the town to the greater Providence and Boston metropolitan areas. In 2013 Barrington had approximately 460 private businesses and 11 government units. The private sector, as of the second quarter of 2013, employed an average of 2,697; health care was the largest sector followed by retail and food services. Governmental jobs employed an average of 690.

Barrington’s non-residential tax base has increased in recent years, from 3.9 percent of the total tax base in 2005 to 4.4 percent in 2009, according to the RI Division of Municipal Finance. The completion of streetscape improvements (new sidewalks, street lighting, street trees, etc.) in the early 2000s within the County Road/Maple Avenue business district has helped encourage the redevelopment of several key underutilized parcels in the area. Commercial development within the past 10 years includes two new banks and three mixed-use buildings that have provided storefronts for new restaurants and shops. Town officials anticipate additional commercial growth resulting from a new \$1.6 million streetscape project focusing on other areas within the “Village Center,” including Wood Avenue, Waseca Avenue and West Street. Construction is anticipated to be completed in 2017.

4 Risk Assessment

This risk assessment evaluates potential impacts of hazards to the people, economy, and built and natural environments of Barrington, creating a basis for the Mitigation Strategy (Section 6). As described in FEMA’s Local Mitigation Planning Handbook (p. 5-1) and illustrated in **Figure 4.1**, the degree of risk can be measured by the overlap between hazards and community assets; the larger the overlap the greater the risk.

This Risk Assessment is organized with the goal of measuring this overlap, as follows:

4.1: Hazard Identification: Identification of hazards relevant to Barrington

4.2: Hazard Profiles: Profiles of each identified hazard

4.3: Climate Change/Sea Level Rise Impact: Recognition of how climate change and sea level rise exacerbate natural hazards

4.4: Community Assets: A description of community assets

4.5: Vulnerability Analysis: An analysis of risk of hazards impacting community assets

4.1 HAZARDS IDENTIFICATION

The 2014 Rhode Island State Hazard Mitigation Plan (SHMP) defines a natural hazard as “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 or loss” (RIEMA. State, 27).

In preparing this Update, the Barrington Hazard Mitigation Committee employed a process of identifying natural hazards that consisted of reviewing the Town’s 2010 Multi-Hazard Mitigation Plan for continued relevance, the SHMP, plans from adjacent and similar communities, information from the National Oceanic and Atmospheric Administration and relevant articles on natural hazards.

Figure 4.1: Degree of Risk—Risk Assessment



Source: FEMA (Local Mitigation Planning Handbook, p. 5-1)

In order to fulfill the planning guidelines outlined in Section 322 of the Disaster Mitigation Act of 2000 (DMA 2000), this Plan addresses only natural hazards, and does not consider man-made hazards (i.e. structural fires, hazardous materials, chemical spills, and weapons of mass destruction).

The Committee reviewed the State list of hazards and assessed the probability and impact each may have on the Town. The hazards were evaluated based on their local historic frequency, as well how Barrington’s natural features (such as a lack of steep slopes with regard to landslides, or mountains with regard to avalanches) lend to the probability of the hazard occurring.

This assessment, the outcome of which is summarized in **Table 4.1** (next page), allowed the Committee to focus the mitigation strategies outlined in this Plan on the hazards which potentially pose the greatest threat to Barrington. This was a critical step in the process as all municipalities have finite resources and it is therefore imperative that allocation of those resources be used wisely.

Keeping in line with the SHMP’s risk assessment, the natural hazards that will be addressed in this Plan, have been grouped into five categories, and in **Table 4.2** are

listed in order of frequency and impact, starting at the top of the list with the most frequently occurring natural hazards. These hazards pose the greatest risk to Barrington and their probability of occurring over the next five years and severity of community impact are summarized within the table. A description of the vulnerability analysis criteria is included as **Appendix 3**.

4.2 HAZARD PROFILES

As indicated below, the hazards identified as posing the greatest threat to Barrington have been classified into five categories, each of which will be profiled in this section. The profiles include a description and are defined in terms of location (geographic areas affected), extent (strength or magnitude of impact), previous occurrences, and probability of future events.

4.2.1 – Flood-Related Hazards (Inland Flooding, including dam failure, Coastal Flooding/Storm Surge, Coastal Erosion)

4.2.2 – Wind-Related Hazards (Hurricanes, High Winds, Tornadoes)

4.2.3 – Winter-Related Hazards (Heavy Snow, Ice)

4.2.4 – Geologic-Related Hazards (Earthquakes)

4.2.5 – Other Hazards (Droughts, Wildfires)

Table 4.1: Hazard Probability Occurring in Barrington, RI

High Probability: Addressed in this Plan	Low Probability: Excluded from this Plan (with Explanation for Exclusion)
Inland Flooding (including dam failure)	<i>Following excluded as area lacks mountains, steep slopes</i>
Coastal Flooding/Storm Surge	<i>or subsurface conditions:</i>
Coastal Erosion	Avalanches
Hurricanes	Expansive soils
High Winds	Land Subsidence
Tornadoes	Volcanoes
Heavy Snow	Landslides
Ice	<i>Following excluded as there have been no reported incidences in Bristol County since 1950:</i>
Earthquakes	Extreme Heat/Cold
Droughts	Tsunamis
Wildfires	

Source: www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=44%2CRHODE+ISLAND

4.2.1 Flood-Related Hazards

Flooding, the accumulation of a substantial amount of water in areas that are typically dry, generally results from heavy rainfall, storm surges and melting snow. Barrington is a low-lying community containing approximately 7.2 square miles of water, including lakes, rivers, watercourses, inlets, and coves. Barrington’s extensive inland water as well as coastal exposure make it particularly susceptible to flooding.



Some of the most significant recent floods in Bristol County are highlighted in **Table 4.3** (next page). Barrington experienced substantial flooding in some areas during these high precipitation events. A heavy rain event that was particularly damaging to Barrington and across

Table 4.2: Probability of Community Impact from Hazards Affecting Barrington Over Next 5 Years

Hazard	Probability	Impact
FLOOD-RELATED HAZARDS		
Inland Flooding	High	Moderate
Dam Failure	Low	Minor
Coastal Flooding/Storm Surge	High	Serious
Coastal Erosion	High	Serious
WIND-RELATED HAZARDS		
Storm Surge	High	Serious
Hurricane	Medium	Serious
High Winds	Medium	Moderate
Tornado	Low	Serious
WINTER STORM-RELATED HAZARDS		
Heavy Snow	High	Moderate
Ice	High	Moderate
GEOLOGIC-RELATED HAZARDS		
Earthquake	Low	Minor
OTHER HAZARDS		
Drought	Medium	Minor
Wildfire	Low	Minor
Probability: <u>High</u> = 90% - 100% chance of occurrence <u>Medium</u> = 10% - 90% chance of occurrence <u>Low</u> = 1% - 10% chance of occurrence Impact*: <u>Serious</u> = Significant to Extensive Exposure, Severe to Extreme Extent <u>Moderate</u> = Limited Exposure, Moderate Extent <u>Minor</u> = Negligible to Limited Exposure; Weak Extent		
*See Appendix 3		

the state occurred in March 2010 and prompted a Presidential Major Disaster Declaration for Rhode Island.

The RI Graphic Information System (RIGIS) has made available FEMA's Digital Flood Insurance Rate Map (DFIRM) database for the state. The Town has utilized the DFIRM data in developing this Plan. FEMA has designated flood zones according to varying levels of flood risk as shown on **Map 1**. Each zone reflects the potential severity and type of flooding in the area. High risk areas in Barrington are designated as Zone AE and Zone VE. Zone AE, or the 100-year flood zone, identifies areas with a one percent or greater chance of flooding in any given year and where the base flood elevation has been determined. Zone VE, the Velocity Zone, identifies coastal areas with a one percent or greater chance of flooding plus storm-induced waves, or velocity action.

Based on State GIS data, almost two-thirds of Barrington's land area is within a FEMA-designated flood zone: 6 percent within Zone VE, 36 percent within Zone AE, and 24 percent within the 500-year flood zone (0.2 per-

cent annual chance floodplain). **Table 4.4** (next page) provides an estimated count of the number of structures (excluding accessory buildings) within flood zones AE and VE in Barrington. The VE zones extend along areas exposed to Narragansett Bay, along Allin's Cove and Bullock Cove and the Warren River. AE zones are prevalent in the Bay Spring / West Barrington area, Adams Point and Mathewson Road areas, and sections in the vicinity of the Barrington and Palmer Rivers and One Hundred Acre Cove.

4.2.1.1 Inland Flooding

Flooding directly impacts Barrington residents in many of the low-lying areas of Town. Significant inland flooding can lead to extensive damage to structures and personal property and flooded roadways can cause dangerous conditions for motorists. Additionally, flooding has the potential to disrupt water, stormwater, and sewer systems; carry toxic material or contaminants thereby spreading pollution, disrupting wildlife, and standing water following a flooding event can provide a conducive environment for breeding mosquitos.

Table 4.3. Severe Rainfall and Floods in Bristol County, Rhode Island, 1993-2010

Date	Type	Rainfall (inches)	Notes
January 10, 1997	Coastal Flood	N/A	2-4 foot tidal surge in Narragansett Bay. Palmer River flooded some Barrington streets.
March 28, 2005	Flood	3-4	Flooding in poor drainage areas; significant street flooding.
June 7, 2006	Flood	2-4	Some street flooding.
October 28, 2006	Coastal Flood	2-4	Significant coastal flooding; some street flooding.
March 2, 2007	Flood	2-3	Urban, small stream; some street flooding.
February 13, 2008	Flood	2-4	Flooding in streams and poor drainage areas; some minor river flooding; minor wind damage from strong northeast winds, especially along the coast.
March 8, 2008	Coastal Flood	2-3	Minor coastal flooding at high tide, rough seas, storm surge.
December 12, 2008	Flood	3-5	Small stream and some street flooding.
March 30, 2010	Flood	7-8	Upland Way/Maple Avenue/Middle Highway intersection flooded. Basements in houses across Barrington inundated with water that had to be pumped out by the Fire Department.
August 10, 2012	Flood	Unavailable	Rte 114 at Barrington/Bristol line (bridge) flooded with 1.5 feet of water
July 15, 2015	Flash Flood	Unavailable	In Barrington, Prospect Street and Simmons Road at Massasoit Avenue as well as several other streets were flooded and impassable. A basement was flooded on Broadview Dr.
July 28, 2015	Flood	6	In Barrington, New Meadow Road at Route 114 was flooded with six inches of water.

Sources: National Climatic Data Center, <http://www4.ncdc.noaa.gov/cgi-win/wwwgi.dll?wwevent~storms>, Rhode Island Department of Transportation, http://www.dot.state.ri.us/Flooded_streets_March2010.asp#Closures

Table 4.4. Estimated Number of Structures in Flood Zones - Barrington

Use	Residential- Single Family		Multifamily/ Senior Hsg.		Commercial		Marina		Institutional		Schools	
	AE	VE	AE	VE	AE	VE	AE	VE	AE	VE	AE	VE
Structures	678	98	22	0	4	1	4	0	1	0	1	-

Source: Town of Barrington GIS data

Description

As described in FEMA’s Flood and Floodplain Management unit, the types of flooding that present a risk within inland (non-coastal) areas in Barrington include:

- Riverine flooding: overbank flooding, flash floods
- Shallow flooding: sheet flow, ponding
- Special flood hazard: dam/levee failure

Flooding has the potential to disrupt water, stormwater, and sewer systems; carry toxic material or contaminants thereby spreading pollution; disrupt wildlife; and standing water following a flooding event can provide a conducive environment for breeding mosquitos.

◇ *Riverine Flooding*

Riverine flooding is defined as flooding that occurs along a channel. Overbank flooding is the overflow of water from a river or stream into the adjacent floodplain due to an increase in the volume of water within a channel. Riverine flooding can result in damage to structures and personal property.

Flash floods result from severe storms that drop significant rainfall over a short time. Steep slopes and narrow stream valleys increase a community’s vulnerability to flash floods and resultant damage. Flash flooding also can occur where impervious surfaces (streets, parking lots, etc.), gutters, and stormwater facilities speed runoff. Another potential source is the result of dam failure or the release of ice-jam flooding.

◇ *Shallow Flooding*

Shallow flooding occurs in flat areas where a lack of channels means water cannot drain away easily. Urbanization exacerbates the accumulation of floodwater due to increased impervious surfaces, and is of particular concern in areas that have a high groundwater table, where development has occurred within floodplains, or with marginal urban drainage systems.

Often urban drainage systems, which include swales, ditches, storm sewers, retention ponds, and other facilities constructed to store or carry runoff to a receiving waterbody, are insufficient in size or due to lack of maintenance to accommodate heavy rainfall. Two categories of shallow flooding are:

- Sheet flow – A lack or insufficiency of defined channels creates conditions where floodwater spreads over a large area at a roughly uniform depth.
- Ponding –This condition occurs when stormwater runoff collects in depressions and cannot drain out; the water remains until it infiltrates into the soil, evaporates or is pumped out. (This does not include stormwater retention ponds specifically designed to collect stormwater and retain the water until it infiltrates into the soil – typically within a matter of hours.)

◇ *Special Flood Hazard – Dam Failure*

Dam failures can create the most damaging flash flood events. The speed of onset of such an event provides little or no warning time, limiting the opportunity to prepare and evacuate.

Location

◇ *Riverine Flooding*

The town lacks any significant non-tidal rivers, but there are creeks and streams that represent a risk for riverine flooding for inland neighborhoods that are removed from the coast. These include:

- Annawamscutt Brook, which flows south from Riverside in East Providence, through the Riverside Plaza shopping center, into Barrington through a neighborhood of single-family houses and Haines Park, underneath Bay Spring Avenue via a culvert, and past Barrington Cove Apartments where it ends at Allin’s Cove.
- Mussachuck Creek, which flows westerly for about a mile from Brickyard Pond to Narragan-

sett Bay. It flows through culverts under Middle Highway and Washington Road and under a small bridge near the Bay constructed as a private driveway across the creek.

- Hampden Meadows Greenbelt streams and drainage channels. This conservation area features significant freshwater wetlands in addition to manmade drainage channels; the main channel flows north-south, and near the Greenbrier Drive/New Meadow Road intersection flows through a culvert into the Barrington River.
- An unnamed creek/stream originates from Barrington River/Osemequin Park and connects to Upper Echo Lake (Little Echo). It flows through a forested wetland to the west of the St. Andrews School campus, then proceeds underneath Federal Road via a culvert where it crosses to the west of the Public Safety Building, and continues on behind Atlantic Crossing and to the south of the Middle School.

◇ *Shallow Flooding*

New development is subject to the State's stormwater regulations, requiring bioretention basins, swales, dry wells and other measures to capture and treat stormwater from streets, rooftops and other impervious surfaces. However, as development in most areas of town predated such requirements, the majority of stormwater is handled by catch basins and roadside ditches which convey flow to wetlands, creeks, swales and channels, and eventually reach such inland waterbodies as Brickyard Pond, Echo Lake, and O'bannon Pond at Haines Park, as well as coastal waters (Barrington, Palmer and Warren Rivers, and Narragansett Bay).

◇ *Special Flood Hazards – Dam Failure*

The Rhode Island Department of Environmental Management's 2015 Annual Dam Safety Report (3-Risk Assessment) lists a total of two dams within Barrington: the Echo Lake Dam at South Lake Drive and Echo Lake, and the New Meadow Neck Dam in Hampden Meadows. The Echo Lake Dam is earthen and controls flow from Echo Lake into Mussachuck Creek. The New Meadow Neck Dam is also earthen and holds water forming the Kent Street pond. Water from this dam is released into a manmade drain-

age canal that runs north-south through the Hampden Meadows Greenbelt conservation area.

Both dams are located in the 100-year Flood Zone (Zone AE). The Echo Lake Dam and the New Meadow Lake Dam (listed as "unnamed") are both classified as "Low" hazard dams in the 2015 Annual Dam Safety Report. These dams present minimal threat to Barrington as the failure or misoperation of "Low" hazard dams is determined to result in no probable loss of human life and low economic losses.

The extent of flooding may increase in the future as a result of climate change producing more intense rainfall.

Extent

Although there is no distinct flood season in Barrington, climate change, which is predicted to intensify rainfall, is likely to increase peak flooding, particularly in urban environments in the future. The magnitude of this increase is dependent on the level and rate of greenhouse gas emissions through the end of the century.

◇ *Riverine Flooding*

While there is potential for flash flooding, Barrington is mostly a low-lying community, lacking steep slopes and narrow stream valleys that exacerbate flash floods. As a result, riverine flooding is more likely to result from an event with a slower speed of onset that causes stream and creek banks to overtop. In relatively flat floodplains, as in Barrington, floodwaters are typically slow-moving and shallow. As Barrington's creeks and streams are part of small basins, flooding may be more difficult to predict and therefore unlikely to provide useful warning time. Streams and small rivers are also susceptible to flooding from more localized weather systems that cause intense rainfall over only a small area.

◇ *Shallow Flooding*

Throughout the town, shallow flooding can impact streets, but the impact typically is minor, as the water generally drains away quickly once heavy rainfall ends. The potential damage from flash flooding is also minor, as Barrington is mostly a low-lying community,

Figure 4.2: Coastal Flooding—East Bank of Barrington River, Day Before Hurricane Irene, Nov. 2011



lacking steep slopes and narrow stream valleys that exacerbate flash floods.

◇ *Special Flood Hazards—Dam Failure*

Dam failures can create the most damaging flash flood events. The speed of onset of such an event provides little or no warning time, giving people limited opportunity to prepare and evacuate. However, the two dams in Barrington are not anticipated to create this type of significant flash flood. The Kent Street earthen dam was designed to hold water as a skating pond. The Mussachuck Creek dam is located upstream from a large open space—the golf course at the RI Country Club at Echo Lake.

Previous Occurrences

Barrington regularly experiences storms and heavy rains that result in localized flooding.

◇ *Riverine and Shallow Flooding*

Per Table 4.3 (page 15), there have been multiple flooding events in inland areas over the past 20 years, including flooded streets and stream flooding. The heavy, extended rains in March 2010 inundated areas throughout the town, requiring the Fire Department to pump out flooded basements across town. As it has done several times in the past, the Rhode Island Department of Transportation (RIDOT) closed the intersection of Middle Highway and Maple Avenue for several days due to flooding

from Volpe Pond and associated wetlands. At the time, this area had been identified on FEMA's Flood Insurance Rate Map (FIRM) as a minimal flood hazard, located well outside the 100-year Flood Zone, and even outside the 500-year Flood Zone, or the 0.2 percent chance annual floodplain. The revised FIRMs, effective July 7, 2014, placed this area in the AE zone.

◇ *Special Flood Hazards – Dam Failure*

There are no recorded instances of dam failure in Barrington.

Probability of Future Events

◇ *Riverine and Shallow Flooding*

Barrington's lack of steep slopes and narrow stream valleys mean the probability of flash floods is low. However, the likelihood of stream flooding and flooded streets is high based on previous occurrences.

◇ *Special Flood Hazards – Dam Failure*

Both dams in town are considered low hazard and are stable. Although a dam breach is unlikely, should it occur such an event presents a minimal threat.

4.2.1.2 Coastal Flooding/Storm Surge

Description

Coastal flooding (**Figure 4.2**) is related to wind hazards, as this type of event is often a result of storm surge and wind-driven waves, which erode the coastline. These condi-

tions are produced by hurricanes (tropical storms) during the summer and fall. Nor'easters and other large coastal storms (extra-tropical storms) are produced during the fall, winter, and spring. Storm surge – the abnormal rise in water level caused by the wind and pressure forces of a hurricane or nor'easter – may overrun barrier islands and push sea water up coastal rivers and inlets, blocking the downstream flow of inland runoff (RIEMA. State).

As a low-lying community with 20 miles of coastline exposure to Narragansett Bay, coastal flooding is highly probable and may have serious consequences for the Town of Barrington.

Large swaths of developed and forested land may be inundated by both saltwater and freshwater. Escape routes may be cut off quickly, stranding residents in flooded areas, hampering rescue efforts, and limiting life support services. In addition to storm surge, coastal storms produce wave action at the shoreline, which can become very destructive, damaging natural and manmade structures, battering solid objects, and scouring sand from around foundations.

Coastal flooding can cause damage to structures and property along the coast. It can also erode beach material and carry debris out to sea. As sea levels continue to rise the inundation area subject to coastal flooding and storm surge will continue to increase.

Location

Current Flood Insurance Rate Maps (FIRMs) for Barrington (effective July 7, 2014) show the coastal VE zone occurring along much of the western and southern coast, where the town is in close proximity to Narragansett Bay and the Warren River. The VE zone also extends along the easterly shore of Bullock Cove in the Bay Spring neighborhood.

The Town also has extensive areas within the AE (100-year) zone associated with coastal waters—Barrington River, One Hundred Acre Cove, Palmer River and Warren River. The potential extent of coastal flooding is depicted in **Map 1**, showing the location of the Velocity flood zone and the 100- and 500-year flood zones throughout town.

Areas of undeveloped coastal wetland can be found along Rumstick Point, between Nayatt Point and the Town Beach, and along Mussachuck Creek. These areas may help minimize the effects of localized flooding. Zone AE extends inland to include low-lying areas such as the land near Brickyard Pond and Echo Lake, and the estuarine wetlands associated with the Barrington River, 100-Acre Cove, and the Palmer River.

Based on State GIS data, almost two-thirds of Barrington's land mass is within a FEMA-designated flood zone: 6 percent within Velocity zones, 36 percent within 100-year zones, and 24 percent within the 500-year zone.

Extent

Coastal flooding is a particular concern to Barrington because of its extensive coastline. With the exception of several elevated shoreline areas, much of Barrington's coast is low-lying and therefore vulnerable to flooding. As water depth over a given surface increases with storm surge, larger waves can be generated. Storm surge heights in Barrington range from a few feet higher than normal tides during nor'easters to more than 10 feet during hurricanes. The areas of Barrington susceptible to storm surge are depicted on **Map 2**.

It is recognized that hurricanes have the potential to worsen coastal flooding, significantly impacting areas beyond the mapped flood zones. Long term, as shown in **Map 3**, and discussed further in Section 4.3, even in the absence of a storm event, the projected rise in sea level alone would have a dramatic impact on the base flood elevations throughout the town. The magnitude of storm surge within a coastal basin is governed by both the meteorological parameters of the storm event and the physical characteristics of the basin. Rather than characterize the extent of storm surge itself, it is more functional to characterize the extent of the event causing the surge.

As outlined in the SHMP the meteorological aspects of storm surge include:

- Hurricane size - Measured from the center of the hurricane to the location of the highest wind speeds within the storm. This radius may vary from as little as 4 miles to as much as 50 miles;
- Hurricane intensity – Measured by sea level pressure and maximum surface wind speeds at the storm center;

- Hurricane path, or forward track of the storm; and
- Hurricane forward speed.

Previous Occurrences

As denoted on Table 4.3 (page 15) incidents of coastal flooding since 1997 include minor coastal flooding in March 2008 due to high tide, rough seas, and storm surge. Impacts from these storms were minor, predominately street flooding. In 2011, Irene (a tropical storm when it reached Rhode Island) flooded some street sections in low-lying areas by the water, and at least one house had flood damage, resulting in an insurance claim. Table 4.6 (page 22), which lists hurricanes that have impacted the region, includes several such events that produced significant storm surge impacts. The most substantial storm surge was from the hurricane of 1938 (12 to 15 feet) and Hurricane Carol of 1954 (14 feet), both of which resulted in widespread destruction in the community.

Probability of Future Events

Flooding is the most prevalent and frequent natural hazard that impacts the state. As a low-lying community with 20 miles of coastline exposure to Narragansett Bay, coastal flooding, resulting from a variety of sources, is highly probable and may have serious consequences for the Town of Barrington.

4.2.1.3 Coastal Erosion

Description

Coastal erosion is the wearing away and removal of beach resulting in loss of sand and material stability. Sea wall failure and coastal erosion are related issues increasingly impacting neighborhoods along the Barrington coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of protective walls, some of which are many decades old. Sea walls protect the buildings behind them and their failure can lead to increased property damage from storms. Similarly, intact beaches with dunes dissipate wave energy, protecting buildings behind them. As beaches erode, this protection is lost.

FEMA has indicated in their latest post hazard event management practices, that reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive this funding, the Town must maintain records of maintenance and repair activities that demonstrate the status of each structure. The Town has recently updated its aerial imagery, which will be beneficial in qualifying future storm damage claims.

Figure 4.3: Extreme High Tide— Barrington Beach



An extreme high tide in November 2016 inundated the west end of Barrington Beach.

Location

All of Barrington's coastline is susceptible to the impacts of coastal erosion. A report prepared for FEMA by the Heinz Center (2000) stated that "Over the next 60 years, erosion may claim one out of four houses within 500 feet of the U.S. shoreline" (Heinz Center, 150).

There are shoreline structures on sections of Barrington's shoreline, protecting private and public properties. The Town maintains revetments at Latham Park/Shore Drive in Bay Spring. Sections of the Latham Park structure were rebuilt in 2014. Additionally, the Town has completed periodic repairs to the sea wall along Mathewson Road at the Barrington River.

Extent

While measurable coastal erosion may occur during a storm event, the actual extent is assessed over extended periods of time. The magnitude of long term coastal erosion may have significant impacts on the duration of flooding and damage from various weather events. According to coastal geologist Janet Freedman of the RI Coastal Resources Management Council (CRMC), the average coastal erosion rate is 1.6 feet per year in Rhode Island (Sullivan). Extreme high tides, or King Tides, occur several times a year, inundating low-lying shoreline areas such as the area west of Barrington Beach (**Figure 4.3**, previous page). Such events threaten to worsen erosion if coupled with wave energy produced by storms.

Previous Occurrences

Sea level rise, coupled with severe coastal storms, has over time caused erosion along Barrington's shores. Shoreline Change Maps from CRMC suggest that the Town Beach lost up to 0.16 feet of shoreline a year on average between 1939 and 2003. Further, approximately 11 acres of coastal wetlands were degraded at the mouth of Allin's Cove. A significant restoration project was completed in 2006 to stabilize this area and for halting erosion along Byway Road.

4.2.2 Wind-Related Hazards

Wind is the movement of air caused by a difference in pressure from one place to another. Local wind systems are created by the immediate geographic features in a given area, such as mountains, valleys, or large bodies of water. Wind effects can include blowing debris, interruptions in



elevated power and communications utilities, and intensification of the effects of other hazards related to winter weather and severe storms.

4.2.2.1 Tropical Cyclones: Tropical Storms and Hurricanes**Description** (as per the SHMP)

Tropical cyclones, a general term for tropical storms and hurricanes, are low pressure systems that usually form over the tropics. These storms are referred to as "cyclones" due to their rotation. Tropical cyclones are among the most powerful and destructive meteorological systems on earth. Their destructive phenomena include very high winds, heavy rain, lightning, tornadoes, and storm surge. As tropical storms move inland, they can cause severe flooding, downed trees and power lines, and structural damage. There are three categories of tropical cyclones:

- Tropical Depression: maximum sustained surface wind speed is less than 39 mph.
- Tropical Storm: maximum sustained surface wind speed from 39-73 mph.
- Hurricane: maximum sustained surface wind speed exceeds 73 mph.

Most Atlantic tropical cyclones begin as atmospheric "easterly waves" that propagate off the coast of Africa and cross the tropical North Atlantic and Caribbean Sea. When a storm starts to move toward the north, it begins to leave the area where the easterly trade winds prevail, and enters the temperate latitudes where the westerly winds dominate. This produces the eastward curving pattern of most tropical storms that pass through the Mid-Atlantic region. When the westerly steering winds are strong, it is easier to predict where a hurricane will go. When the steering winds become weak, the storm follows an erratic path that makes forecasting very difficult. According to NOAA the Atlantic hurricane season runs from June 1 to November 30, with the peak between mid-August and late October.

Location

The RI 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.

Barrington’s coastal location and low elevation town-wide, makes it particularly susceptible to tropical cyclones. The town’s small size means that the majority of properties are to some extent vulnerable to the impacts from tropical storms and hurricanes. The Sea, Lake and Overland Surges from Hurricanes (SLOSH) model was developed by the National Weather Service (NWS) to theoretically estimate storm surge associated with hurricanes. Using the SLOSH model, RIEMA produced surge inundation maps for the state.

Understanding what areas may be flooded by hurricane storm surge is a useful planning tool. Under modeled scenarios, even Category 1 and 2 hurricanes could produce storm surges that inundate large areas of town, particularly in Hampden Meadows.

Extent

Hurricanes can damage structures, property, and infrastructure, as well as disrupt transportation routes and pose threats to public safety. Hurricanes also have the potential to cause coastal erosion, particularly along Bar-

ington’s southern and western shores. As such, it is critical for the public to understand the magnitude and therefore potential impact from a storm. Hurricanes are categorized according to the Saffir/Simpson scale (**Table 4.5**) with ratings determined by wind speed and central barometric pressure. Hurricane categories range from one (1) through five (5), with Category 5 being the strongest (winds greater than 155 mph). A hurricane watch is issued when hurricane conditions could occur within the next 48 hours. A hurricane warning indicates that sustained winds of at least 74 mph are expected within 36 hours or less.

Previous Occurrences

As chronicled in the SHMP, 37 hurricanes have tracked within 50 miles of Rhode Island since 1851. According to the SHMP, Rhode Island was significantly impacted by 11 tropical cyclones. These included three Category 3 hurricanes (**Figure 4.4**, next page) directly impacting Rhode Island and causing millions of dollars in damage and hundreds of deaths. A list of significant tropical cyclones start-

Table 4.5. Saffir/Simpson Scale of Hurricane Intensity

Wind Speed	Type of Damage Due to Hurricane Winds
Category One Hurricane	
74-95 MPH (64-82kt)	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
Category Two Hurricane	
96-110 MPH (83-95kt)	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.
Category Three Hurricane	
111-129 MPH (96-112kt)	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.
Category Four Hurricane	
130-156 MPH (113-136kt)	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.
Category Five Hurricane	
Greater than 157 MPH (137kt)	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.

Source: <http://www.nhc.noaa.gov/aboutsshws.php>

ing with the Hurricane of 1938 is included in Table 4.6. The most recent major tropical weather systems to directly impact Rhode Island include Hurricane Bob, a Category 2 hurricane in 1991; tropical storm Irene in 2011, and Hurricane Sandy in 2012.

Probability of Future Events

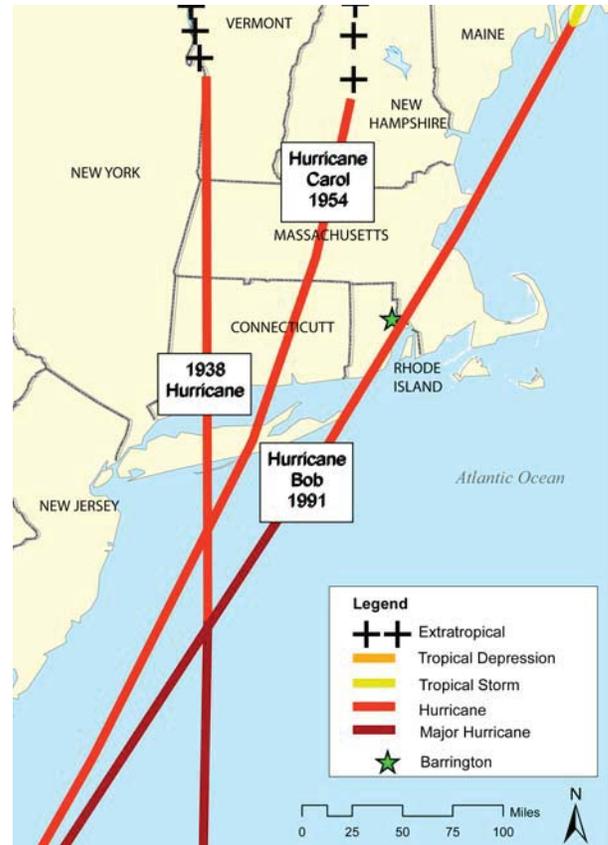
Although hurricanes are rare in Rhode Island, their impact can be devastating. It is therefore important for the Town to remain apprised of improvements in forecasting and understanding the impact from hurricanes. The Intergovernmental Panel on Climate Change (IPCC) has created long-term global climate models that indicate the probability of hurricanes becoming more intense, with stronger winds and heavier precipitation, through the 21st century. According to the RIEMA, over a four year period, there is a 22.8 percent annual chance of a hurricane impacting Rhode Island.

4.2.2.2 High Winds

Description

The wind is air moving from an area of high pressure to an area of low pressure. The term Nor'easter is used for storms, mainly affecting the northeastern part of the United States, wherein the strongest winds are traveling in a

Figure 4.5: Hurricane Paths of Significant New England Hurricanes—1938, 1954, 1991



Source: NOAA

Table 4.6. Significant Tropical Cyclones Affecting Rhode Island Since 1938

Hurricane	Category	Wind Speed at Landfall	Damage to RI
Hurricane of 1938	Hurricane: 3	Sustained to 91 mph, gusts to 121	Extensive - roofs, trees, crops. Storm surge 12 to 15 ft. destroyed coastal buildings
Carol, 1954	Hurricane: 3	Sustained to 100 mph, gusts to >125	Westerly to Narragansett coastal communities wiped out, downtown Providence under 12 feet of water, 14 ft. storm surge in upper bay, regionally \$90 million in damages and 19 deaths
Edna, 1954	Hurricane: 2	Sustained to 95 mph, gusts to 110	Inland flooding. Rivers rose several feet above flood stage. Knocked out electrical power.
Donna, 1960	Hurricane: 3	Sustained to 95 mph, gusts to 130	Moderate storm surge, extensive beach erosion. Wind damage to trees and utility poles causing major power outages.
Gloria, 1985	Hurricane: 2	Sustained to 81 mph, gusts to 100	Minor coastal flooding and erosion. Scattered power outages.
Bob, 1991	Hurricane: 2	Sustained to 100 mph, gusts to >105	Storm surge of 5 to 8 feet, extensive beach erosion. Wind damage to trees & utility poles, 60% of South East RI lost power.
Irene, 2011	Tropical Storm	Sustained to 44 mph	Storm surge of 2 to 5 feet; 2 feet of water on Mathewson Rd. Widespread wind damage to trees, utility poles; major power outages.
Sandy, 2012	Tropical Storm	60 to 80+ mph gusts	Storm surge; major coastal flooding and erosion, especially Westerly area. 122,000+ lost power. \$40 million+ in insured losses paid.

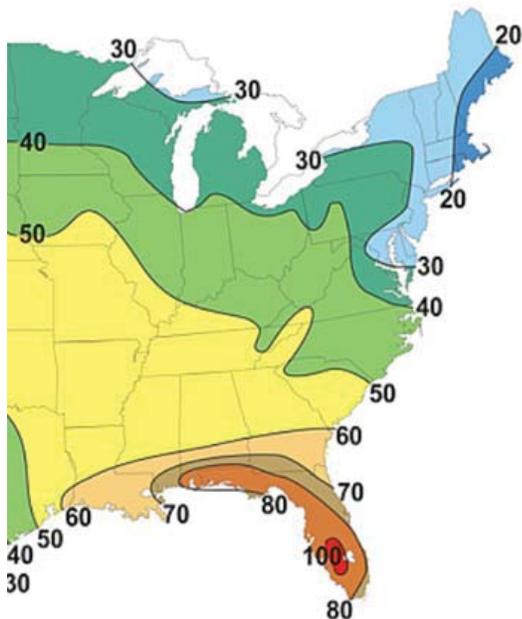
Source: SHMP, National Weather Service

northeasterly direction. Although these storms occur between October and April, they are most severe in the winter when the difference in temperature between the converging cold polar air and warmer air over the Atlantic Ocean is the greatest.

As reported by Storm Solutions, nor'easters differ from hurricanes as they have cold centers and are generally much greater in size and have a longer duration. So although less dramatic than a hurricane, they occur more frequently in Rhode Island, and can produce considerable damage. Nor'easters are associated with gale force winds, which range from 40 to 54 miles per hour. These winds can severely damage structures and trees, thereby threatening public safety, and have the potential to produce significant storm surge, similar to that of a Category 1 hurricane. In addition, these types of storms can also produce wind gusts to near hurricane force as well as flooding rain and crippling snowfall.

High winds can cause damage to property, vehicles, utility lines, and vegetation, as well as bodily injury from flying debris or structures collapsing. Loss of power can disrupt daily routines and businesses, spoil refrigerated food, and if occurring in conjunction with freezing temperatures, a lack of heat in households can lead to dangerous health conditions and the potential for pipes to freeze and burst.

Figure 4.5. Average Annual Number of Thunderstorms in Eastern Half of United States



Source: http://www.srh.noaa.gov/jetstream/tstorms/tstorms_intro.html

Table 4.7. Beaufort Wind Scale

Beaufort Number	Wind Speed (MPH)	Description
0	< 1	Calm
1	1-3	Light Air
2	4-7	Light Breeze
3	8-12	Gentle Breeze
4	13-18	Moderate Breeze
5	19-24	Fresh Breeze
6	25-31	Strong Breeze
7	32-38	Moderate Gale
8	39-46	Fresh Gale
9	47-54	Strong Gale
10	55-63	Whole Gale
11	64-72	Storm
12	> 73	Hurricane Force

Source: <http://www.spc.noaa.gov/faq/tornado/beaufort.html>

The Beaufort Scale (Table 4.7), created in 1805, is still used today as a standardized scale for characterizing wind. However, anemometers, which measure wind speed and wind pressure can be found at almost all weather stations.

Location

Severe wind—including wind produced by tropical weather systems, severe thunderstorms, and Nor'easters—poses a threat to all of Barrington.

Extent

The speed at which it moves is influenced by a number of factors including the differential in pressure (the greater the difference the faster air will move), Rossby waves (strong winds in the troposphere), and local weather conditions. Based on historic tornado and hurricane data, FEMA has produced a Wind Zones map that depicts maximum wind speeds and is applicable in designing structures to withstand these forces. Rhode Island is included in Wind Zone II (160 mph) and is also within the Hurricane Prone Region.

In addition to lightning and rain or hail, thunderstorms can have high winds. As Figure 4.5 illustrates, on average 20 thunderstorms occur annually in Rhode Island. According to NOAA, severe thunderstorms, which can include winds gusting in excess of 50 knots (57.5mph),

Figure 4.5: Damaged Police Vehicles after Wind Storm, August 4, 2015



Photo Credit: Barrington Police Department

generally account for only ten percent of all thunderstorms.

Previous Occurrences

Over the years, the National Climatic Data Center (NCDC) has recorded 498 high wind events in Rhode Island causing more than \$15.5 million in total damages. Since 1990 the NCDC reports 19 high wind events in Bristol County. The most significant of these events was ‘Superstorm Sandy’ which recorded wind speeds in Barrington of 63 knots and caused an estimated \$220,000 in damages throughout the County. On August 4, 2015, a severe thunderstorm (67 mph gust at TF Green Airport) passed through the area. It produced wind damage along an east-west path that felled trees, dropped limbs that damaged police cruisers at the Public Safety Building, destroyed the bus shelter at Barrington Congregational Church, and left several areas in town without power.

On average, one to two nor’easters a year hit 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 and the winds can severely damage structures and trees, thereby threatening public safety. High winds associated with these storms, as well as with hurricanes, are a frequent natural hazard in Barrington, particularly along the coastal areas.

Probability of Future Events

Based on historical occurrences, Barrington can expect an event characterized as “High Wind” once every 18 months. However, the probability of a damaging wind event that does not fall into another hazard category is considered moderate.

4.2.2.3 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 do not exceed 100 yards wide, though some can remain in contact with the earth for well over fifty miles and exceed one mile in width” (RIEMA. State, 72).

As per NOAA, the tornado season nationally lasts from March to August, with peak tornado activity normally occurring in April, May, and June. Historically, the highest concentrations of tornadoes have been in the Central U.S. and portions of the Gulf Coast states.

The NOAA’s Storm Prediction Center issues tornado and severe thunderstorm watches. A tornado watch does not indicate an imminent tornado; rather, a tornado watch is an advisory for citizens to be alert and prepared to go to safe shelter should a tornado develop or if a tornado warning is issued. Local National Weather Service

Table 4.8. Fujita Scale and Enhanced Fujita Scale

Fujita Scale			Enhanced Fujita Scale	
F No.	Fastest ¼ mile (MPH)	3 Second Gust (MPH)	EF No.	3 Second Gust (MPH)
0	40-72	45-78	0	65-85
1	73-112	79-117	1	86-110
2	113-157	118-161	2	111-135
3	158-207	162-209	3	136-165
4	208-260	210-261	4	166-200
5	261-318	262-317	5	Over 200

Source: <http://www.spc.noaa.gov/efscale/>

offices are responsible for issuing tornado warnings. Tornado warnings indicate that a tornado has been spotted, or that Doppler radar detects a thunderstorm circulation capable of spawning a tornado.

Location

Though Rhode Island is not a region that is highly susceptible to tornados, it is possible for one to occur anywhere in the region. All areas of Barrington are considered equally exposed to a tornado.

Extent

Tornadoes can be devastatingly destructive to everything in their path, including homes, property, and infrastructure. According to NOAA, approximately 60 deaths a year are related to tornados. Wildlife can also be killed or disrupted if their habitat is impacted.

The Fujita scale is used to characterize tornadoes based on the damage they produce and relating that damage to the fastest quarter-mile wind at the height of a damaged structure. An Enhanced Fujita scale became operational in 2007 and improves upon the original scale by including more damage indicators, taking into account construction quality and variability, and providing a more definitive correlation between damage and wind speed (**Table 4.8**, previous page).

Previous Occurrences

Based on data from 1950 through 2012, Rhode Island had 20 tornadoes; there were 23 injuries and no fatalities. The

Figure 4.6: Photo of a funnel cloud off Rumstick Point by Nicholas Caisse of Barrington, RI



Source: Boston Globe, July 24, 2008

total cost of tornadoes between 1950 and 2012 is estimated at \$3.6 million. **Table 4.9** lists tornadoes occurring in Rhode Island since 1970. On July 23, 2008, an F1 scale tornado began just off of Rumstick Point in Barrington (**Figure 4.6**) and then moved to land in Warren. The tornado's path was 3.0 miles long and 40 yards wide, with winds reaching speeds of 65-75 mph. The total damage, mostly to trees, was minor (estimated at \$45,000) and no injuries were reported.

New England does not frequently suffer destruction from tornados, with the region's most serious tornado event occurring in Worcester Massachusetts on July 9, 1953. In that event, 90 people were killed and 1,300 injured. From 1950 to the present, approximately 20 tornadoes were reported in or near Rhode Island, but none of them was as devastating as the Worcester event. In 2011 a series of tornadoes occurred in western and central Massachusetts, with another reported in southern Maine. The most serious of these was classified an EF-3, and struck Springfield Massachusetts, killing 3 people, injuring 300, and destroying about 500 homes. A tornado is reported in southern New England, on average, once every two to three years (NASA. Earth).

Probability of Future Events

Rhode Island ranks 49th out of 50 states for the occurrence of tornadoes. Although tornadoes are a rare occurrence in Rhode Island, a risk does exist, particularly during peak hurricane season (mid-August through October).

Table 4.9. RI Tornadoes with Property Damage (since 1970)

Date	County	F-Scale	Injuries	Damage (2012 dollars)
8/7/86	Providence	1	0	\$523,707
8/7/86	Providence	2	20	\$5.23 million
8/8/86	Providence	1	0	\$523,707
9/23/89	Providence	0	3	\$462,889
10/18/90	Kent	1	0	\$439,160
7/23/08	Bristol	1	0	\$47,987
8/10/12	Washington	0	0	\$50,000

Source: SHMP

4.2.3 Winter-Related Hazards: Heavy Snow, Ice, and Extreme Cold



Description

◇ *Heavy Snow*

"A heavy snow is generally defined as having more than eight (8) inches of accumulation in less than 24 hours. Heavy snow can bring a community to a standstill by inhibiting transportation, knocking down trees and utility lines, and by causing structural collapse in buildings not designed to withstand the weight of the snow. Repair and snow removal costs can be significant and surpass annual municipal salt and snow removal budgets, often before the end of the season. A winter storm warning is issued when snowfall is expected to accumulate more than 4 inches or freezing rain more than a quarter inch in 12 hours" (RIEMA. State, 85).

The National Weather Service defines a blizzard as a storm that contains a large amount of snow, with winds in excess of 35 mph, and visibility of less than ¼ mile for an extended period of time. In the north-eastern United States, the term nor'easter is used to describe storm events that have northeasterly winds that blow in from the ocean.

Nor'easters are a common winter occurrence in New England and repeatedly result in flooding, various degrees of wave and erosion-induced damage to structures, and erosion of natural resources, such as beaches, dunes and coastal bluffs. The erosion of coastal features commonly results in greater potential for damage to shoreline development from future storms.

Nor'easters cause varying amounts of coastal erosion depending on the intensity and the duration of the storm; the tidal phase at the time of the storm (neap or spring tide); the path of the storm; and the time interval between storms. Back to back storms do not allow time for the beaches and dunes to recover sand that has been transported offshore. Damage resulting from nor'easters are often due to coastal erosion and undermining the structures that were previously behind the dunes or on the top of coastal bluffs. Damages to a house that topples off an embankment

are usually much more costly than damages resulting from localized areas of flooding (RIEMA. State).

◇ *Ice* (as per the SHMP)

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.

◇ *Extreme Cold* (as per the SHMP)

Extreme 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 minus five indicates that the effects of wind and temperature on exposed flesh are the same as if the air temperature alone were five degrees below zero, even though the actual temperature could be much higher. The National Weather Service 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

All areas of Barrington are considered equally exposed to winter-related hazards. Winter weather events in Bar-

Figure 4.7: Blizzard of 1978 Providence, RI

Source: Providence Journal file photo

rington, as in most of the northeast, can be described as unpredictable. Days of frigid, arctic air and below freezing temperatures may be followed by days of mild temperatures in the 40s or 50s. Barrington residents can expect to experience several nor'easters, which usually bring coastal erosion and a possibility for blizzard conditions or heavy rainstorms dependent on the temperature (RIEMA. State).

Extent

Other than characterizing a winter storm as an ice storm, snow squall, or blizzard, there is no universally accepted scale to measure them. Often, winter storms are defined by their components such as wind, snow, ice, and the resultant impact on visibility.

The storm radius of a nor'easter, traveling up the eastern United States coast, is often as large as 1,000 miles, and the horizontal storm speed is generally around 25 miles per hour. Sustained wind speeds of 10-40 mph are common during a nor'easter, with short term wind speeds gusting up to 70 mph. Unlike hurricanes and tropical storms, nor'easters can sit off shore, wreaking damage for days. While the winds from nor'easters are not as powerful as hurricane winds, their wind gusts can approach hurricane force, which means nor'easters also have the potential to tear off roofs and topple structures. If a nor'easter hits the coast as a blizzard, the ensuing snowfall can collapse weak roofs, as well. The winds also produce storm surges that, because nor'easters are pro-

longed events, can continue through multiple high tides – the period when the threat of flooding is greatest along the extensive Barrington shoreline.

Winter storms causing a loss of electricity can result in dangerous conditions due to lack of heat and loss of phone/internet service for purpose of storm advisories and medical emergencies. The lack of heat may also cause household water pipes to freeze or burst disrupting service and potentially causing flooding. Exposure to extreme cold for an extended period can lead to health concerns including hypothermia, which is of particular concern especially for infants and older adults. Outdoor animals are also in danger from exposure. Additionally, heavy snow accumulation and freezing temperatures can create dangerous driving conditions, disrupt ecosystems, and destroy crops and vegetation.

Previous Occurrences

Over the past 100 years, the most significant nor'easter to impact Rhode Island was the Blizzard of 1978 (Figure 4.7). The snow accumulation was up to 4 feet and wind speeds exceeded 60mph. Throughout the state more than 10,000 people were stranded on roadways, 232 injuries and 26 deaths were attributed to the storm, and damages totaled more than \$15 million (Strauss).

More recently, the state experienced a powerful nor'easter in February 2013, known as Winter Storm DR-4107 (Figure 4.8). As a result, several areas in Barrington experienced power loss for as long as a week. Governor Lincoln Chafee declared a state of emergency in Rhode

Figure 4.8: Barrington Public Works Truck 8 - Winter Storm DR-4107, 2013



Island and enacted a state travel ban that lasted nearly 24 hours (Rapoza). National Grid estimated more than 180,000 customers lost power. Rhode Island received \$1 million in reimbursements from the Federal Emergency Management System (FEMA) for snow removal costs from the storm (Cicilline). Barrington received \$75,500 in FEMA reimbursements for DR-4107.

Another significant nor'easter, Winter Storm DR-4212, occurred in January 2015. It inundated Rhode Island with roughly 16 inches of snow, prompting a Presidential Major Disaster Declaration for Bristol and other Rhode Island Counties, and caused statewide damages of approximately \$8.4 million. Barrington received \$46,000 in reimbursements from FEMA for this storm.

Probability of Future Events

Data from The National Climatic Data Center (NCDC) suggest that any county in Rhode Island can anticipate between two to six significant winter weather events per winter season.

4.2.4 Geologic-Related Hazards: Earthquakes

Description

According to the U.S. Geological Society (USGS), an earthquake is the vibration of the ground produced by the sudden release of slowly accumulated energy. This energy can be generated by a sudden dislocation of segments of the crust, volcanic eruptions, or manmade explosions.



The sudden dislocation of segments of the crust generally produces the most destructive quakes. Tectonic plates are massive, irregularly shaped slabs of rock within the lithosphere, the rigid outermost shell of a planet, and are continually slowly moving because of convection in the mantle. But when plates come in contact, the force of their movement against one another will cause deformation or strain on the rocks, building up potential energy. If the stress becomes too great, the weaker segments

Table 4.10: Intensity and Effects of Earthquakes defined by the Richter and Modified Mercalli Intensity (MMI) Scales

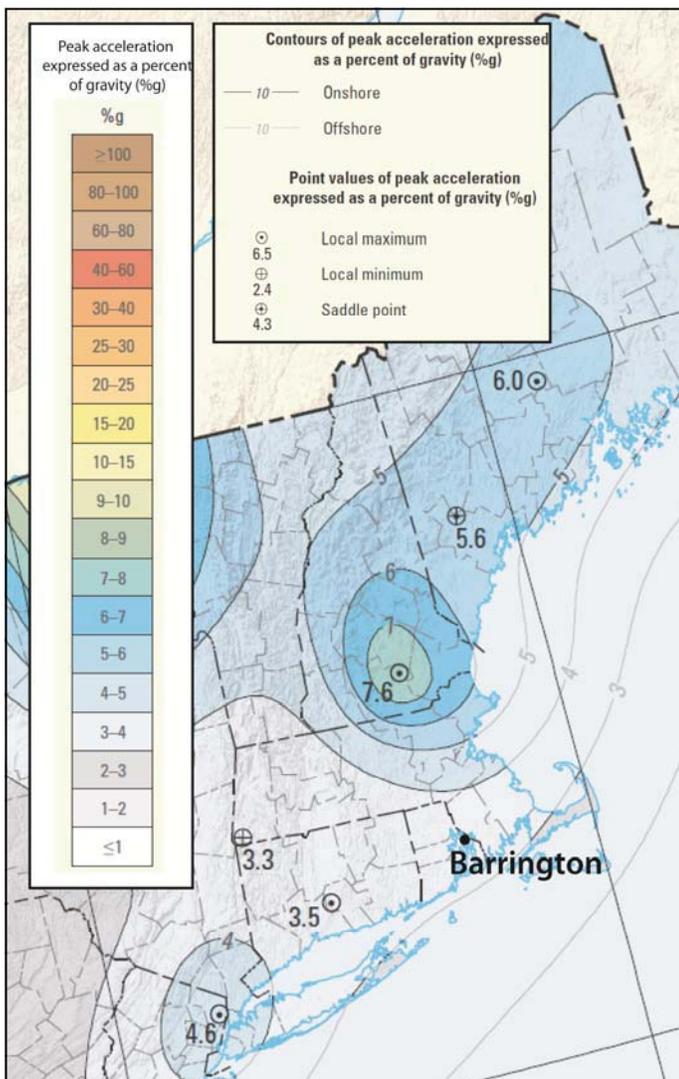
Richter Magnitude Scale	MMI Rating	Description
1.0-3.0	I	Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck.
4.0 - 4.9	IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like truck striking building. Standing vehicles rocked noticeably.
	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 - 5.9	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
6.0 - 6.9	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. 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.
7.0 and higher	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.

Source: <https://earthquake.usgs.gov/learn/topics/mercalli.php>

of rocks may suddenly snap, releasing large amounts of energy. This energy, in the form of seismic waves travels outwardly, in all directions, from its origin, commonly referred to as the focus or hypocenter. The location on the Earth's surface directly above the focus is called the epicenter and usually sustains the greatest damage in an earthquake event.

Earthquakes can affect large areas, cause extensive damage to property, result in loss of life and injury to many people, and disrupt the social and economic functioning of the affected area. Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to the amplitude and duration of the ground vibrations. Ground movement can also cause

Figure 4.9: Seismic-Hazard Map—Peak Horizontal Acceleration with 10% Probability of Exceedance in 50 Years



Source: https://pubs.usgs.gov/sim/3325/pdf/SIM3325_sheet1.pdf

flooding, dam failure, and rupture underground utilities which can result in various secondary hazards including flash floods and fires.

Location

Although Barrington is located on the North Atlantic tectonic plate, there are no significant geologic fault lines in New England. However, as the impact from an earthquake can be experienced miles from the epicenter, all areas of Barrington are considered vulnerable to some extent.

Extent

As discussed in the SHMP, the severity of an earthquake can be expressed in terms of both magnitude and intensity. Magnitude is related to the amount of seismic energy released at the hypocenter of the earthquake. It is based on the amplitude of the earthquake waves recorded on uniformly calibrated seismographs, using the Richter Magnitude Scale (Table 4.10). The magnitude of an earthquake is thus represented by a single, instrumentally determined value. Earthquakes with a magnitude of 2.0 or less on the Richter Scale are generally not felt by people, only recognized by local seismographs, and considered micro earthquakes. Around the world, hundreds of these occur daily. Earthquakes with a magnitude of at least 4.5 are strong enough to be recorded by sensitive seismographs worldwide. Great earthquakes which have a magnitude of at least 8.0 occur about once a year. The largest earthquake ever recorded was in Chile in 1960 with a magnitude of 9.5.

The Richter Scale is not used to express damage. An earthquake in a densely populated area that results in many deaths and considerable damage may have the same magnitude as a quake in a remote area that does nothing more than frighten wildlife. Large magnitude earthquakes that occur beneath the oceans may not even be felt by humans.

The USGS Earthquake Hazards Program identifies Barrington and the state of Rhode Island as a whole as a low seismic risk area. This is illustrated in the USGS Seismic Hazard Map of 2014 (Figure 4.9) showing Barrington in an area on the lower end of the scale measuring potential peak acceleration of a potential earthquake.

Previous Occurrences

According to the Rhode Island Emergency Management Agency (RIEMA), only three or four earthquakes having

a MMI Scale rating of V or greater have been centered in Rhode Island, including the 1951 South Kingstown earthquake of magnitude 4.6 on the Richter scale.

On August 23, 2011 a 5.9 magnitude earthquake struck Virginia and was felt up and down the Eastern seaboard, including Rhode Island. The RI Emergency Management Agency opened its Emergency Operations Center on a limited basis, but indicated that statewide there no reports of substantial damage or injury. There was no reported damage in Barrington.

Probability of Future Events

Seismologists and geologists agree that earthquakes are impossible to predict with any degree of accuracy. However, according to RIEMA, experts currently estimate that there is roughly a 50% probability of a very damaging magnitude 5.0 earthquake occurring in New England, in a 50-year period. Using the hazard ranking criteria, the probability of an earthquake with any significant impact occurring in or near Barrington over the next five-years has been given to a Medium-Low ranking.

4.2.5 Other Hazards: Droughts and Wildfires

4.2.5.1 Droughts

Description

Drought is a natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought.



As per the National Drought Mitigation Center, droughts can be classified as follows:

- Agricultural drought – related to agricultural impacts from lack of precipitation, reduced ground water levels, and dry soils.
- Hydrological drought – related to the effects of periods of precipitation (including snowfall) shortfalls on surface or subsurface water supply (stream flow, reservoir and lake levels, ground water).

- Meteorological drought - refers to a reduction in the normal rainfall for a given geographic area. It is area-specific, as the average rainfall can vary greatly in different areas.
- Socioeconomic drought - measures the impact that any or all of the first three have on people and businesses.

Location

All areas of Barrington are considered susceptible to drought conditions.

Extent

According to WeatherDB, over the last 30 years, the average rainfall for Barrington is 46.33 inches per years, which is slightly less than the Rhode Island average and about 7 inches greater than the national average. This quantity generally insures a plentiful water supply for the daily needs of the Town and Safe Water RI ranks Barrington’s water purveyor, the Bristol County Water Authority, as having a low risk for drought.

A drought so severe as to significantly deplete the Scituate reservoir would have implications not only in Barrington but statewide in terms of impact on water supplies, as well as localized impacts for the few households that rely on wells for potable water. The magnitude of agricultural drought in Barrington would be limited due to the relatively small section of town in agricultural use (the George Street area).

Previous Occurrences

According to the RI Water 2030 plan, there have been just six historical drought events since 1929, most with statewide impacts. The last long-term drought in the state was in the early to mid-1960s. Barrington and all of Bristol County had two declared severe droughts in the

Table 4.11: Drought Events—Bristol County

Date	Area Affected	Remarks
2012	Severe drought (D2) designated in Bristol County	Meteorological drought. Precipitation 5-7 inches below normal January 1-April 15. High fire danger.
2016	Severe drought (D2) designated in Bristol County Sept–October	Ponds, rivers well below normal levels.

Source: NOAA Storm Events Database

past five years—one in 2012, when precipitation was 5 to 7 inches below normal for more than 3 months, and another in September-October 2016, when ponds and rivers were well below normal levels.

Probability of Future Events

As the last major drought in Rhode Island was more than 50 years ago, the potential for severe impacts from drought is low. While short durations of heat and humidity can be expected in our area most years, the potential for drought is a relatively low risk hazard in Barrington. Most of Barrington has access to public water from the Bristol County Water Authority, with water from the Scituate Reservoir delivered through the cross-bay pipeline. With the majority of water users in Barrington reliant on public water, the community’s vulnerability to drought is directly related to the availability of water provided by the Bristol County Water Authority - either from the Scituate Reservoir or from a secondary source.

The area of Barrington potentially most vulnerable to impacts of agricultural or hydrological drought is the George Street locale, which is 100 percent reliant on well water. There are just 11 houses in the area currently; however, Four-Town Farm is a heavy user of water, requiring it for irrigation on approximately 60 acres of farmland.

4.2.5.2 Wildfires

Description

A wildfire is an uncontrolled fire ignited by humans or natural agents, of which the most common is lightning. Wildfires are fueled by natural cover, including native and non-native species of trees, brush and grasses, and crops along with weather conditions and topography. Climatic and meteorological conditions that influence the moisture content of wood and leaf litter, thereby impacting wildfires, include solar insulation, atmospheric humidity, and precipitation. Dry spells, heat, low humidity, and wind increase vegetative susceptibility to fire (RIEMA. State).



The U.S. Forest Service has established the National Fire Danger Rating System to determine the daily risk to fire experienced by different regions of the country (Table 4.12). The system uses mathematical formulas including

Table 4.12: National Fire Danger Rating System

Fire Index	Rating	Description
0	Class 1	No rating
1-30	Class 2	Low danger
31-60	Class 3	Medium danger
61-80	Class 4	High danger
81+	Class 5	Extreme

wind speed and fuel type to determine a fire index. The fire indexes are categorized into five groups based on severity, and each group has an associated class rating (Classes 1 through 5) and fire risk level. A fire index of zero occurs when there is snow on the ground or there has been a prolonged period of substantial rain.

Peak fire season for the state is typically between mid-March and mid-May when dry windy weather can occur increasing the potential for wildfires (RIDEM. Wildland).

Location

Barrington, and Rhode Island in general, historically exhibits a humid continental climate, with hot, rainy summers and cold winters and thereby warrants a low or medium fire rating (Class 1 or 2). Based on 2011 land use figures, approximately 38 percent of Barrington is forested (1,969 acres), and approximately one percent is brush/transitional (45 acres). According to the SHMP, Barrington does not have any critical facilities located in a Wildland Urban Interface zone. These zones represent areas where developed and undeveloped vegetated land intermingle and should a wildfire occur, exacerbates the threat to structures.

Extent

Wildfires can disrupt and endanger wildlife and ecosystems, and if they reach the built environment can damage structures and other property. Rhode Island Department of Environmental Management (RIDEM) Division of Forest Environment is responsible for predicting the risk of wildfires throughout the state. Forewarning of dangerous fire conditions aids firefighters and can result in reducing the severity of a fire thereby mitigating risks to life and property.

Previous Occurrences

Rhode Island has experienced some significant wildfires. The most devastating was the Coventry fire of 1942, which consumed 18,000 acres of forest. A wildfire in Exe-

ter in 1951 consumed 5,000 acres (RIEMA. State). The National Climatic Data Center reports no wildfire events for Providence or Bristol Counties in recent years. Significant wildfires have not been known to occur in Barrington, although occasional brush fires have occurred in the wooded parts of town.

Probability of Future Events

The probability of a wildfire in Barrington is considered low, as significant wildfires have not been known to occur in Barrington (there are no reported wildfires in Bristol County since 1950, according to NOAA's Storm Events Database).

4.3 CLIMATE CHANGE/SEA LEVEL RISE IMPACT

The impacts of changing climate are already present. No longer viewed as a future possibility, the effects of climate change, including sea level rise (SLR), are exacerbating the impact of other natural hazards. The long-term forecast of greater frequency and intensity of storms is of particular concern in areas near the shore, where properties within the Velocity and Coastal A Zones could be subjected to greater risk of damage from flooding, wave action, and wind in the future.



According to an article by the URI Climate Change Collaborative, "In New England, temperatures are expected to increase by a few degrees by the end of the century. While summers may be 3°F to 7°F warmer, winters will likely be 5°F to 8°F warmer. Likewise, we will continue to see a shift in the seasons. Summer weather potentially will persist longer and with more days over 100°F. Winters will be warmer with more rain and less snow. Wet days will be wetter but droughts will be more frequent. The average annual temperature of Narragansett Bay has warmed approximately 3.6°F (with winters even greater) since the 1960s, and the Bay is expected to continue warming throughout the century. Rates of sea level rise have been increasing as well" (URI).

CRMC has integrated climate change and sea level rise scenarios into its programs to assist communities in preparing for these evolving conditions. According to the CRMC, potential effects include:

- Increased extent of flood damage and greater vulnerability to storm surges in lower elevations;
- Greater risk to infrastructure—roads, sewers, storm-water facilities, utilities—in areas more prone to flooding;

According to CRMC, potential effects of climate change and sea level rise include increased vulnerability to storm surges, risk to infrastructure, higher water tables, more extreme high tides, worsening coastal erosion and net loss of coastal marshes.

- Saltwater intrusion into aquifers contaminating water supplies;
- Higher water tables resulting in subsurface issues such as wet basements;
- A significant increase in incidence of extreme high tide levels;
- More coastal lands becoming susceptible to erosion due to increased intensity and frequency of storms;
- 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.

Barrington's Hazard Mitigation Plan recognizes the potential effects of climate change and sea level rise related to the following hazards and correspondingly will take appropriate steps within the Town's Action Plan to mitigate these impacts.

- Flooding (coastal and inland)
- Coastal erosion
- Tropical storms and hurricanes
- Winter storms, nor'easters and blizzards
- Drought

4.3.1 Climate Model Simulations for the Northeast

Based on the National Oceanic and Atmospheric Administration (NOAA) Technical Report NESDIS 142-1, Regional Climate Trends and Scenarios for the U.S. National Climate Assessment: Climate of the Northeast, two

climate model simulations project the effects of high and low greenhouse gas emission scenarios. Analyses of the simulated future climate are provided for the periods of 2021-2050, 2041-2070, and 2070-2099, with changes calculated with respect to a historical climate reference period (1971-1999, 1971-2000, or 1980-2000). The resulting climate change conditions are to be viewed as scenarios, not forecasts, and there no explicit or implicit assumptions about the probability of either scenario.

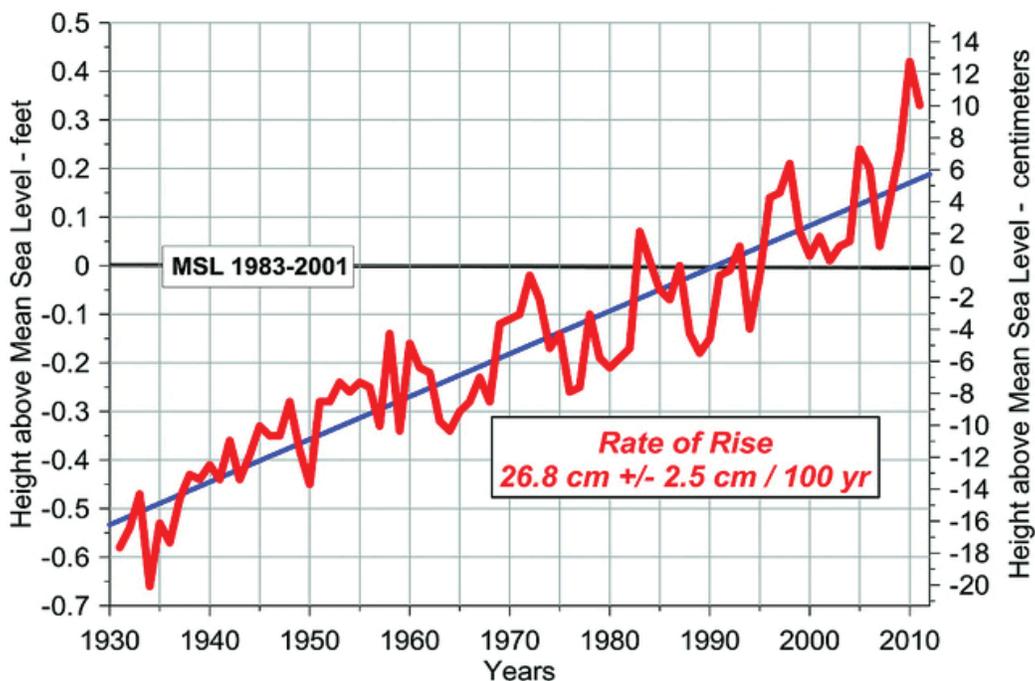
Key findings of the simulated climate models are as follows:

- Models indicate an increase in temperature for all three future periods, with little spatial variation. Changes along coastal areas, such as Barrington, are slightly smaller than inland areas.
- Simulated temperature changes are similar in value for the high and low emissions scenarios for the near future, whereas late in the 21st century the high emissions scenario indicates nearly twice the amount of warming.
- The range of model-simulated temperature changes is substantial, indicating substantial uncertainty in the magnitude of warming associated with each scenario.

However, in each scenario, the modeling is unequivocal and large compared to historic variations.

- Increases in the number of days with a maximum temperature above 95 degrees Fahrenheit are simulated to occur throughout the northeast, with the largest increases occurring in the southern and western areas.
- Simulated decreases in the average annual number of days with a minimum temperature below 10°F are largest (21 days or more) in northern areas. Decreases in the number of days with a minimum temperature below 32 degrees Fahrenheit are 20-23 days across most of the region.
- The freeze-free season is simulated to lengthen by at least 19 days across the region by mid-21st century. Simulated increases in most areas are 3-4 weeks.
- The far northern regions show the largest simulated increases in average annual precipitation, while southern and coastal areas show less of an increase. Models are mostly in agreement that precipitation will increase over the entire region under these scenarios. Simulated seasonal changes are mostly upward in winter, spring, and fall, and downward in summer.

Figure 4.11. Historic Sea Level Rise—Newport



Source: RI Climate Change Collaborative / <http://www.riclimatchange.org/graphics/sea-level-rise-graph-LG.gif>

- All areas see simulated increases in the number of days with precipitation totals exceeding 1 inch, with the greatest increases (up to 30%) occurring in parts of New York. The simulated increases are statistically significant in most northern areas.
- Most models do not indicate a statistically significant change in temperature (with respect to 2001-2010) for the near future; however, as the time period increases a greater number of models simulate statistically significant temperature changes, with all being significant at the 95% confidence level by 2055 (for the high emission scenario).

These modeled scenarios of hotter weather and increased precipitation, along with current climate trends such as increased sea level rise will affect Barrington in the long term. Increased precipitation can lead to inland flooding and potentially cause issues, such as dam breach of the drinking water reservoir, which already is deemed a high hazard. Conversely, hotter weather can lead to drought-like conditions and strain Barrington's drinking water supply. The rise in sea level will intensify coastal erosion and damage vulnerable areas. Based on the actions outlined in this Hazard Mitigation Plan, Barrington will be better prepared to respond to and mitigate the effects of climate change.

4.3.2 Sea Level Rise (SLR)

The most widely accepted consequence of climate change is global warming. Greenhouse gas emission released to the atmosphere increase surface warming, which in turn, warms ocean waters and accelerates the melting of glacial ice. The impact of which is accelerating sea level rise (CRMC. Sea Level and Climate).

As the average water level of the oceans rise, previously dry land will be permanently inundated. Over the last 100 years, sea levels have risen 0.56 feet globally, with the average rate of rise during the years between 1961 and 2003 at 0.071 inches per year, and between 1993 and 2003 that rate nearly doubled to 0.12 inches per year (IPCC. Climate). Although the rate of sea level rise is accelerating, it is not expected to be globally uniform, due to a number of factors including prevailing winds and powerful ocean currents. Recordings from the Newport Tide Gage (**Figure 4.11**, previous page) indicate that since 1931 the sea level has risen 8.5 inches in Newport.

According to Rhode Island Statewide Planning, "The latest estimates of the scientific community are that Rhode Island could experience up to 7 feet of sea level rise by the end of the century" (Statewide Planning Program. Vulnerability, 4). Hence, in addition to addressing how climate change and sea level rise exacerbate other natural hazards, the Hazard Mitigation Committee determined that sea level rise in and of itself, presents a real long-term threat to Barrington. The Town therefore undertook a sea level rise vulnerability study which is included in Section 4.5.

In addition to addressing how climate change and sea level rise exacerbate other natural hazards, the Hazard Mitigation Committee determined that sea level rise in and of itself, presents a real long-term threat to Barrington

4.4 COMMUNITY ASSETS

Barrington's community assets are comprised of the town's population, local economy, built environment including public infrastructure, and natural environment. It is important to examine how potential natural hazards may impact these assets in order to better protect them.

4.4.1 People

It is important to know the number of people that are considered to be at a higher risk in a natural hazard event in order to plan for their needs and safety. According to the 2010 census, the population of Barrington is 16,310. Of which, approximately 4,888 residents are 19 years or younger and almost 2,393 are 65 or older. The population over 75 was listed as approximately 1,234.

To expedite assistance response it is important for the Town to have a registry of those individuals who may require assistance. The Town encourages residents who due to special healthcare needs, chronic conditions, or disabilities may require assistance response to enroll in the Rhode Island Special Needs Emergency Registry. The registry, which is overseen by the RI Department of Health, provides a reliable system for the identification of Rhode Islanders who may require special assistance during emergencies (RIDOH). A link to this registry be accessed through the Town's website.

Barrington has several group homes and two senior living complexes which should be evaluated in terms of their capacity and access to evacuation routes, thereby ensuring that any residents of those facilities can be assisted in the event of a natural disaster or evacuation.

4.4.2 Economy

Barrington's largest revenue source is from the property tax, which according to the Town's certified budget in FY2015-16 represented 79% of the total \$71.9 million budget (Town and Schools). If properties are destroyed as a result of a disaster the corresponding decrease in the tax base would need to be shouldered by the remaining property owners. As such, it is important to take all reasonable measures to protect property from potential hazards.

The most significant commercial development is within the "Village Center" district (County Road/Maple Avenue area). Smaller commercial nodes are in the vicinity of Bay Spring/Washington Road and Sowams Road/Kent Street. Waterfront commercial areas (marinas and associated businesses) are in Bay Spring on Bullock Cove and at Tyler Point at the confluence of the Warren and Barrington Rivers. While Barrington's commercial sector is limited, it is an important feature of the Town and adds to the tax base. The higher concentration of imperious surface due to building size and large parking areas makes commercial properties more susceptible to flooding and snow hazards.

4.4.3 Built Environment/Utility Infrastructure

Above-ground utilities like transmission and distribution lines can be impaired by strong winds and heavy snow and ice associated with winter storms. Power outages can have secondary effects on the Town's ability to manage emergencies and keep residents safe and warm. Winter storms also regularly contribute to coastal erosion, which then in turn contributes to flooding by reducing the buffer of land between coastal waters and Barrington's developed areas. Roads and bridges are also susceptible to impacts from natural hazards.

4.4.3.1 Public Water Supply

Barrington's public water supply, along with that of Warren and Bristol, is provided by the Bristol County Water Authority (BCWA), a public water authority

which has been operational since 1984. With the exception of the George Street area, located in northeast section of town, the remainder of Barrington has access to public water.

The Town Manager is responsible for coordinating with BCWA and the Water Resource Board (WRB) in periods of drought or extended dry conditions that require an emergency response to reduce water usage in the community. Barrington has also appointed a citizens water conservation committee to work with Town departments to notify the public about water restrictions and encourage practices that reduce water consumption.

The BCWA purchases 100 percent of its water from the Providence Water Supply Board (PWSB), which is delivered from the Scituate Reservoir via the East Bay Pipeline under the Providence River. Completed in 1998, the pipeline provides the system with a supply of up to 3.5 mgd of treated water. The primary main runs under the East Bay Bike Trail, with six pump stations in Barrington (BCWA).

While the Water Authority has an alternate surface water supply—consisting of the Shad Factory Reservoir and Anawan Reservoir in Rehoboth, MA; the Swansea Reservoir in Swansea, MA; and the Kickemuit Reservoir in Warren — there is little redundancy or emergency back-up built into the current supply infrastructure. Water from the pipeline is pumped to the BCWA's system via the Barrington Booster Pump Station. Should the service from Providence be interrupted, or the cross-bay pipeline or Nayatt Road pump station fail, the BCWA would need to re-activate the Child Street Water Treatment Plant in Warren. The Child Street Treatment Plant, previously used to treat water from the BCWA's various surface sources, has been taken out of operation and is maintained only as emergency supply. However, this back-up treatment plant is not sufficient to meet the total demand of the service area. Moreover, the treatment plant would be classified as non-potable until full testing determined compliance with the drinking water regulations, which could take several days.

4.4.3.2 Wastewater Treatment

Barrington's Public Works Department is responsible for maintenance of the town-wide sewer system including the force mains, laterals, and pumping stations. The

Town has six major sewer pumping stations, located at Police Cove, near the Barrington River Bridge, on County Road near Prince's Pond, Freemont Avenue, Legion Way near Brickyard Pond, Walnut Road, and Bay Spring. The pump stations at Police Cove, Prince's Pond, and Freemont pump into the Brickyard Pond station on Legion Way. This station, along with Walnut Road and Bay Spring, pump into a sewer force main located adjacent to the East Bay Bike Path.

There are also smaller ejector stations and sewer grinders that pump and move the wastewater through the system into the various pumping stations. The force main connects the wastewater collection system to the treatment facility in East Providence. The Town shares the cost of upgrades to the East Providence treatment facility based upon the percentage of Town wastewater conveyed to the plant. The sanitary force main connection with East Providence failed in December 2006. In response, the Town replaced the force main, a \$5 million-plus project. The cost was covered through the sewer enterprise fund, which is also the mechanism for covering future multi-million dollar improvements at the treatment facility. The Town also recently undertook upgrades to the six major pump stations as well as improvements to the ejector stations and grinders.

The National Weather Service (NWS) developed a computerized numerical model for Sea, Lake and Overland Surges from Hurricanes (SLOSH). Under the worst case SLOSH scenario, 11 of Barrington's 15 pump stations are located in storm surge areas for Category 1 or Category 2 hurricanes. The risk of flooding during these or other

hazard events could damage or jeopardize the continuous operation of the pump stations.

4.4.3.3 Roads, Bridges, and Dams

Fast moving, widespread flooding also has the ability to halt transportation and damage transportation infrastructure. If roads were to become impassable, Barrington's population, including Special Needs populations, could also experience difficulty evacuating and/or conducting daily activities until flood waters recede. The Town's Public Safety Complex could experience flooding from high caliber hurricanes, but other emergency centers/operating facilities such as Town Hall and the Department of Public Works are located well beyond the storm surge area identified for any hurricane.

Strong winds and winter storms can also present a major obstacle to transportation and impair road functions, with the potential to damage structures and impair electric utilities. Already the Town has infrastructure impacted by coastal waters, such as the drainage outfall at Allin's Cove (**Figure 4.12**), which is connected to a drainage pond at the end of Third Street. This outfall is underwater at high tide and requires frequent maintenance from Public Works to keep it clear of sand and debris.

As discussed in Section 4.2.1, Barrington has two dams (Echo Lake and Kent Street dams) the failure of which only presents a minimal threat to the town.

4.4.3.4 Future Development Trends

Barrington has limited vacant land available for future development. The Housing & Neighborhoods element of the 2015 Comprehensive Community Plan calls for development of key remaining areas to fulfill current land use needs such as affordable and senior housing.

Barrington is projected to add approximately 200 to 300 housing units in the next few years via two major projects: the 40-unit Palmer Pointe affordable housing multi-family development on Sowams Road and a 280-unit senior residential development at the former Zion Bible Institute campus on Middle Highway at Primrose Hill Road. The Zion Bible Institute property is situated outside of hurricane surge inundation zones and considered at low risk for natural hazards.

Figure 4.12. Drainage Outfall—End of Third Street at Allin's Cove



The Palmer Pointe development (**Figure 4.13**), consisting mostly of duplexes, received preliminary plan approval in the summer of 2016. Construction is anticipated to begin in 2017, subject to final plan approval and issuance of permits. Although the site is partially located within the 100-year Flood Zone (areas nearest the Palmer River), no structures will be placed within this zone according to the Planning Board-approved plan.

Another proposed development is a 27-unit townhouse development on George Street, which sought waivers and variances through the comprehensive permit process. The Planning Board denied the application, but that decision was overturned in 2014 by the State Housing Appeals Board (SHAB). The Town's appeal of the SHAB decision was still pending as of February 2017.

On the commercial development side, there have not been any large-scale commercial developments completed since the early 2000s. New commercial and mixed-use buildings have involved redevelopment of infill sites, typically one acre or less in area.

As for industrial land use, the only industrially zoned land (Limited Manufacturing) remaining in Barrington is a 4.8-acre area to the south of Bay Spring Avenue abutting Allin's Cove. The development potential of the site is unknown. The property is constrained by its proximity to the water and wetlands, and floodplain issues, as well as stringent CRMC requirements due to its proximity to Al-

lin's Cove. In 2016, the owner continued to work with the RI Department of Environmental Management to complete the remediation of contaminants that remained following the closing of the old Pilling Chain mill.

4.4.4 *Natural Environment*

Barrington's natural features are important resources, serving as habitat for wildlife, providing passive recreational opportunities for the public, and enhancing the scenic characteristics of the community. The natural environment also plays a role in reducing natural hazard impacts and increasing the community's resiliency. For example, freshwater wetlands and coastal marshes help absorb flood waters; open spaces, soils, and landscape features contribute to stormwater management; and vegetative cover controls erosion and reduces runoff.

4.4.4.1 Wetlands

Most of Barrington's 955 acres of wetlands are on conservation land owned by the Town, the State, the Land Conservation Trust, and Audubon Society or otherwise protected. There also are several significant areas of wetlands in private ownership. The largest contiguous coastal wetlands are around One Hundred Acre Cove, the upper Barrington and Palmer Rivers, on Narragansett Bay at the RI Country Club and Tillinghast Estate, and on Rumstick Point. The most significant freshwater wetlands areas include the Hampden Meadows "Greenbelt" be-

Figure 4.13. Palmer Pointe Neighborhood on Sowams Road—Site Plan (Master Plan)



Source: Town of Barrington Planning Office

tween New Meadow and Sowams Roads, the “Brickyard Wetlands” between the Barrington Shopping Center and the YMCA, those within the Tall Pines conservation area east of Washington Road near County Road, and the Divine Vargas wetlands west of Wampanoag Trail.

4.4.4.2 Open Space Parcels

The Town of Barrington, the Barrington Land Conservation Trust, Audubon Society and other private interests have acquired a substantial amount of open space throughout town, totaling more than 900 acres, according to the 2015 Comprehensive Community Plan. Approximately 110 acres of privately owned open space is protected by deed restriction or other similar mechanism.

The majority of privately owned open spaces in Barrington are not permanently protected and therefore may be available for development, though environmental constraints such as the presence of wetlands are found on many of these parcels. Privately owned open space properties that have not been protected in perpetuity include institutional sites that also contain significant open space areas with conservation values.

These include: the former Zion Bible Institute campus (a section of forested wetlands); St. Andrews School (forested wetlands in the westerly portion of the site); Tillinghast Estate, owned by the RI School of Design (coastal wetlands); and the RI Country Club (coastal wetlands, Mussachuck Creek). Along the shoreline of the Palmer River, Hundred Acre Cove, and Allin’s Cove are open space lots of unknown ownership. These lots, totaling approximately 90 acres, all have severe environmental constraints – including portions underwater. They also are located near protected open space areas owned by the Town, the Land Conservation Trust, and the Audubon Society.

4.4.4.3 Agricultural Lands

Roughly 190 acres in town are in agricultural use. The northeast section of Barrington (George Street area) is the largest contiguous agricultural area. The Town has zoned the area, which lacks access to city water and sewer, for single-family detached houses on large lots (Residence 40-Conservation Development) and conservation/resource protection (Wildlife Refuge, Open Space-Passive and Conservation zoning).

4.4.4.4 Surface Water

As tabulated in the 2015 Comprehensive Plan, inland water bodies (lakes, ponds, creeks, streams) in Barrington total approximately 199 acres. The largest bodies of water include Brickyard Pond (105 acres), Echo Lake (22.5 acres), and Prince’s (Tiffany) Pond (8.3 acres). Significant creeks include Annawumscutt Brook and Mus-sachuck Creek.

4.5 VULNERABILITY ANALYSIS

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. In assessing the Town’s vulnerability to the identified natural hazards, the Barrington Hazard Mitigation Committee considered what is at risk in these areas (structures, population, natural resources) and what the impacts will be (loss of life, environmental damage, inconvenience to residents).

4.5.1 Critical Facilities

Due to its coastal location and the potential for the occurrence of various seasonal storms, Barrington’s critical assets are more vulnerable to flooding than any other hazard. Hurricane storm surge has perhaps the greatest potential to impact the Town, as surge from even a low

Table 4.13. Critical Assets Located in Areas Susceptible to Storm Surge and Flood Zones (cumulative)

Asset Type	Hurricane Category: Storm Surge						Flood Zone	
	1	2	3	4	AE	VE		
Dams (Kent Street, Echo Lake)		2	2	2	1			
Public Safety Building (Police/Fire/EMS)				1				
Public Schools		3	5	5	1			
Private School		1	2	3				
State Facility (East Bay Center)			1	1				
Post Office			1	1				
Elderly Housing/Assisted Living		2	2	2				
Marina		3	4	4	4	4		
Park & Ride Lots		2	2	2	2	2		
Sewer Pump Stations		2	4	5	5	3	1	

Source: Town GIS, Assessor’s Office

RISK ASSESSMENT

Table 4.14. Assessed Value — Properties with Structures in Flood Zones

Flood Zone/Use	Parcels with Structures	Assessed Value				Total
		Principal Structure	Accessory Structures	Land		
500-Year Flood Zone						
Single-Family	924	\$ 222,003,452	\$ 3,660,000	\$ 205,147,900	\$ 430,811,352	
Multifamily	13	\$ 2,135,700	\$ 98,700	\$ 1,357,100	\$ 3,591,500	
Senior Housing	1	\$ 442,600	\$ 6,700	\$ 2,826,900	\$ 3,276,200	
Commercial	22	\$ 10,312,700	\$ 985,600	\$ 19,306,100	\$ 30,604,400	
Marinas	0	\$ -	\$ -	\$ -	\$ -	
Group Homes	1	\$ 226,100	\$ -	\$ 340,400	\$ 566,500	
Day Cares	1	\$ 203,600	\$ 36,200	\$ 256,900	\$ 496,700	
Institutional	3	\$ 712,500	\$ 48,200	\$ 1,081,900	\$ 1,842,600	
Government	1	\$ 398,900	\$ 28,100	\$ 539,500	\$ 966,500	
Schools/Education	2	\$ 10,771,000	\$ 4,700	\$ 8,973,200	\$ 19,748,900	
Utilities	2	\$ 387,000	\$ 42,400	\$ -	\$ 429,400	
Subtotal: 500-Year Zone	970	\$ 247,593,552	\$ 4,910,600	\$ 239,829,900	\$ 492,334,052	
100-Year (AE Zone)						
Single-Family	678	\$ 197,786,500	\$ 3,980,500	\$ 149,484,300	\$ 351,251,300	
Multifamily	21	\$ 3,183,000	\$ 79,000	\$ 2,854,500	\$ 6,116,500	
Senior Housing	1	\$ 1,789,100	\$ 135,700	\$ 10,139,500	\$ 12,064,300	
Commercial	4	\$ 1,330,600	\$ 51,800	\$ 1,116,100	\$ 2,498,500	
Marinas	4	\$ 8,844,600	\$ 4,030,400	\$ 1,984,200	\$ 14,859,200	
Group Homes	2	\$ 330,600	\$ 11,600	\$ 440,600	\$ 782,800	
Day Cares	0	\$ -	\$ -	\$ -	\$ -	
Institutional	1	\$ 226,900	\$ 4,600	\$ 547,700	\$ 779,200	
Government	0	\$ -	\$ -	\$ -	\$ -	
Schools/Education	1	\$ 385,300	\$ 76,500	\$ 846,500	\$ 1,308,300	
Utilities	3	\$ 368,100	\$ 30,800	\$ -	\$ 398,900	
Subtotal: AE Zone	715	\$ 214,244,700	\$ 8,400,900	\$ 167,413,400	\$ 390,059,000	
Velocity Zone (VE)						
Single-Family	98	\$ 59,951,400	\$ 784,600	\$ 26,625,000	\$ 87,361,000	
Multifamily	0	\$ -	\$ -	\$ -	\$ -	
Senior Housing	0	\$ -	\$ -	\$ -	\$ -	
Commercial	1	\$ 121,100	\$ 11,300	\$ 235,900	\$ 368,300	
Marinas	0	\$ -	\$ -	\$ -	\$ -	
Group Homes	0	\$ -	\$ -	\$ -	\$ -	
Day Cares	0	\$ -	\$ -	\$ -	\$ -	
Institutional	0	\$ -	\$ -	\$ -	\$ -	
Government	0	\$ -	\$ -	\$ -	\$ -	
Schools/Education	0	\$ -	\$ -	\$ -	\$ -	
Utilities	1	\$ 97,800	\$ 30,800	\$ -	\$ 128,600	
Subtotal: VE Zone	100	\$ 60,170,300	\$ 826,700	\$ 26,860,900	\$ 87,857,900	
Total	1,785	\$ 522,008,552	\$ 14,138,200	\$ 434,104,200	\$ 970,250,952	

Source: Town GIS data, Assessor's Office, RIGIS

level hurricane could flood large sections of Town in a short period of time.

Table 4.13 provides a summary of critical assets susceptible to storm surge and flooding. Winter storms and heavy rains can flood assets located within the 100-year Flood Zone and the Velocity Zone, including schools (Barrington High School and three private schools), coastal homes, roads, park and ride lots, and utility infrastructure. Both park and ride lots serving the bus routes on RI 114 are in the AE zone and susceptible to storm surge, even during weak hurricanes. (A detailed list of Barrington critical assets vulnerable to various hazards has been prepared as **Appendix 4.**)

A GIS analysis completed by the Town, utilizing Tax Assessor data for property values, is summarized in **Table 4.14**. The analysis shows that there are approximately 100 structures within the VE zone, mostly single-family residential, with an average age of 71 years. Total assessed value of the principal structures on these lots is about \$60 million.

The AE flood zone contains approximately 715 parcels with structures, of which 678 are single-family residential, 4 marinas, 4 other commercial sites, and 21 multi-family (including Atria Bay Spring Assisted Living). The High School falls within the AE zone. The assessed value of principal structures in this zone totals about \$214 million, with an average age of 61 years. In addition, there are approximately 970 developed parcels in the 500-year flood zone, with a total assessed value of nearly \$250 million.

The Rhode Island Building Code requires residential and commercial structures in the Barrington area to be built to withstand 110 mile per hour winds, or a Category 2 hurricane. The facilities that house and support Barrington’s special population centers were mostly built in the latter half of the 20th century and meet this requirement. The senior center, which is housed in the library, an old-

er masonry structure, may not meet this standard. All special needs population centers may be vulnerable to wind-borne damage from higher caliber hurricanes.

Half of Barrington’s 15 public and private schools are located in storm surge inundation areas based on the SLOSH worst case scenario model. The schools most at risk are Tot’s Cooperative Nursery School, which is at risk from storm surge associated with a Category 1 hurricane, as well as the Montessori Centre of Barrington, Sowams Elementary School, and Barrington High School, which are all at risk from storm surge inundation associated with a Category 2 hurricane.

Barrington’s two existing elderly housing facilities are located on the west side of town in the Bay Spring neighborhood. The Atria Bay Spring Assisted Living facility and the Barrington Cove Apartment’s parking lot are at risk from surge inundation associated with a Category 2 hurricane. The Barrington Cove Apartment building is at risk of storm surge from a Category 3 hurricane. Further, the East Bay Center, a State-owned outpatient mental health facility on County Road, is located in the AE zone and at risk from inundation associated with a Category 3 hurricane.

Barrington has several group homes, at least two of which are at risk from inundation from a Category 2 hurricane. These facilities are located on Upland Way, New Meadow Road, and County Road.

4.5.2 Repetitive Loss Properties

FEMA’s Severe Repetitive Loss (SRL) grant program was authorized by the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, which amended the National Flood Insurance Act of 1968 to provide funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss structures insured under the National Flood Insurance Program. Under this program the riskiest SRL properties could be targeted and owners

Table 4.15. National Flood Insurance Program Statistics - Barrington

Total NFIP Policies	Insurance In Force	Annual Premiums	Claims Since 1978		Payments Since 1978	Repetitive Loss Properties
			Filed	Paid		
1,192	\$353,065,000	\$1,349,831	428	278	\$1,564,877	14

Source: FEMA –NFIP As of April 30, 2016

would be offered financial help to get their buildings high and dry: either moved to a safer location or elevated well above the flood elevations. However, the Biggert Water Flood Insurance Reform Act of 2012 eliminated the SRL program (FEMA. Severe).

As FEMA indicates, although the SRL program was terminated, its Flood Mitigation Assistance (FMA) Grant Program is available to assist eligible properties. Residential or non-residential properties currently insured with the National Flood Insurance Program (NFIP) that meet the definitions of a repetitive or severe repetitive loss property are eligible to receive FMA funds. A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than \$1,000 were paid by the National Flood Insurance Program (NFIP) within any rolling ten-year period, since 1978. As shown in **Table 4.15** (previous page), the Town of Barrington has 14 repetitive loss residential properties.

These are distinct from properties which FEMA categorizes as “Severe Repetitive Loss” which include properties for which 4 or more separate claim payments have been made under flood insurance coverage with each claim exceeding \$5,000 and a cumulative amount exceeding \$20,000; or a property for which at least 2 separate claim payments (includes only building) have been made under such coverage, with the cumulative amount of such claims exceeding the market value of the insured structure (FEMA. Fact Sheet).

4.5.3 Sea Level Rise

As the long-term forecast projects greater frequency and intensity of storms, buildings in low-lying areas along the shore, in particular houses within the Velocity and Coastal A Zones, may be subjected to greater risk of flood and wind damage in the future. Further, with an extensive coastline, Barrington is among the most susceptible communities in the state to impacts from projected sea level rise (SLR), which will potentially enlarge the flood zones and impact more properties over time. **Map 7** depicts the vulnerability of critical facilities under SLR scenarios of 1, 3 and 5 feet.

Coastal erosion and encroachment resulting from rising seas increases Barrington’s exposure to cascading damages. Government agencies warn that this threat will grow

significantly in Rhode Island in the coming decades. For example, CRMC has been using a benchmark of 7 feet of SLR by 2100, while NOAA’s more recent projection, from January 2017, is 9.8 feet of SLR by 2100. The inevitable impact on the Town’s transportation system, structures, property, and coastal wetlands — critical for flood control and habitat viability — cannot be understated.

4.5.3.1 Transportation System

The Rhode Island Statewide Planning Program reports that, “Sea level rise presents a major challenge to Rhode Island’s transportation infrastructure, both via daily tidal flooding of coastal assets and making storm surge events more severe” (Statewide Planning Program. Vulnerability, 4). In order to assist municipalities to prepare for sea level rise and storm surge in their local planning efforts, Statewide Planning utilized STORMTOOLS, developed by CRMC in collaboration with the University of Rhode Island, to identify the transportation assets at risk under one, three, five and seven feet of sea level rise, and also those scenarios compiled with a 100-year storm surge event. Although there are some inherent limitations in the STORMTOOLS model and the analysis did not include the compounding impacts from erosion, riverine flooding, and such, the findings provide municipality’s valuable information regarding the affect SLR will have on their local transportation infrastructure. Under the conditions analyzed it was determined that transportation infrastructure will be compromised in all 21 coastal Rhode Island communities.

State Planning performed a vulnerability assessment to determine the relative vulnerability of transportation assets throughout the State. For all transportation assets impacted, both the characteristics of the physical hazard and the importance of the asset were scored on a scale of 1-5, producing a maximum vulnerability score of 10. Portions of both Wampanoag Trail and County Road are included in the State’s top 10 roadways vulnerable to SLR and County Road (N) is considered the most vulnerable road in the state with respect to a 100-year storm surge.

Additionally, when Statewide Planning looked at the cumulative municipal road SLR vulnerability, Barrington ranked forth out of the 21 coastal municipalities impacted. When the 100-year storm surge is added to the SLR

analysis, Barrington is considered the second most vulnerable community.

As shown in **Table 4.16**, SLR will have a permanent impact on a number of road sections throughout Barrington. Additionally, the intensity of a 100-year storm surge, even without the compounded issue of SLR, will impact nearly 54 miles of roadway in town.

The Statewide Planning vulnerability assessment further determined that 90 bridges throughout the State are vulnerable to sea level rise and 148 are vulnerable to storm surge. The County Road bridges across the Barrington River and the Warren River rank first and second, respectively, on the State’s top ten bridges vulnerable to SLR.

The East Bay Bike Path bridges over the Warren River and the Barrington River are both slated for replacement in the State’s Transportation Improvement Program, with construction scheduled for 2025. The Barrington Town Council in February 2017 passed a resolution requesting the State to re-evaluate the bridges and move up the schedule given concerns about the condition of the structures, as well as future impacts of SLR. This will be an issue for boaters as well. Statewide Planning’s report on SLR cited above states that rising seas will make traversing underneath the Barrington River and Warren River vehicular bridges—and by extension the bike path bridges—impossible. For example, 7 feet of SLR would leave *negative* 10 inches of freeboard for the Barrington River Bridge. (Freeboard is the space between the bottom of a bridge’s structure and the surface of the water underneath the bridge.) The Harbormaster’s dock at Police Cove, located between the Barrington River bike path bridge and vehicular bridge, would be rendered unusable.

The detailed findings and vulnerability assessment for Barrington’s compromised transportation assets, as prepared by the Statewide Planning Program, has been included as **Appendix 5**. These long-term projections are important as they provide Barrington with the oppor-

Looking toward the end of the century, in a worst case scenario with 7-ft of SLR and a 100-year storm surge, nearly two thirds of all structures in Town would be impacted.

tunity to mitigate the impact as improvements to local roadways and bridges are made.

Statewide Planning’s road and bridge analysis confirms and augments local analysis of the town’s compromised transportation system components as related to SLR scenarios. An overview of the elevation categories for the roadways throughout Barrington is shown on **Map 8**. In addition, **Maps 9 - 15** depict critical sections of roadway that will be inundated under 1-, 3-, and 5-foot SLR scenarios. As clearly depicted, numerous roadways, including portions of key corridors essential to emergency evacuation, are low lying and subject to periodic inundation from storm surge and flooding as well as future permanent inundation from sea level rise.

4.5.3.2 Structures

Utilizing the sea level rise inundation zones developed by CRMC, Statewide Planning also performed inundation analysis for structures. As shown in **Table 4.17** (next page), their analysis identified 19 single family residences in Barrington as well as one commercial structure that will be impacted by a 3 foot sea level rise. When sea level rise reaches 5 feet, 82 residences, 3 public service, and 5 commercial structures in Town may be inundated (9 - Risk Assessment). Looking toward the end of the century, in a worst case scenario with 7-ft of SLR and a 100-year storm surge, nearly two thirds of all structures in Town would be impacted.

4.5.3.3 Wetlands and Tidal Marshes

CRMC and its partners developed Sea Level Affecting Marshes Model (SLAMM) Maps for the coastal wetlands throughout Rhode Island. The maps show the potential

Table 4.16: Linear Miles of Road Inundated - Barrington

Exposure	No SLR	1ft SLR	3ft SLR	5ft SLR	7ft SLR	Total Miles
Exposed to SLR	N/A	0.01 miles	1.26 miles	5.22 miles	7.94 miles	14.44 miles
100-Year Storm Surge	53.91 miles	5.08 miles	5.93 miles	4.82 miles	3.85 miles	73.58 miles

Note: the mileage represented per column should be added to columns to the left to obtain cumulative impact
 Source: Technical Paper 167

Table 4.17 Summary of Barrington Structures Exposed to Inundation Under SLR Scenarios

Groupings	Total Build-ings (Town)	SLR 1ft Exposed Buildings	SLR 2ft Exposed Buildings	SLR 3ft Exposed Buildings	SLR 4ft Exposed Buildings	SLR 5ft Exposed Buildings	SLR 7ft Exposed Buildings	SLR 7ft and 100yr Storm Surge Exposed Buildings
Commercial	154	0	0	1	5	8	8	109
Public Service	74	0	0	0	3	4	4	33
Residential	6,100	0	2	19	82	261	261	3,930
Utilities	8	0	0	0	0	0	0	5
TOTALS:	6,336	0	2	20	90	273	273	4,077

Public Service	Total Build-ings (Town)	SLR 1ft Exposed Buildings	SLR 2ft Exposed Buildings	SLR 3ft Exposed Buildings	SLR 4ft Exposed Buildings	SLR 5ft Exposed Buildings	SLR 7ft Exposed Buildings	SLR 7ft and 100yr Storm Surge Exposed Buildings
Fire Stations	1	0	0	0	0	0	0	2
Health Care Facilities	8	0	0	0	0	1	1	5
Police	1	0	0	0	0	0	0	1
Educational	36	0	0	0	0	0	0	13
Government	3	0	0	0	0	0	0	1
TOTALS:	49	0	0	0	0	1	1	22

Source: Statewide Planning; Modified from URI Coastal Resources Center/RI Sea Grant (<http://www.beachsamp.org/stormtools/e911/>)

changes in wetland and tidal marshes that may occur under sea level rise scenarios of 1, 3 and 5 feet. According to the technical findings from the SLAMM Project, “Coastal wetlands, especially tidal marshes, are one of the most susceptible ecosystems to climate change and in particular accelerated sea level rise. A considerable percentage of coastal wetlands may be permanently lost by the end of this century unless upland areas directly abutting coastal wetlands are protected or otherwise set aside for the purpose of providing wetland migration in response to sea level rise” (Beach SAMP. The).

Two SLAMM maps (Map 11 under current conditions and with 5ft SLR) have been included as Maps 6 and 7 to represent the concerns from SLR facing coastal wetlands. All thirty-six SLAMM Maps prepared for Barrington and can be accessed via the following link: http://www.crmc.ri.gov/maps/maps_slamm/slamm_barrington.pdf.

Save the Bay has prepared a list of potential adaptation projects for Barrington, which have been included as **Appendix 6**.

4.5.3.4 Identified Areas of Concern

As Barrington’s coastal area consists of residences, businesses, and public facilities and infrastructure, the impacts resulting from an increase in SLR, especially as it approaches five feet, will be challenging. The Committee

has identified the following key areas of concern for both the built and natural environment that should be integrated into the Town’s long-term Mitigation Strategy.

Built Environment

- The loss of Walker Farm (including a boat ramp, community gardens and a yard waste storage area) and most of Osemequin Park, should waters rise by 4 or more feet;
- Regular flooding at high tide of the Wampanoag Trail, County Road near the High School and Prince’s Pond (**Figure 4.14**), and sections of New

Figure 4.14. Culvert Under County Rd. Handles Water Flow Between Prince’s Pond and Barrington River



Photo Credit: Save the Bay

Meadow Road and Sowams Road (in particular nearest the Barrington and Palmer Rivers);

- Worsening flooding of RI 114/103 on the Warren side of the Warren River Bridge;
- The loss of Town Beach as a recreational asset should SLR exceed four feet;
- More frequent flooding of streets and other upland areas due to rising water exceeding the elevation of stormwater outfalls, preventing water from discharging from the pipes;
- Inundation of sewer pump stations in low-lying areas such as at the end of Adams Point;
- Water from the Barrington and Warren Rivers covering sections of Mathewson Road (**Figure 4.15**) and Tyler Point, impacting boat facilities and other uses close to the Barrington and Warren Rivers, and a critical roadway for residents in the Mathewson Road area;
- Inundation of residential lots near the shoreline, including those at the end of residential streets near the Palmer River and the Warren River;
- Waters extending from Bullock Cove into low-lying areas of Latham Park, and from Allin's Cove into low-lying areas in the Alfred Drown and Bay Spring neighborhoods; and
- Rising water overtopping the banks of Echo Lake, Brickyard Pond and Mussachuck Creek affecting adjacent neighborhoods and the RI Country Club;

Figure 4.15. Inundation at High Tide—Edge of Mathewson Road at End of Ferry Lane (Warren River)



Photo Credit: Save the Bay

Natural Environment

- Waters from Narragansett Bay reaching into the coastal marshes at RI Country Club and portions of RISD's Tillinghast Estate;
- Inundation of coastal marshes (Palmer River, Hundred Acre Cove/Barrington River (**Figure 4.16**), Allin's Cove, along Narragansett Bay) that serve as wildlife habitat areas as well as provide protective buffers against storm surge for inland areas;
- The loss of freshwater wetlands due to saltwater intrusion from SLR.

Figure 4.16. Crab Island in Barrington River (Lower Part of Photo) - Subject to Inundation at High Tide

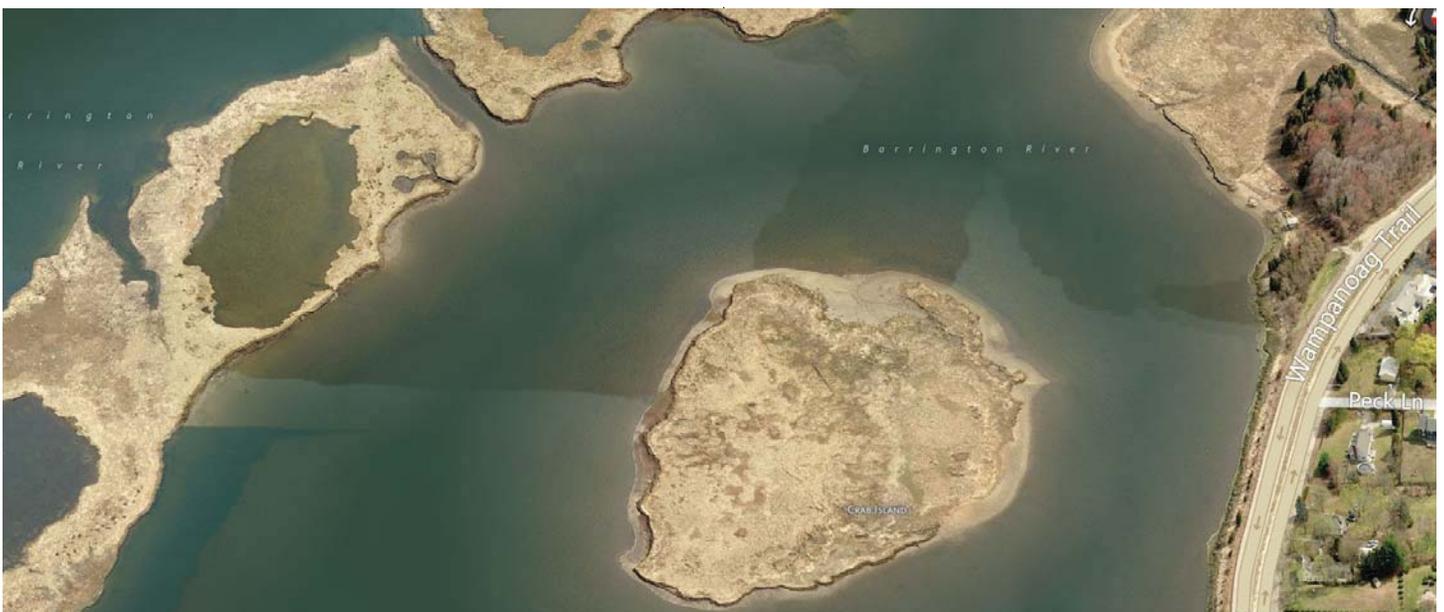


Table 4.17 Vulnerability Summary

Hazard	Exposure (Geographic Area Affected)	Maximum Probable Extent (Magnitude / Strength)	Risk Frequency	Overall Significance Ranking
Coastal Flooding	Extensive	Severe	Highly Likely	High
Coastal Erosion	Significant	Extreme	Highly Likely	High
Climate Change/SLR	Extensive	Extreme	Highly Likely	High
Dam Failure	Limited	Moderate	Unlikely	Low
Storm Surge	Extensive	Extensive	Highly Likely	High
Hurricane	Significant	Severe	Likely	Medium
High Wind	Significant	Severe	Likely	Medium
Tornado	Limited	Moderate	Unlikely	Low
Winter Weather	Extensive	Extensive	Highly Likely	High
Earthquake	Extensive	Weak	Unlikely	Low
Wildfire	Negligible	Weak	Unlikely	Low

The probability of future climate change-related events, including continued sea level rise, is certain. How these changes impact “normal” conditions, as well as, exacerbate routine weather events is an area for continued study and analysis. Barrington’s Hazard Mitigation Committee recognizes SLR as a considerable concern to community assets. Of Barrington’s 8.2 square miles of land, roughly 1.2 square miles fall at or below the 5 foot contour line.

This represents a loss of 14.6% of Barrington’s landmass when sea level rise reaches this juncture. As such, the Town is committed to staying abreast of state, federal, and research information pertaining to climate change and sea level rise and undertaking additional studies to identify potentially compromised assets. The Town is currently engaged in a pilot project to identify portions of the storm drainage system that will be inundated under various SLR scenarios.

4.5.4 Vulnerability Summary

Descriptions of the assessment matrices the Hazard Mitigation Committee used in evaluating potential vulnerability of the town from the identified hazards can be found in **Appendix 5**. The result of the Committee’s analysis is summarized in **Table 4.17**.

5 Capability Assessment

The Capability Assessment identifies and evaluates the Town’s capabilities – programs, regulations, policies, personnel, and other resources – which “reduce disaster losses or could be used to reduce losses in the future, as well as capabilities that inadvertently increase risks in the community” (FEMA. Local Mitigation Planning Handbook, 4-1) The Town has the capacity to implement and institutionalize hazard mitigation through its personnel, legal, and fiscal resources; intergovernmental coordination and communication; and academic and analysis tools. Most importantly, Barrington has a community base – business owners, institutional leaders, and residents – that has been actively engaged in planning for natural hazards and other critical issues important to the Town’s future.

The following sections provide an overview of the critical capabilities within the Town and how they play a role in the mitigation effort. The capabilities outlined below reflect current conditions. The Town has the capacity to expand on certain capabilities through the passage and enforcement of additional codes and regulations, as well as continually increase the stakeholders involved in the Hazard Mitigation Committee to reflect growth and change in the community.

5.1 PLANNING/REGULATIONS

Local plans and policies were consulted for the creation of this Hazard Mitigation Plan, including those prepared by or on behalf of the Town as well as those prepared by citizen groups and committees. Critical planning documents include the Comprehensive Community Plan (2015) and the Open Space Plan (2011). Additionally, public services and facilities provided by the Town are crucial resources for preparing for natural hazard events, as well as responding to and mitigating such events. The Town has enacted a number of regulatory restrictions designed to reduce the potential impacts of flooding to property by limiting development in and around wetlands and flood-prone areas.

5.1.1 Building Codes

Rhode Island administers a State Building Code through the Building Code Commission. The Building Code is implemented statewide and enforced through the building official in Barrington. The Code consists of uniform regulations to control construction, reconstruction, repair, removal, demolition, and inspection of all buildings. The NFIP standards, wind, and snow loads are all an integral part of the State Building Code, ensuring that all new construction and substantial improvements meet national flood resistant standards through consistent statewide application of the NFIP minimum criteria.

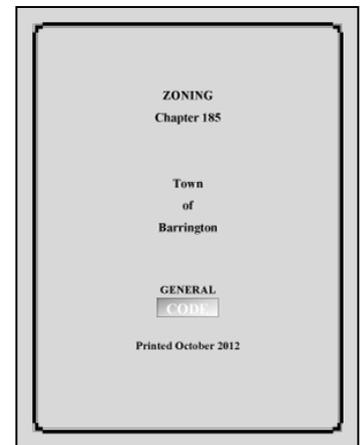
Current building codes in Barrington require structures to be able to withstand 110-mile-per-hour winds, or a Category 2 hurricane.

5.1.2 Zoning

5.1.2.1 Development in Areas of Special Flood Hazard (Article XXIII)

The Development in Areas of Special Flood Hazard section of the Zoning Ordinance was amended in 2014 as required by

FEMA to be consistent with the new Flood Insurance Rate Maps that became effective on July 6, 2014. The Article requires a permit for all construction or other development within a special flood hazard area (the AE or VE zone). Development projects include any filling, grading, excavation, mining, drilling, storage of materials, and temporary stream crossings. If the construction or other development within a special flood hazard area is not covered by a building permit, all other nonstructural activities are to be permitted by either the CRMC and/or the RI Department of Environmental Management



(DEM), as applicable. The Article further specifies enforcement procedures and use regulations.

5.1.2.1 Wetlands Overlay District (Article XXV)

In 1994 the Town adopted a Wetlands Overlay District Zoning Ordinance that requires a special use permit from the Zoning Board for proposed activities within the 100-foot wetland setback. The ordinance also prohibits any reduction in flood storage capacity, and the storage of materials or equipment which could cause damage under flood conditions. In addition, the ordinance requires any construction occurring in the Velocity Zone to take place above the mean high tide line.

5.1.3 Land Development and Subdivision Regulations

5.1.3.1 Special Flood Hazard Areas (Section 200-51)

Section 200-51 requires the mapping of flood zones, including base flood elevation data, on all master plan sketches and all preliminary and final plats. Further, the regulations require the following design standards:

- The design of the development or subdivision is consistent with the need to minimize flood damage.
- Public improvements, facilities, and utilities are constructed or installed in a manner that will minimize flood damage.
- Adequate drainage will be provided to minimize the accumulation of water.
- Where a development or subdivision is located in a special flood hazard area, the finished ground grades in the area of the proposed building locations shall not be below the base flood elevation specified for such area.

5.1.3.2 Stormwater and Erosion Control (Sections 200-49 and 200-50)

Applicants for qualifying development activity must develop and submit a stormwater management plan consistent with the Rhode Island Stormwater Design and Installation Standards Manual and the Rhode Island Soil Erosion and Sediment Control Handbook. The Planning Board in recent years has approved plans with low impact development features, such as at Walker Farm Lane,

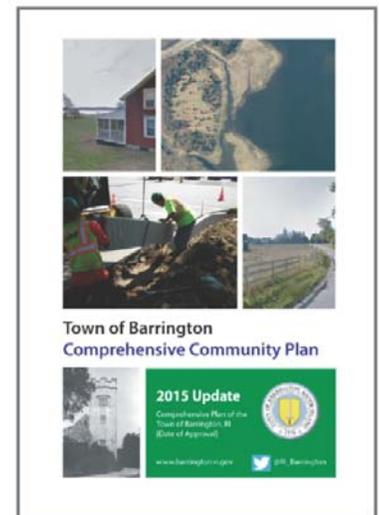
where surface runoff from the street drains into a retention pond, rather than through culverts and pipes; the development features narrow street widths and pervious pavement for on-street parking spaces and driveways. The Board has also granted waivers allowing private streets for subdivisions of up to two lots, allowing access through shared driveways that require much less pavement compared to development of a street to Town standards.

5.1.3.3 Open Space Dedication (Section 200-48)

The Open space, recreation, and natural resource areas Section states that the Planning Board will consider acceptance of a proposed dedication of open space where the property is of “unique natural character or is included in the Barrington Comprehensive Community Plan or Open Space Plan.”

5.1.4 Comprehensive Community Plan

The Town’s Comprehensive Community Plan (2015) serves as the basis for initiating and evaluating for consistency proposed regulations, policies and capital expenditures. As required by the Rhode Island Comprehensive Planning and Land Use Act amendments of 2011, the Town added a new Natural Hazards element in the Comprehensive Plan, which was adopted by the Town and approved by the State in 2015.



5.1.4.1 Natural Hazards Element

The Natural Hazards element describes critical issues, planning opportunities and sets of goals, strategies and actions related to natural hazards, including the threat of sea level rise. The Hazard Mitigation Committee drew from the Natural Hazard element’s Goals, Objectives, Policies and Actions in developing this Hazard Mitigation Plan.

5.1.4.2 Natural and Cultural Resources Element – Open Space Acquisition Criteria

The Comprehensive Community Plan establishes criteria for evaluating open space acquisition (Policy NCR-1.1.1). The following criteria recognize the value of open space in mitigating risk from sea level rise and flooding:

- Protection of upland areas adjacent to coastal wetlands that are projected to migrate landward due to impacts from sea level rise.
- Property providing storm water storage, flood protection, or groundwater recharge.

On Dec. 7, 2015, the Town Council voted to accept a property owner's offer to donate to the Town the development rights to approximately one acre of Residence 25-zoned property on Blount Circle, located within the 100-year floodplain. In approving the request, the Council cited the open space acquisition criteria, specifically the provision of flood protection, as well as Natural Hazards Policy NH-1.1.2 to reduce the "impact of development within the floodplain and other vulnerable areas."

5.2 OPEN SPACE PROTECTION AND INCENTIVES

Techniques to protect open space utilized by the Town, Land Trust, and others include:

- Land Acquisitions—Town. The Town has had success protecting properties through land acquisition. Acquisitions since 2000 include:
 - ◇ The "Brickyard Wetlands." This property is located between the Barrington Shopping Center and the YMCA. The 10-acre site, which is mostly wetlands, was purchased using State Open Space bond funds with a local match; a conservation easement restricts the type of activities and land disturbances that may take place at the site.
 - ◇ Former Vitullo Farm property on Wampanoag Trail (**Figure 5.1**). A section of the former 29-acre farm just off Wampanoag Trail was converted in 2014 for use as the Barrington Community Garden. This property, acquired in 2003, has been merged with the adjacent 38-acre Devine Vargus conservation parcel, also owned by the Town. Environmental constraints include wetlands, extensive floodplain areas, and a high water table. A trails design has been approved for the rear portion of the site to provide public access.
 - ◇ Sowams Road open space parcel. An upland area within the 5.9-acre site near Sowams Road has been converted to a practice field with parking. The rear portion of the site, within the "Hampden Meadows Greenbelt," has the potential for new trails.
 - ◇ St. Andrews Farm, Middle Highway. The Town acquired the 28.5-acre tract from St. Andrews

Figure 5.1: Vitullo Farm on Wampanoag Trail—Protected Open Space Containing Floodplain, Wetlands



School for active and passive recreation. The rear of the site consists of an open field to be preserved for passive recreation.

- ◇ George Street parcel. In 2009, the Cemetery Commission acquired approximately seven acres primarily upland in the George Street area for a future cemetery. The site includes a small section of coastal marsh on Hundred Acre Cove.

- Land Acquisitions—Land Conservation Trust. The Land Trust also has played a vital role in protecting sensitive properties throughout Barrington. One of the more significant acquisitions was made in 2007, with the purchase of “Sowams Woods” on Washington Road. The 12.3-acre site, which abuts Echo Lake, was purchased from RI Country Club using several funding sources. A conservation easement is in place for the site.
- Land Donations. The Town and Land Trust have also acquired several properties in recent years through land donations—including the acceptance in 2011 of two acres that abut the Town’s Hampden Meadows Greenbelt; the parcel included wetlands and floodplain. (Town acquisition).
- Acquisition of Development Rights. The purchase of development rights is when a landowner voluntarily sells his development rights, in perpetuity, to a governmental agency or land trust for the difference between the value of land as protected open space or farmland, and the land’s potential development value under existing zoning. The Town acquired the development rights in the early 1990s on 8.7 acres of farmland and coastal wetlands owned by Four-Town Farm. The acquisition was made in exchange for allowing Four-Town Farm to lease Town property off George Street for 20 years. Additionally, a voluntary donation of development rights was offered and accepted by the Town in 2015 for a one-acre residentially zoned site on Blount Circle.
- Farm, Forest and Open Space Program. The Farm Forest and Open Space Program is a tax incentive program that helps to achieve open space protection, but does not provide permanent protection. The program is intended to encourage property owners to manage their land for forestry, agriculture, and open

space. Property owners enter into an agreement with the Town to keep their properties undeveloped for at least 15 years in exchange for lower property tax assessments. Should a property owner decide to remove land that has been designated under the tax program, back taxes would be owed to the Town. As such, these properties are not protected in perpetuity, unless, for example, there is also a permanent conservation easement in place.

As noted previously, lots farmed by Four-Town Farm in the George Street area represent the largest acreage of any property owner in the program, totaling 33 acres (this includes an 8.7-acre parcel to which the Town acquired the development rights).

Other properties in the program include three properties on Adams Point totaling approximately 10 acres, and an 11.8-acre property off Half Mile Road with woods, forested wetlands, and an area reserved for residential use. The properties on Adams Point include areas within the 100-year floodplain (AE zone) and the VE zone. Most of the Half Mile Road site falls within the AE zone.

5.3 ADMINISTRATIVE/TECHNICAL

5.3.1 Building Official

The Town’s Building Official is responsible for ensuring new structures meet building code requirements, and is the designated keeper of flood maps for Barrington.

5.3.2 Town Planner

The Town Planner also serves as the Planning Board Administrative Officer. The Planner enforces requirements of the Land Development & Subdivision Regulations involving subdivision of land and major land development projects. The Planning Board has the discretion to require applicants to submit a peer review fee to the Town to cover third-party engineering review of development/subdivision proposals, including compliance with storm water regulations, erosion control, and standards related to development within the flood plain and/or within proximity to a wetland or coastal feature.

5.3.3 Department of Public Works (DPW)

DPW's responsibilities include:

- Engineering review (utilizing engineering consultants);
- Street, drainage, and sewer system maintenance
- Street sweeping;
- Maintenance of municipal buildings and parks
- Snow plowing and storm cleanup;
- Tree trimming/tree maintenance—parks and public rights of way; and
- Oversight of the leaf compost site at Walker Farm.

5.3.4 Geographic Information System (GIS)

The Town Planner, Public Works, and Tax Assessor are responsible for maintaining updated GIS data, including updates related to new subdivisions, street extensions, buildings, and drainage and sewer system improvements. Mapping is completed by the Town Planner's office as well as a consultant under contract to maintain the GIS data. An on-line web viewer provides Town departments and the public access to GIS mapping – including parcels, zoning, public infrastructure, wetlands, and flood zones. GIS data include the following:

- Locally maintained data: parcels, zoning, street edge, storm drainage system, sanitary sewer system, and water distribution system (BCWA).
- State-maintained (RIGIS) data – flood zones, storm surge inundation zones, sea level rise, wetlands, water bodies, roads, open space, soils, land use, structures, watershed, town boundaries, contours, etc.

The Town, in spring 2014, updated its town-wide aerial photography, which is available to all Town departments for viewing via the Pictometry website. Funding to complete aerial flyovers is included in the Town's Capital Improvement Program as needed.

5.3.5 Public Safety

The Police and Fire Departments are located in the Public Safety Building, 100 Federal Road. The Police Department has a force that consists of a Police Chief, 25 full-time police officers, and seven civilian support personnel (four dispatchers, an animal control officer, and administrative staff). The Fire Department has one fire station staffed by a Fire Chief and 28 full-time firefighters. In

2014, the Hampden Meadows Volunteer Fire Department, stationed at 168 Sowams Road, closed. The station was razed in 2016 to clear room for two new houses.

The Emergency Operations Center (EOC) is based at the Public Safety Building. The Town in 2017 utilized a Homeland Security grant and local funds to improve communications at the EOC, upgrading from a VHF to 800 MHz system. The new system eliminated a problem with dead zones in town and allows for better and safer communications among local, state and federal agencies.

The Town has one Red Cross-certified shelter—at Primrose Hill School, 60 Middle Highway. The building, located outside the floodplain and areas subject to storm surge, is equipped with an emergency generator. Primrose Hill is a backup to the primary shelter at East Providence High School, utilized by the under a memorandum of understanding.

5.4 FINANCIAL

The annual Financial Town Meeting (FTM) is typically held on the fourth Wednesday in May each year. Registered voters at the FTM vote on the municipal and school budget, including the annual capital budget, as recommended by the Committee on Appropriations. The budget forwarded to the FTM by the Committee on Appropriations is first developed by the Town Manager and approved by the Town Council (potentially with revisions) and the School Committee. In addition to operating and capital budgets for the Town and Schools, voters at the FTM also may approve bonds to finance capital projects. Authority to issue bonds may also be decided by referendum as part of Town-wide elections, such as the 2016 bond referendum to finance a new Middle School.

Annual capital budgets are developed as part of a six-year Capital Improvement Program, updated each year. This plan helps identify projects that should be undertaken in the next six years. This long-range planning is essential in addressing the future development and growth of the Town. The Town has continually funded its capital requirements each year, in the \$1 million range, and maintains a pay as you go funding for most of its capital needs, which limits its borrowing requests. The School Department in recent years has designated annual budget surpluses for use in funding its capital needs.

Net position can serve over time as a useful indicator of a government's financial position. According to the Town's FY2016 Comprehensive Annual Financial Report, the Town's combined net position (government and business-type activities) totaled \$55,853,202 at the close of FY2015-16. Governmental activities cover most of the Town's basic services such as police, fire, school, library, public works, and general administration. Property taxes finance most of these activities, supplemented by charges for services and state funding.

Business-type activities are fees charged to customers to cover the costs of certain services it provides; including the Town's sewer system.

In FY2016-17, the municipal budget totaled \$17.8 million; the School budget totaled \$47.97 million, including a \$5.26 million State share. The School budget typically is about 70 percent of the overall operating budget. The capital budget, including \$275,000 in school capital, totaled 1.2 million (Town of Barrington. Certified Detailed Budget 2016-2017).

5.5 EDUCATION/OUTREACH

The Town regularly updates its website (www.barrington.ri.gov) and publishes Twitter posts (@RI_Barrington), which are displayed on the Town's website, to directly inform the public of natural hazard events, including impacts of winter storms. The Town's Twitter followers totaled almost 250 as of November 2016. Updates are handled through the Town Manager's office. Department Heads have access to the Twitter feed to post information they feel is relevant. Examples from the winter of 2016 include messages reminding the public about the Town's ordinances requiring property owners and businesses to shovel sidewalks and limiting on-street parking during the winter months.

The Town lacks a public information office, with each individual Department handling their own public information campaigns. Venues such as the Public Library's auditorium and the Bay Spring Community Center are often used for public presentations and workshops on special topics. An example is a workshop held in 2013 at the Bay Spring Community Center on options for protecting the shoreline at Latham Park / Shore Drive, attended by more than 20 people.

5.6. ASSESSMENT OF EXISTING MITIGATION ACTIONS

Barrington has taken an extremely proactive approach to hazard mitigation. Some existing actions have been in place for decades, while others have been implemented as situations change and new vulnerabilities must be addressed.

5.6.1 Building Codes

The Town's Building Official is responsible for ensuring new structures meet Building Code requirements. Before a building permit is issued for construction in the AE or VE flood zone, an elevation certificate that verifies a proposed structure meets the minimum first-floor elevation requirements, must be submitted to the Building Official. Other Building Code requirements include:

- Structures are required to be able to withstand 110-mile-per-hour winds, or a Category 2 hurricane.
- Residential and commercial structures must be designed and built to resist the effects of earthquake motions based on site-specific elements such as soil profile and ground motion.
- Bridges must be built to withstand seismic forces based on the bridge's classification and site-specific geophysical conditions.

5.6.2 Regulations and Ordinances

Regulating development in flood-prone areas is a critical component in flood hazard mitigation and is a requirement for participating in the National Flood Insurance Program, of which Barrington is a member. The Town has enacted regulatory restrictions that are designed to reduce the potential impacts of flooding to property by limiting development in and around wetlands and flood-prone areas.

- Floodplain Ordinance. The Town's floodplain ordinance (Article XXIII of the Zoning Ordinance) was last amended on June 2, 2014, representing adoption of the official Flood Insurance Rate Maps effective July 7, 2014. Article XXIII establishes Special Flood Hazard Areas – areas designated AE or VE on the FIRM panels – as a floodplain overlay district. (The Town's most recent update to the floodplain ordi-

nance prior to these amendments was on Sept. 4, 2007.)

- Wetlands Overlay District. In 1994 the Town adopted a Wetlands Overlay District Zoning Ordinance that requires a special use permit from the Zoning Board for proposed activities within the 100-foot wetland setback. The overlay ordinance also prohibits any reduction in flood storage capacity, and the storage of materials or equipment which could cause damage under flood conditions. In 2016, the Planning Board began reviewing the Town's wetland setback requirements for compliance with revisions to State law adopted in 2015 prohibiting municipalities from adopting wetland setbacks more stringent than the State's. While the local wetland setback will need to be adjusted to comply with the 2015 law, the Town's Wetland Overlay District requirements related to the floodplain were not affected.
- Land Development & Subdivision Regulations. Section 200-51: Special Flood Hazards in the Town's Land Development & Subdivision Regulations was first adopted in 1994. No revisions have been made to this section since its adoption; however, the section incorporates criteria and specifications in the State Building Code by reference, so plans must comply with the latest requirements of the Building Code.
- Stormwater Ordinance. The Town's Stormwater Bylaw (Chapter 91, Article V of the Code of Ordinance) was last updated in 2009, to incorporate State stormwater management and erosion control requirements during site development.

5.6.3 National Flood Insurance Program

Barrington continues to participate in the National Flood Insurance Program, a federal program created by Congress in 1968 that makes flood insurance available to communities that enact minimum floodplain management regulations. The Town, through its Planning Board, Conservation Commission, and Building Official all exercise a high level of regulatory control over proposed new construction and renovations in flood-prone areas.

The Town in 2014 successfully applied for a FEMA Hazard Mitigation Grant on behalf of six property owners who were seeking assistance to elevate their houses out of the flood zone. The total grant awarded came to

\$644,871; each private property owner is required to provide the minimum 25 percent match. As of November 2016, engineering plans were underway for three of the houses. Two of the property owners who were awarded an elevation grant withdrew from the grant program.

Similar grant opportunities are likely to become available in the future. The Town has more than 1,000 residential and commercial structures in the flood zone. As shown in Table 4.14 (page 40), as of April 2016, there were 1,192 flood insurance policies in effect, totaling insurance in force of over \$350,000,000. There are approximately 14 repetitive loss properties in town, of which two have been mitigated, according to the RI Emergency Management Agency (not including properties to be elevated using the 2014 FEMA grant).

The Town has consistently taken the required steps, and will continue to do so, to participate in the federally-backed flood insurance program, including adoption of the latest Flood Insurance Rate Maps and enforcement of flood-plain management ordinances to reduce future flood damage.

5.6.4 Protection and Restoration of Coastline

Barrington regularly works with the State and conservation organizations such as the Barrington Land Conservation Trust and Save the Bay to restore degraded wetlands in critical areas, which helps reduce the risk of damages from flooding events.

- In 2006 a significant wetland restoration project (\$760,000) was completed that restored approximately 11 acres of degraded coastal wetlands at the mouth of Allin's Cove. This project was also critical for halting erosion of the shoreline along Byway Road, which had the potential to undermine the structural integrity of the road. Efforts to address erosion along the Byway Road shoreline are ongoing. The installation in 2013 of sand-filled coir envelopes provided a base for establishing vegetation needed to stabilize the slope. This area is susceptible to damage from wave action, such that the area requires periodic monitoring and repair. The Land Trust has worked with the Town to maintain the area, including controlling invasive Phragmites. The Town has worked on shoreline projects in other

coastal areas as well. At Latham Park and Barrington Beach, the Town completed projects intended to restore coastal protection features, reduce potential structural flood damage, stabilize shorelines, and enhance public access.

- Improvements at Town Beach (**Figure 5.2**) have taken place in two phases. In 2011, the Town built a new beach house with restrooms and office space, replacing a 1950s cinderblock restroom building that was located within the VE zone. The new building is built on piles and set back from the shoreline to meet elevation requirements. The second phase consisting of site improvements was completed in 2014, including the removal of excess asphalt, which allowed the shifting of the parking lot away from the bay by 10 to 12 feet. Bioretention swales were built to capture and treat storm-water from adjacent streets, as well as reduce beach erosion. About 20 parking spaces at the west end of the parking lot were eliminated to allow asphalt removal within an area most vulnerable to impacts from storms and flooding. Where asphalt was removed, creating additional beach area, beach grass was planted in an effort to establish new vegetation and, over time, protective dunes.
- The Latham Park project was completed in summer 2014. It included repairs to the existing revetment protecting the shoreline along Bullock Cove, with additional public access provided to the water. Re-

configuration of the parking lot shifted pavement away from the water's edge, allowing for additional plantings, storm-water retention, and a new public walkway with benches in the park adjacent to the revetment.

Other recent/ongoing protection and restoration projects include:

- Walker Farm marsh restoration. In 2005, restoration of the Walker Farm marsh was completed, increasing the size of the marsh to 15 acres and addressing problems on the site from historic alterations, including roads and dam structures. This property separates Route 103/114 from the Barrington River and 100-Acre Cove, and is vital for storing flood waters.
- Mussachuck Creek. In 2007 restoration work was completed along Mussachuck Creek, restoring the tidal flow and aquatic system after sand buildup restricted the inlet.
- The former "Vitulo Farm" site on Wampanoag Trail. The Town has a plan to adjust the gravel driveway and parking area to allow more area to accommodate the northerly expansion of coastal wetland.
- RISD marsh. Save the Bay has been working with RISD to improve the health of coastal marsh areas at Tillinghast Estate off Nayatt Road by improving on-site drainage.

Figure 5.2: Reconstruction of the Town Beach Parking Lot, 2012-14



5.6.5 Acquisition of Freshwater/Inland Wetlands

To reduce the potential impacts to structures and property due to flooding associated with hurricanes and heavy rains, Barrington has worked to protect and acquire wetlands, which serve as a natural buffer and storage area for flood waters. The most recent major acquisitions of property containing significant wetland areas took place in the early 2000s. These sites are:

- The “Brickyard Wetlands,” a 10-acre site between the Bayside YMCA and the Barrington Shopping Center acquired in 2001. Almost the entire site is within the AE 12 flood zone, and more than half contains wetlands.
- The 21.5-acre former Vitullo Farm (2003) on Wampanoag Trail, more than half of which is in the 100-year floodplain (AE 9 zone); the site also has wetland areas within the interior.

5.6.6 Bridge Projects

The State in 2016 opened the newly replaced Central Bridge, which carries Massasoit Avenue across the Barrington River. RIDOT, in response to local concerns from the Harbormaster and Fire Department regarding the impact of rising sea levels on boat clearance, re-engineered the bridge to add two feet to the height.

Other bridge projects in Barrington are the planned replacement of the East Bay Bike Path bridges that cross the Barrington and Warren rivers. Construction, estimated at \$9.61 million, is scheduled for 2025 in the RI Transportation Improvement Program adopted in September 2016 and amended Nov. 30, 2016 (covering FFY 2017-2025). The land to either side of both bridges is within the AE flood zone. As noted earlier, the Town in 2017 asked the State to evaluate the condition of the bridges to determine if replacement should be expedited.

5.6.7 Location of Emergency Centers and Town Facilities

In 2000 the Public Safety Building, housing both the Police and Fire Departments, was built at 100 Federal Road, an area outside of the 100-year Flood Zone and beyond the surge inundation areas for Category 1 and 2 hurricanes. This action allowed the Town to demolish the old

police station, which was at risk of flooding due to its location in the 100-year Flood Zone near the Barrington River. The old police station site has been redeveloped as a park (Police Cove Park), which was completed in 2016.

All other municipal operations facilities – Town Hall, the Department of Public Works, and the Public Library – are located outside of the 100-year Flood Zone and surge inundation areas for Category 1 and 2 hurricanes. With only one hurricane-approved shelter, Primrose Hill Elementary School, the Town has signed agreements with the City of East Providence, and the Towns of Seekonk and Rehoboth, Massachusetts, which allow Barrington residents to use the hurricane shelters in those communities in the event of a Category 3 or greater hurricane.

5.6.8 Maintenance and Repair Program

Successful hazard mitigation is an ongoing process with many actions requiring regular maintenance and repair. The Town aggressively engages in maintenance and repair measures which help to ensure the safety of residents and mitigate impacts from natural hazards.

On an ongoing basis, the Department of Public Works conducts maintenance and repairs to the Town’s infrastructure including streets and sidewalks, the storm drainage system, and the sanitary sewer system. Additionally, the DPW oversees a regular tree trimming program which has significantly helped to reduce damage to utilities and property during storm events. Further, to mitigate winter hazards, the Town uses its own equipment and personnel for snow removal and disposal.

5.6.9 Public Outreach

To better prepare community members and reinforce individual pro-active hazard mitigation measures, the Town continues to improve its outreach and education programming efforts as described below.

- **Town Website Upgrades and Updates.** To educate the public about natural disasters and mitigation measures, the Town is maintaining a web-based program of education, including the vital flood mitigation information on the Town website. The FEMA Flood Insurance Rate Maps and the Floodplain Mapping Tool are available on the “Maps” page: <http://>

Table 5.1: 2010 Mitigation Plan Actions and Status

Action #	Action Title	2017 Status
1A	Acquire Open Space	Continued - Incorporated into Several Actions
1B	Establish a Wetland/ Coastal Velocity Overlay Zone	Continued
1C	Improve GIS Capabilities	Continued as Action NH-1I
2A	Remove Hazardous Tree Limbs	Maintenance Capability
2B	Regular Tree Trimming Program	Maintenance Capability
2C	Relocate Police Station	Completed
2D	Close Endangered Space Before Storm	Capability
2E	Protect Personal Property and Transportation Infrastructure	Integrated into Action NH-1B
3A	Signage	Continued as Action NH-4A
3B	Public Outreach	Continued as Actions NH-4B and NH-4C
3C	Public Notification	Completed
4A	Repair and Maintain Coastal Areas	Projects Completed. Incorporated into Several Actions
5A	Debris Management	Capability
5B	Coastal Damage Assessment and Recovery	Capability

www.barrington.ri.gov/Maps/index.php. The flood-plain mapping pages were added to the Town website as part of the 2014 redesign of www.barrington.org. The website has been used for rotating informational pages on flood mitigation matters including: the publication of the 2017 HMP Update; proposed, and adopted copies of changes to the Wetland Rules and Regulations; proposed and adopted changes to the Subdivision Rules and Regulations; informational materials on the impacts of floods and flooding; sea level rise reports; Elevation Grant program information; and storm ready activities. All of this information is also available in hard copy at the Town library.

- Flood Zone Information Added to GIS Mapping Available On-Line.** The FIRM maps were added in 2015 as a layer to the on-line GIS mapping hosted and maintained by Main Street Maps. Users of the on-line GIS system can zoom in on their property and view where flood zones are located in approximate relation to the property lines and building footprints. The flood zone information is beneficial to residents, potential home buyers, insurance agencies, and lenders. The Town's GIS map can be accessed by the public through the following link: <http://www.mainstreetmaps.com/ri/barrington/public.asp>
- CodeRED Promoted on Town Website.** A critical tool initiated in 2010 and administered by the Barrington Fire and Police Chiefs, is the CodeREDTM Emergency Notification System which facilitates more rapid citizen notification and warning in advance of or during

a disaster. The alert system sends out a pre-recorded message to homes, cell phones, and emails of occupants in hazard areas alerting them to situations that could impact their safety. The Town website provides a link to CodeRED on the main page, in the highly visible "Quick Links" section.

- Provision of Flood Hazard Information.** The Town provides information and encourages residents to purchase flood insurance policies. Letters are sent out each year to real estate offices, insurance agencies, and mortgage companies with information concerning this service.

5.6.10 2010 Mitigation Actions Review

The Hazard Mitigation Committee conducted a review of the 2010 Mitigation Actions to determine their status and validity for inclusion in this update. They assessed the 2010 actions with regard to changes in the community that have occurred over the past several years and compatibility with the Town's updated 2017 Hazard Mitigation Goals. **Table 5.1** summarizes the outcome of the review process for the 14 actions included in the 2010 Plan. Those actions that were completed or determined to be no longer applicable, given the Town's hazard mitigation goals, have been eliminated from the HMP in the 2017 Update. Actions that the Committee determined to have continued relevance have been incorporated in this HMP (see the "2017 Status" column for a description of how these 2010 actions have been carried forward).

6 Mitigation Strategy

The core of hazard mitigation plans is the mitigation strategy, serving “as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how the community will accomplish the overall purpose, or mission, of the planning process” (FEMA. Local Mitigation Planning Handbook, 6-1).

This Mitigation Strategy is comprised of three main components (Figure 6.1): Mitigation Goals, Mitigation Actions, and an Action Plan, as described below.

- **Goals** – General guidelines explaining what the plan proposes to achieve. These are usually broad statements with long-term applicability.
- **Actions** – Specific projects for achieving the goals. (Mitigation Actions can be found in the Action Plan.)
- **Action Plan** – A plan for implementing the mitigation actions. The Action Plan establishes priorities, assigns responsible parties, and defines the type of action (capitol, program, regulation, or policy), potential funding sources, and timeframe for completion.

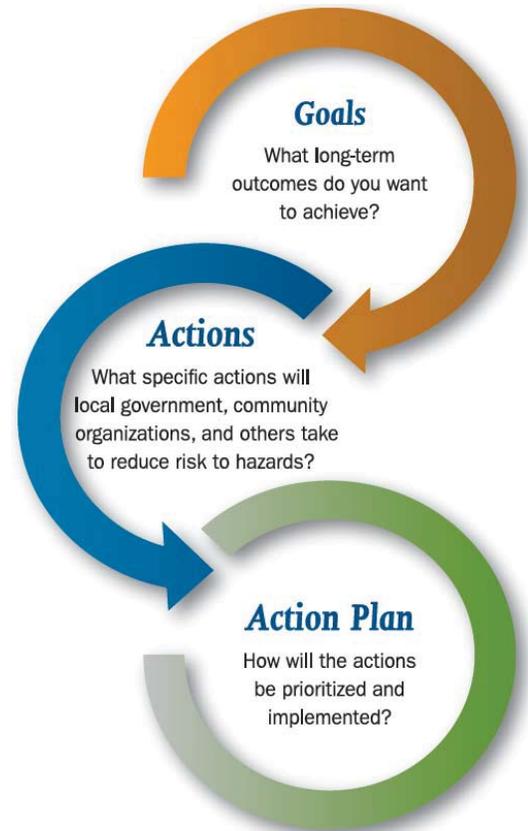
6.1 MISSION STATEMENT

The Mitigation Strategy, as detailed in this section, is built around this Plan’s Mission Statement:

Reduce Barrington’s vulnerability to impacts of natural hazards through sustainable, cost-effective measures that limit risk and reduce potential loss from hazard events, including safeguarding against the increased threats from climate change and sea level rise.

Through the commitment of state and local government and its policymakers, Barrington is striving to become a disaster resistant community and achieve sustainable development by mitigating hazard impacts before disas-

Figure 6.1: Mitigation Strategy Components



Source: FEMA Local Hazard Mitigation Planning Handbook, March 2013, Page 6-1

ter strikes and by restricting the infringement on sensitive lands.

Barrington is becoming a safer and more resilient community through the implementation of mitigation programs and policies. The Town implements and institutionalizes hazard mitigation through its human, legal and fiscal resources; the effectiveness of intergovernmental coordination and communication; and the knowledge and tools at hand to analyze and cope with hazard risks and the outcomes of mitigation planning.

The Mitigation Strategy consists of a coordinated, consistent set of goals for reducing or minimizing: human and property loss; major economic disruption, and the degradation of ecosystems and environmentally critical habitats

from natural and technological disasters by integrating policy and action across functional areas and working with the citizenry to maintain the delicate balance with nature.

6.2 MITIGATION GOALS, OBJECTIVES, POLICIES, AND ACTIONS

The Mitigation Strategy consists of Goals, Objectives, Policies, and Actions, described in detail in the Mitigation Action Plan and defined below.

- *Goals* are broad statements describing a desired outcome.
- *Objectives* identify measurable outcomes to be attained within a specified timeframe. Not all goals have measurable objectives.
- *Policies* are statements providing guidance so that future decisions are made in support of a goal.
- *Actions* are specified acts that, when implemented, help Barrington achieve or move closer to achieving a goal.

In order to ensure consistency with the Town’s Comprehensive Community Plan, the Hazard Mitigation Committee adopted the following goals from the 2015 Comprehensive Plan Natural Hazards element as the goals of the Mitigation Strategy:

Goal 1: Reduce current and future risk of natural hazards and sea level rise to the built environment.

Goal 2: Preserve and enhance the capacity of the natural environment to improve Barrington’s resilience against impacts of natural hazards.

Goal 3: Reduce flood risk and the cost of flood insurance within Barrington.

Goal 4: Improve the community’s awareness of threats to minimize risk to the public due to natural hazards.

6.3 DEVELOPMENT OF ACTION PLAN

Based on a comprehensive review of the Town’s natural hazard risks and vulnerabilities; input from the public and Town Officials; completion of a Capability Assessment; and a review of the 2010 Hazard Mitigation Plan, the Haz-

ard Mitigation Committee selected mitigation actions to incorporate into the 2017 Hazard Mitigation Plan.

These actions support the Mission Statement and Mitigation Goals. They reflect updated priorities, including response to climate change and accelerated sea level rise, and have been realigned and modified to address the Town’s current goals. The Mitigation Actions are described within the Action Plan and organized under the Mitigation Goal the action supports. The actions, identified for implementation during the 5-year span covered by this Plan, will continually be assessed and evaluated for relevance over time.

The Mitigation Strategy includes a mix of mitigation actions and non-mitigation actions, such as a study that evaluates risk of projected increases in sea level rise to the Town’s critical assets.

6.3.1 Actions – Prioritization

Flooding and wind-related damage remain the most prevalent threats to the Town, with the coastal areas the most vulnerable, due to the risk of coastal flooding, damage from wave action and wind, and shoreline erosion. These risks will only worsen with projected sea level rise and other predicted impacts of climate change.

In the process of preparing this Update, the Town has continued to review past and ongoing actions to determine their relevance in the future. Several of the non-completed hazard mitigation actions from 2010 were carried over in-part or intact for consideration in the 2017 Plan. Additional actions, which support the Town’s current goals, also

Figure 6.2: Partners Involved in Plan Implementation

<p>Partners Involved in Hazard Mitigation Activities</p> <ul style="list-style-type: none"> Building Official/Zoning Official Emergency Management Public Safety (Police & Fire) Harbormaster Planning Office Public Works Recreation Department Senior Services State Emergency Management Office <p>Partners with Authority to Regulate Development</p> <ul style="list-style-type: none"> Conservation Commission (advisory) Planning Board Town Council Zoning Board of Review

were considered. The 2017 Plan reflects updated priorities, including response to climate change and accelerated sea level rise. Actions were realigned and modified to address the Town’s 2017 Hazard Mitigation Goals.

Due to budgetary and other constraints it is impossible to implement all of mitigation actions considered. In accord with the Disaster Mitigation Act 2000 (DMA), the Hazard Mitigation Committee undertook a prioritization process to select and prioritize actions for implementation in order to develop a realistic approach toward mitigating risks. Each of the actions considered received a priority score of “High,” “Medium” or “Low” based upon a general set of criterion common to public administration officials and planners, known as STAPLEE. The acronym stands for Social, Technical, Administrative, Political, Legal, Economic, and Environmental. A description of the criterion and the Town’s STAPLEE evaluation of potential Mitigation Strategy actions can be found in **Appendix 7**.

6.3.2 Actions – Other Descriptors

In addition to Priority Levels, the Action Plan includes the following descriptors:

- **Cost and Funding Sources.** Estimated costs and potential funding sources are provided, based on the Committee’s analysis of similar initiatives completed in Town and elsewhere.

Costs are shown as follows:

- ◇ Staff Time / Negligible Cost
- ◇ \$: Up to \$25,000
- ◇ \$\$: \$25,000 to \$100,000
- ◇ \$\$\$: \$100,000 to \$250,000
- ◇ \$\$\$\$: \$250,000+ (bond or multi-year appropriation likely required)

- **Timeframe.** The Hazard Mitigation Committee created an expected timeframe for implementation of each action. Factors used to determine the timeframe for specific actions include priority level scores, cost/budget implications, and whether an action is mandated. Timeframes are categorized as follows:

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

- **Lead.** The proposed lead Department/Agency/Individual responsible for implementation of an ac-

tion. (**Figure 6.2**, previous page, lists the parties involved in implementing the Action Plan.)

- **Action Type.** Types of implementation actions fall into four general categories:
 - ◇ *Capital:* Projects requiring significant investment from Town, State and/or Federal funding sources, such as major infrastructure projects or property acquisition.
 - ◇ *Program:* Actions involving more planning to implement, such as an analysis of infrastructure threatened by sea level rise.
 - ◇ *Regulation:* Actions relating to projects involving Town regulations – such as amendments to the Zoning Ordinance and/or Subdivision & Land Development Regulations.
 - ◇ *Policy:* Actions involving the adoption of local ordinances and policies—such as an agreement with adjacent municipalities on access to emergency shelters.

6.3.3 Actions Supporting Community Rating System Activities

The most common and the most destructive natural disaster in the United States is floods, the damage from which is not covered under a standard homeowner’s policy. To protect lives and property and to reduce the financial burden of providing disaster assistance, in 1968, Congress created the National Flood Insurance Program (NFIP) which is administered by the Federal Emergency Management Agency (FEMA). The NFIP offers flood insurance to communities that comply with minimum standards for floodplain management. All Rhode Island municipalities comply with the minimum standards allowing residents to purchase federal flood insurance through the NFIP.

Beyond the minimum participatory requirements, communities can choose to undertake additional public information and floodplain management activities to achieve discounts on flood insurance premiums ranging from 5% (rate class 9) up to 45% (rate class 1) (FEMA. National Flood). It is a Goal of Barrington to participate in the Community Rating System (CRS) program and achieve a rate class 7 (15% discount) or better by 2020. In the Action Plan, items which support CRS Activities have been denoted as the Town intends to aggressively pursue these initiatives.

6.4 ACTION PLAN: 2017 BARRINGTON HAZARD MITIGATION PLAN

Goal 1: Reduce current and future risk of natural hazards and sea level rise to the built environment.

Objective 1.1: By 2018 complete a town-wide assessment of the potential impacts to structures and infrastructure resulting from projected sea-level rise.

Policy 1.1.1: Consider the effects of projected sea level rise and flooding in the site selection and planning of parks, buildings, and other public projects.

Policy 1.1.2: Reduce impact of development within the floodplain and other vulnerable areas.

Action 1.A—Complete community-wide storm surge and sea level rise impact assessment. Complete an assessment of potential impacts, including physical and economic, of projected sea-level rise on publicly and privately owned buildings and sites, roads, storm-water systems, sewer systems, and other utilities. The scope would involve mapping vulnerable areas, generating cost estimates and establishing project priorities. Potential available tools for the assessment include STORMTOOLS and the RI e911 Exposure Assessment (see Technical and Financial Assistance Resources on Page 83). In addition, the Town will work with institutions, such as the Coastal Institute at the University of Rhode Island, to identify resources to model economic impacts. **Figure 6.3** is a photo taken of a sea level site assessment conducted in May 2017 as part of the Climate Response Demonstration Site project led by URI's Coastal Institute and others. Information from this initiative will be used when the Town conducts this more detailed community-wide assessment.

Priority:	High
Cost:	\$\$
Funding Sources	Town, Grants
Timeframe:	Short-term
Lead:	Public Works, Town Planner
Action Type:	Program

Figure 6.3: Coastal Response Demonstration Site Sea Level Rise Assessment—Allin’s Cove, April 2017



Action 1.B—Complete infrastructure projects in order to protect critical assets. Include in the six-year capital improvement program and work with the State to include in the Transportation Improvement Program critical short-term and long-term projects required to mitigate threats to infrastructure and properties. Priority projects to be identified in the SLR assessment (Action 1.A). Potential projects include the following, as well as those presented by Save the Bay and included in Appendix 7:

- Inspect and secure seawalls / revetments on public property in order to protect infrastructure. Priority areas include Mathewson Road, Shore Drive/Latham Park and Police Cove Park.
- Enhanced protection of pump stations in vulnerable areas (shut off, flood-proofing, emergency pumping).
- Improvements to State roads threatened by SLR—including Wampanoag Trail and Sowams Road (in the vicinity of the Bike Path bridge) — to the roadway and/or drainage, in response to long-term threat of sea level rise inundating the roadway at high tide.
- Installation of larger culverts to accommodate larger tidal flows, such as under County Road at Prince’s Pond.

Priority:	High
Cost:	\$ to \$\$\$\$
Funding Sources	RIDOT, Town CIP, Grants

Timeframe: Short-, Mid-, and Long-term
Lead: Planning Bd., Town Planner
Action Type: Capital

Action 1.C—Revise regulations to reduce future risk of natural hazards. Revise the Town’s Zoning Ordinance and Land Development and Subdivision Regulations to lessen encroachment of development into the existing or projected floodplain, to limit future development in the floodplain, and to reduce vulnerability of new construction to coastal flooding and storm surge due to rising sea levels. Potential revisions including allowing flexible lot sizes, such as through a cluster subdivision design, and establishing setbacks or buffers to account for sea level rise.

Priority: High
Cost: \$ to \$\$
Funding Sources Operating Budget
Timeframe: Short-term
Lead: Planning Board
Action Type: Regulation
CRS: Activities 310 and 430

Action 1.D—Publish design, site guidelines for elevation projects. Publish illustrated design guidelines to provide recommendations for designing building elevations that are compatible with the surrounding neighborhood while complying with flood elevation requirements. Include best practices to mitigate impacts of elevations that require relief from the height limit.

Priority: Medium

Figure 6.4: Construction of a Rain Garden in the Parking Lot at Latham Park—2014



Cost: \$
Funding Sources Operating Budget
Timeframe: Mid-term
Lead: Town Planner
Action Type: Program

Action 1.E—Adopt LID standards to reduce amount of impervious surfaces within new subdivisions and other private development projects. Adopt low-impact development standards to reduce the amount of impervious coverage, such as reduced street widths and a maximum impervious lot coverage percentage. This action would require revisions to the Town’s Land Development & Subdivision Regulations.

Priority: High
Cost: Negligible
Funding Sources Operating Budget
Timeframe: Short-term
Lead: Planning Board, Town Planner, Solicitor
Action Type: Regulation

Action 1.F—Improve stormwater facilities at public facilities. Provide measures to improve stormwater retention in the planning and design of park improvements and construction of schools and other new public buildings. An example is Phase 1 improvements at Latham Park, where a rain garden was installed in a parking lot after pavement was removed (**Figure 6.4**). Retrofit existing facilities to include improved stormwater facilities when lots need to be repaved or rebuilt. Priority sites include Latham Park (southern portion of site), where coastal flooding and erosion will worsen over time; and flood zone areas on the grounds of the High School.

Priority: High
Cost: \$\$
Funding Sources Capital, School Budget
Timeframe: Short-term to Long-term
Lead: Public Works, Town Planner, Planning Board
Action Type: Capital
CRS: Activity 450

Action 1.G—Improve GIS capabilities, including enhancements to the Town’s web-based mapping program, to help users identify flood risk throughout town. Improve Geographic Information Systems (GIS)

Figure 6.5: Example—Adaptation Project—Byway Road Shoreline Stabilization Project



Photo Credit: Save the Bay

capabilities to support property tax revaluations, planning, Department of Public Works activities (including drainage system maintenance plan), and floodplain mapping and flood data for impacted properties.

Priority:	Medium
Cost:	\$
Funding Sources	Capital Budget
Timeframe:	Short- to Long-term
Lead:	Public Works
Action Type:	Program
CRS:	Activities 410, 440, and 540

Goal 2: Preserve and enhance the capacity of the natural environment to improve Barrington’s resilience against impacts of natural hazards.

Policy 2.1.1: Identify and protect critical open space areas that are vulnerable to natural hazards and sea level rise.

Policy 2.1.2 Plan and implement projects that allow natural systems to adapt over time to changes in sea level rise and the climate.

Action 2.A—Prioritize and complete Coastal adaptation projects. Prioritize and implement coastal adaptation projects, working with Save the Bay, the State, and other stakeholders, to reduce flood risk and the potential damage to vulnerable infrastructure and allow the expansion of wetlands (for example, **Figure**

6.5). Implement slope stabilization efforts, such as planting brigades in spring, where appropriate. Save the Bay’s presentation on potential projects (Appendix 7) identifies potential projects, including:

- Retrofit municipal and school paved parking areas and ends of streets (such as Belvedere Avenue) in low-lying areas that have excessive pavement (to include drainage, reduce pavement, etc.).
- Allow for salt marsh to become re-established north of the Walker Farm boat ramp.
- Cut back pavement at end of Woodbine Avenue; consider relocating drainage outfall.
- Provide for stormwater infiltration at edge of Bourne Lane.
- Develop plan to allow for marsh migration within low-lying areas at Latham Park.

Priority:	High
Cost:	\$ to \$\$\$\$
Funding Sources	Capital Budget, RIDEM grants
Timeframe:	Short- to Long-term
Lead:	Public Works, Town Planner
Action Type:	Program, Capital

Action 2.B— Implement tree management program. Implement a tree management program to reduce risk to property due to winds, heavy snow/ice, or other natural hazard impacts, to include:

- Identification of native tree species that will

be most resilient to climate change and use these species in public projects.

- Requiring resilient tree species in new subdivisions and land development projects.

Priority: Medium
Cost: \$
Funding Sources Operating Budget
Timeframe: Mid-term
Lead: Public Works
Action Type: Policy

Action 2.C—Complete hydrology studies. Complete hydrology study that includes: inventory of ponds on private and public property; assessment of streams, and condition of and impacts of dams; and prioritization of projects needed to maintain/improve water flow.

Priority: High
Cost: \$\$
Funding Sources Capital Budget, RIDEM grants
Timeframe: Short-term
Lead: Public Works, Town Planner
Action Type: Program

Action 2.D—Develop and complete projects identified in Walker Farm saltmarsh restoration plan. Develop plan to allow restoration of natural areas at

Walker Farm (**Figure 6.6**). Identify potential new locations for yard waste storage area to clear area for marsh migration and prepare for potential inundation from sea level rise.

Priority: Medium
Cost: \$
Funding Sources Capital Budget, RIDEM, EPA
Timeframe: Mid-term
Lead: Public Works, Conservation Commission
Action Type: Program

Action 2.E—Protect vulnerable areas from development through acquisition, easements and other mechanisms. Work with the local Land Trust and other stakeholders to identify and protect from development low-lying land vulnerable to impacts from flooding and sea level rise, and areas adjacent to coastal wetlands susceptible to increased inundation due to sea level rise. This Action also will encourage landward migration of other coastal habitats, such as estuarine beaches and dunes, as these features must be allowed to migrate in response to sea-level rise in order to continue to provide some level of natural storm protection. Take advantage of funding opportunities such as DEM open space acquisition grants, and other mechanisms, including conservation easements, to permanently protect these areas. Develop priority list of sites based on open space acquisition evaluation

Figure 6.6: Walker Farm (on the Barrington River)



criteria in Comprehensive Plan, in coordination with Land Trust.

Priority: High
Cost: \$\$ to \$\$\$\$
Funding Sources Capital Budget, Bond, RIDEM grants
Timeframe: Short- to Long-term
Lead: Town Council, Town Manager, Land Trust
Action Type: Capital
CRS: Activities 420, 520, and 530

Goal 3: Reduce flood risk and the cost of flood insurance within Barrington.

Objective 3.1: Achieve a Community Rating System (CRS) score of “7” or better by 2020.

Policy 3.1.1: Participate in the Community Rating System and provide resources necessary to run an effective program that reduces future risk and results in a CRS score of 7 or better.

Policy 3.1.2: Maintain a FEMA-approved Hazard Mitigation Plan that is based on the latest data and proposes strategies on natural hazards and climate change.

Action 3.A: - Complete steps to enroll in Community Rating System. Complete steps required to enroll in the CRS, with an initial target rating of 8. Complete actions as necessary to improve the CRS score and improve the Town’s floodplain programs.

Priority: High
Cost: \$
Funding Sources Operating Budget
Timeframe: Short- to Long-term
Lead: Town Planner
Action Type: Program
CRS: Activity General

Action 3.B— Engage/provide training for Certified Flood Manager. Engage a consultant or provide staff training for a certified floodplain manager to coordinate implementation of Community Rating System activities and implementation of the Town’s Hazard Mitigation Plan.

Priority: High
Cost: \$
Funding Sources Operating Budget
Timeframe: Short-term
Lead: Building Official
Action Type: Policy
CRS: Activity General

Action 3.C—Develop and enact tracking system to monitor HMP implementation progress, with updates on a semi-annual basis. Develop a tracking system to monitor progress implementing the Hazard Mitigation Strategy, updated by lead department/agency/organization team to include budget status, staffing assignments and other relevant information. This update will include status reports on activities resulting in CRS credit including floodplain management planning.

Priority: High
Cost: Staff Time
Funding Sources Operating Budget
Timeframe: Short-term
Lead: Town Planner
Action Type: Policy
CRS: Activity 510 and General

Action 3.D—Work with property owners to mitigate properties in areas at risk of flooding, including acquisition and elevation projects. The Town will provide the staffing resources needed to identify and apply for outside funding sources, such as the Hazard Mitigation Grant, to elevate or relocate structures out of the floodplain, and acquire property within the floodplain. This effort also will include pursuing opportunities to acquire upland areas to relocate residences if the option of retreat is selected. The Town will consider putting in place mechanisms such as tax incentives to encourage property owners to adopt resilience measures (elevation, retreat landward, etc.).

Priority: High
Cost: Staff Time
Funding Sources Operating Budget
Timeframe: Short- to Long-Term
Lead: Town Planner
Action Type: Policy

Goal 4: Improve the community’s awareness of threats to minimize risk to the public due to natural hazards.

Policy 4.1.1: Inform the public on the concept of community resilience and the risk of impacts from natural hazards, with an emphasis on stream and coastal flooding, including storm surge, and winter storms.

Action 4.A—Initiate program such as “High Water Mark” initiative to increase public awareness of flooding risk and potential future high tide levels from sea level rise. Develop and implement an outreach program consistent with the National Flood Insurance Program’s High Water Mark initiative (Figure 6.7), to include creating and posting informational signs and markers at public properties (such as Latham Park, Police Cove Park, and the Bay Spring Community Center) showing images of flood damage and high water marks based on historic flood levels. The initial focus will be the hurricanes of 1938 and 1954. Provide markers showing elevations based on projected increases in sea level. Commission and install public art in public spaces near coastal waters that illustrate these high water marks. Work with RIDOT to mark projected sea level rise on bridges.

Priority: Medium
Cost: \$
Funding Sources Capital Budget
Timeframe: Mid-term

Lead: Town Planner, Public Works
Action Type: Capital

Action 4.B—Conduct community outreach to increase awareness and improve preparedness for impacts of natural hazards. Conduct community outreach, including public forums, publication/posting of information at Town facilities and the website, and mailings, on natural hazard mitigation initiatives, preparedness and response. Program should include:

- Preparedness for emergency situations, especially during hurricane season.
- Training prior to and/or during hurricane season for volunteers to work as shelter workers.
- Public workshops and publications on threats of natural hazards, including impacts of flooding and long-term sea level rise projections.
- Publicity of spaces (shelters, “warming centers,” etc.) available to the public in times of power outages, loss of heat, and other secondary impacts resulting from natural hazards.
- Dissemination of information on opportunities property owners can take to mitigate future impacts; include “how-to” sessions on mitigation activities including house elevation projects.
- Distribution of brochures (including those on CRS and Flood Insurance) and other information.
- Distribution of information for real estate agents on flood prone areas, etc. that can be passed onto potential purchasers.

Figure 6.7: Examples of High Water Mark signs – New Jersey and Oregon



Photo Credit: FEMA, US Army Corps of Engineers

- Communication to the public on water restrictions, as applicable, during drought conditions; consider direct mailing of information to residents/property owners who rely on well water.
- Alerts posted on the website/social media, etc. about impacts from ice due to winter storms, including risks associated with ice dams on houses.
- Utilization of text messaging to communicate with the public prior to, during and after natural hazard events that impact or threaten to impact the town.

Priority: High
Cost: Staff Time/Negligible
Funding Sources Operating Budget
Timeframe: Short- to Long-term
Lead: Public Works
Action Type: Policy
CRS: Activities 330, 340, 350, and 360

Action 4.C—Establish process to inform vulnerable populations about procedures in place before and after a natural hazard event. The Town will establish a process to expeditiously contact special populations, focusing on those who are particularly vulnerable, due to location or age or infirmity, to ensure their understanding of procedures immediately before and after an event.

Priority: High
Cost: Staff Time
Funding Sources Operating Budget
Timeframe: Short- to Long-term
Lead: Town Manager
Action Type: Policy

7 Implementation and Maintenance

7.1 IMPLEMENTATION

The Town has completed a lengthy community-based process to update the Hazard Mitigation Plan in an effort to enable the community to proactively address natural hazards. In confirming the completeness of this document, the Hazard Mitigation Committee utilized FEMA's Local Mitigation Plan Review Guide and Tool (**Appendix 8**). The success of the Plan lies in the ability to effectively implement and maintain the mitigation actions. In doing so, Barrington will continue building a resilient community; one in which critical lifeline systems, including roads, utilities, infrastructure, and other support facilities, will function in the midst of natural hazards, helping to ensure the safety of the community.

The mitigation action descriptions provide a clear course for the actions to be incorporated into departmental and committee based work plans and budget, pursuant to staff and funding availability. Initiating the actions will attempt to follow the timeline as set forth in **Tables 7.1-7.5**, with the recognition that modifications may be necessary dependent upon available funding and capacity of staff to complete assigned tasks.

The implementation of the actions is intended to be flexible with the expectation that the timeframe may be adjusted in the coming years and responsibilities may shift from one party to another, or become a shared responsibility.

Once the 2017 Hazard Mitigation Plan Update receives FEMA's 'Approved Pending Adoption', the Town Council will adopt the Plan and coordination and implementation will be handled accordingly.

The Implementation Plan on the following pages is organized as follows:

- Table 7.1: Implementation Schedule: Initiate the Following Actions in FY 2017-2018
- Table 7.2: Implementation Schedule: Initiate the Following Actions in FY 2018-19

- Table 7.3: Implementation Schedule: Initiate the Following Actions in FY 2019-20
- Table 7.4: Implementation Schedule: Initiate the Following Actions in FY 2020-21
- Table 7.6: Implementation Schedule: Initiate the Following Actions in FY 2021-22

7.2 EVALUATION AND MONITORING

Success of the Hazard Mitigation plan will be measured by the degree to which actions are implemented and maintained.

The Hazard Mitigation Committee will meet semi-annually to review progress on implementation of the Hazard Mitigation Plan and activities resulting in CRS credit. Additionally, the Committee will conduct a review of the Plan on an annual basis to establish action items and funding priorities for each year to align with the budget process. During the annual review, evaluation of the risk assessment, goals, and actions will be conducted and modified as necessary, and new actions will be considered. The Planning Office will take the lead in this effort.

As future sea level rise may have a significant impact on the extent of damage caused by flooding and storms, the Committee will assess, at a minimum of 10-year intervals, the need for changes in the flood and storm surge maps and implement those changes as available technology permits.

For the Plan to be effective and relevant over time, continued community involvement will be essential. All Committee meetings will be open to the public and outreach programs will encourage community feedback. Barrington residents, as well as officials and residents from neighboring communities, will be encouraged to participate in the process through advertised meetings and events.

Additionally, the public will have access to the Plan via the Town's web site <http://www.barrington.ri.gov>, where updates to the Plan as well as other hazard mitigation information is posted.

7.3 REVISION

The Hazard Mitigation Plan is a dynamic document and over the 5-year implementation period associated with this Update, as actions are completed or modified or new tasks undertaken, the Plan will be revised accordingly.

The Hazard Mitigation Committee will, at a minimum, meet annually to ensure progress is being made and the Plan remains current. The public will be included in this process and once the public education and outreach actions begin, it is the hope that public involvement in the Plan will increase and will be reflected in future revisions.

In addition, post a natural hazard event, the Committee will seek community input based on their experiences during and after the event and will meet to discuss the effectiveness of the Plan and revise accordingly.

In accordance with 44 CFR S 201.6(d)(3), to maintain eligibility for mitigation project grant funding, the Town's Hazard Mitigation Plan needs to be updated and resubmitted for approval within 5 years from the approval of this Plan. In order to maintain compliance, a full revision of the Plan will commence a year in advance of this Plan expiring.

Building a disaster-resistant community and achieving sustainable development, in order to mitigate hazard impacts before disaster strikes, will be the overriding factors upon which revisions to the Plan are made and incorporated into the next Update.

Building a disaster-resistant community and achieving sustainable development, in order to mitigate hazard impacts before disaster strikes, will be the overriding factors upon which revisions to the Plan are made and incorporated into the next Update.

Table 7.1: Implementation Schedule: Initiate the Following Actions in FY 2017-2018

Lead	Action Number and Description	Priority/CRS	Cost	Time-frame	Action Type
Planning Board	1.C—Revise regulations to reduce future risk of natural hazards. Revise the Town’s Zoning Ordinance and Land Development and Subdivision Regulations to lessen encroachment of development into the existing or projected floodplain, to limit future development in the floodplain, and to reduce vulnerability of new construction to coastal flooding and storm surge due to rising sea levels. Potential revisions including allowing flexible lot sizes, such as through a cluster subdivision design, and establishing setbacks or buffers to account for sea level rise.	High CRS Activities 310 and 430	Negligible Cost	Short-term	Regulation
Planning Board, Town Planner	1.E—Adopt LID standards to reduce amount of impervious surfaces within new subdivisions and other private development projects. Adopt low-impact development standards to reduce the amount of impervious coverage, such as reduced street widths and a maximum impervious lot coverage percentage. This action would require revisions to the Town’s Land Development & Subdivision Regulations.	High	Negligible	Short-term	Regulation
Public Works	1.G—Improve GIS capabilities, including enhancements to the Town’s web-based mapping program, to help users identify flood risk throughout town. Improve Geographic Information Systems (GIS) capabilities to support property tax revaluations, planning, Department of Public Works activities (including drainage system maintenance plan), and floodplain mapping and flood data for impacted properties.	High CRS Activities 410, 440, and 540	\$	Short-to Long-term	Program
Town Planner	3.A - Complete steps to enroll in Community Rating System. Complete steps required to enroll in the CRS, with an initial target rating of 8. Complete actions as necessary to improve the CRS score and improve the Town’s floodplain programs.	High CRS Activity General	\$	Short-to Long-term	Program
Town Manager	3.C—Develop and enact tracking system to monitor HMP implementation progress, with updates on a semi-annual basis. Develop a tracking system to monitor progress implementing the Hazard Mitigation Strategy, updated by lead department/agency/organization team to include budget status, staffing assignments and other relevant information. This update will include status reports on activities resulting in CRS credit including floodplain management planning.	High CRS Activities 510 and General	No Cost	Short-term	Policy
Town Planner	3.D—Work with property owners to mitigate properties in areas at risk of flooding, including acquisition and elevation projects. The Town will provide the staffing resources needed to identify and apply for outside funding sources, such as the Hazard Mitigation Grant, to elevate or relocate structures out of the floodplain, and acquire property within the floodplain. This effort also will include pursuing opportunities to acquire upland areas to relocate residences if the option of retreat is selected. The Town will consider putting in place mechanisms such as tax incentives to encourage property owners to adopt resilience measures (elevation, retreat landward, etc.).	High	No Cost	Short-to Long-term	Policy
Public Works	4.B—Conduct community outreach to increase awareness and improve preparedness for impacts of natural hazards. Conduct community outreach, including public forums, publication/posting of information at Town facilities and the website, and mailings, on natural hazard mitigation initiatives, preparedness and response.	High CRS Activities 330, 340, 350, and 360	Negligible	Short-to Long-term	Policy

Table 7.2: Implementation Schedule: Initiate the Following Actions in FY 2018-2019

Lead	Action Number	Priority/CRS	Cost	Time-frame	Action Type
Public Works, Town Planner	1.A—Complete community-wide storm surge and sea level rise impact assessment. Complete an assessment of potential impacts, including physical and economic, of projected sea-level rise on publicly and privately owned buildings and sites, roads, storm-water systems, sewer systems, and other utilities. The scope would involve mapping vulnerable areas, generating cost estimates and establishing project priorities.	High	\$\$	Short-term	Program
Public Works, Town Planner, Planning Board	1.F—Improve stormwater facilities at public facilities. Provide measures to improve stormwater retention in the planning and design of park improvements and construction of schools and other new public buildings. An example is Phase 1 improvements at Latham Park, where a rain garden was installed in a parking lot after pavement was removed (Figure 6.4). Retrofit existing facilities to include improved stormwater facilities when lots need to be repaved or rebuilt. Priority sites include Latham Park (southern portion of site), where coastal flooding and erosion will worsen over time; and flood zone areas on the grounds of the High School.	High CRS Activity 450	\$\$	Short-term to Long-term	Capital
Town Council, Town Manager	2.E—Protect vulnerable areas from development through acquisition, easements and other mechanisms. Work with the local Land Trust and other stakeholders to identify and protect from development low-lying land vulnerable to impacts from flooding and sea level rise, and areas adjacent to coastal wetlands susceptible to increased inundation due to sea level rise. This Action also will encourage landward migration of other coastal habitats, such as estuarine beaches and dunes, as these features must be allowed to migrate in response to sea-level rise in order to continue to provide some level of natural storm protection.	High CRS Activities 420, 520, and 530	\$\$ to \$\$\$\$	Short- to Long-term	Policy
Town Planner, Building Official	3.B— Engage/provide training for Certified Flood Manager. Engage a consultant or provide staff training for a certified floodplain manager to coordinate implementation of Community Rating System activities and implementation of the Town’s Hazard Mitigation Plan.	High CRS Activity General	\$\$	Short-term	Policy
Town Manager	4.C—Establish process to inform vulnerable populations about procedures in place before and after a natural hazard event. The Town will establish a process to expeditiously contact special populations, focusing on those who are particularly vulnerable, due to location or age or infirmity, to ensure their understanding of procedures immediately before and after an event.	High	No Cost	Short- to Long-term	Policy

Table 7.3: Implementation Schedule: Initiate the Following Actions in FY 2019-20

Lead	Action Number	Priority/ CRS	Cost	Time- frame	Action Type
Planning Board, Town Planner	<p>1.B—Complete infrastructure projects in order to protect critical assets. Include in the six-year capital improvement program and work with the State to include in the Transportation Improvement Program critical short-term and long-term projects required to mitigate threats to infrastructure and properties. Priority projects to be identified in the SLR assessment (Action 1.A). Potential projects include the following, as well as those presented by Save the Bay and included in Appendix 7:</p> <ul style="list-style-type: none"> Inspect and secure seawalls / revetments on public property in order to protect infrastructure. Priority areas include Mathewson Road, Shore Drive/Latham Park and Police Cove Park. Enhanced protection of pump stations in vulnerable areas (shut off, flood-proofing, emergency pumping). Improvements to State roads threatened by SLR—including Wampanoag Trail and Sowams Road (in the vicinity of the Bike Path bridge) – to the roadway and/or drainage, in response to long-term threat of sea level rise inundating the roadway at high tide. Installation of larger culverts to accommodate larger tidal flows, such as under County Road at Prince’s Pond. 	High	\$ to \$\$\$\$	Short-, Mid-, and Long-term	Capital
Town Planner	<p>1.D—Publish design, site guidelines for elevation projects. Publish illustrated design guidelines to provide recommendations for designing building elevations that are compatible with the surrounding neighborhood while complying with flood elevation requirements. Include best practices to mitigate impacts of elevations that require relief from the height limit.</p>	High	\$	Mid-term	Program
Public Works	<p>4.A—Initiate program such as “High Water Mark” initiative to increase public awareness of flooding risk and potential future high tide levels from sea level rise. Develop and implement an outreach program consistent with the National Flood Insurance Program’s High Water Mark initiative to include creating and posting informational signs and markers at public properties (such as Latham Park, Police Cove Park, and the Bay Spring Community Center) showing images of flood damage and high water marks based on historic flood levels. The initial focus will be the hurricanes of 1938 and 1954. Provide markers showing elevations based on projected increases in sea level. Commission and install public art in public spaces near coastal waters that illustrate these high water marks. Work with RIDOT to mark projected sea level rise on bridges.</p>	Medium	\$	Mid-term	Capital

Table 7.4: Implementation Schedule: Initiate the Following Actions in FY 2020-21

Lead	Action Number	Priority/ CRS	Cost	Time- frame	Action Type
Public Works, Town Planner	2.A—Prioritize and complete Coastal adaptation projects. Prioritize and implement coastal adaptation projects, working with Save the Bay, the State, and other stakeholders, to reduce flood risk and the potential damage to vulnerable infrastructure and allow the expansion of wetlands. Implement slope stabilization efforts, such as planting brigades in spring, where appropriate. Save the Bay’s presentation on potential projects (Appendix 7) identifies potential projects, including: <ul style="list-style-type: none"> Retrofit municipal and school paved parking areas and ends of streets (such as Belvedere Avenue) in low-lying areas that have excessive pavement (to include drainage, reduce pavement, etc.). Allow for salt marsh to become re-established north of the Walker Farm boat ramp. Cut back pavement at end of Woodbine Avenue; consider relocating drainage outfall. Provide for stormwater infiltration at edge of Bourne Lane. Develop plan to allow for marsh migration within low-lying areas at Latham Park. 	High	\$ to \$\$\$\$	Short- to Long -term	Program, Capital
Public Works, Town Planner	2.C—Complete hydrology studies. Complete hydrology study that includes: inventory of ponds on private and public property; assessment of streams, and condition of and impacts of dams; and prioritization of projects needed to maintain/improve water flow.	High	\$\$	Short- term	Program

Table 7.5: Implementation Schedule: Initiate the Following Actions in FY 2021-22

Lead	Action Number	Priority/ CRS	Cost	Time- frame	Action Type
Public Works	2.B— Implement tree management program. Implement a tree management program to reduce risk to property due to winds, heavy snow/ice, or other natural hazard impacts, to include: <ul style="list-style-type: none"> Identification of tree species that will be most resilient to climate change and use these species in public projects. Requiring resilient tree species in new subdivisions and land development projects. 	Medium	\$	Mid- term	Policy
Public Works, Conservation Comm.	2.D—Develop and complete projects identified in Walker Farm salt-marsh restoration plan. Develop plan to allow restoration of natural areas at Walker Farm (Figure 6.6). Identify potential new locations for yard waste storage area to clear area for marsh migration and prepare for potential inundation from sea level rise.	Medium	\$	Mid- term	Program

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Glossary

100-Year Flood Zone – Floodplain area with a one percent annual chance flood; also referred to as the base flood or 100-year flood.

500-Year Flood Zone – Floodplain area with a 0.2 percent annual chance flood; also referred to as the 500-year flood.

Action Plan – A sequence of steps to achieve specific goals, including identification of responsible parties, resources required, and a timeline.

AE Zones– Located within the 100-year flood limits, these are areas with Base Flood Elevations (BFEs) that reflect the combined influence of stillwater flood elevations and wave effects less than 3 feet. The AE Zone generally extends from the landward VE zone limit to the limits of the 100-year flood from coastal sources, or until it reaches the confluence with riverine flood sources. The AE Zones also depict the SFHA due to riverine flood sources, but instead of being subdivided into separate zones of differing BFEs with possible wave effects added, they represent the flood profile determined by hydrologic and hydraulic investigations and have no wave effects.

American Community Survey – The framework by which the Census Bureau collects and publishes demographic, social, housing, and economic data.

Base Flood Depth (BFD) – The depth shown on the Flood Insurance Rate Map (FIRM) for Zone AO that indicates the depth of water above highest adjacent grade resulting from a flood that has a 1% chance of equaling or exceeding that level in any given year.

Base Flood Elevation (BFE) – The computed elevation to which floodwater is anticipated to rise during the base flood. BFEs are shown on Flood Insurance Rate Maps (FIRMs) and on the flood profiles. The BFE is the regulatory requirement for the elevation or flood-proofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium.

Beaufort Scale – Created in 1805, a scale still used today as a standardized scale for characterizing wind.

Bristol County Water Authority (BCWA) – A public water authority which has been operational since 1984 serving Barrington, Warren and Bristol.

Building Code – The Rhode Island State Building Code.

Built Environment – Manmade surroundings including buildings, infrastructure, parks, lawns, etc.

Climate – An area's typical or average weather.

Climate Change – A change in the typical or average weather of a region or city. This could be a change in a region's average annual rainfall, for example. Or it could be a change in a city's average temperature for a given month or season. Climate change is also a change in Earth's overall climate. This could be a change in Earth's average temperature, for example. Or it could be a change in Earth's typical precipitation patterns.

Coastal Barrier – A naturally occurring island, sandbar or other strip of land, including coastal mainland, that protects the coast from severe wave wash.

Coastal Erosion – The process of the gradual wearing away of land masses along the coast.

Coastal Flooding – Inundation of areas along the coast resulting from storm surge, wave action.

Coastal High Hazard Areas – Special Flood Hazard Areas (SFHAs) along the coasts that have additional hazards due to wind and wave action. These areas are identified on Flood Insurance Rate Maps (FIRMs) as zones V, V1-V30 and VE.

Coastal Resources Management Council (CRMC) – The Coastal Resources Management Council is a State of Rhode Island management agency with regulatory functions. Its primary responsibility is for the preservation, protection, development and where possible the restoration of the coastal areas of the state via the implementation of its integrated and comprehensive coastal management plans and the issuance of permits for work with the coastal zone of the state.

Community Assets – The people, structures, facilities, and systems that have value to the community.

Community Rating System (CRS) – A program developed by FEMA to provide incentives for those communities in the Regular Program that have gone beyond the minimum floodplain management require-

ments to develop extra measures to provide protection from flooding.

Comprehensive Community Plan – A municipal-level plan written in accordance with requirements of the Rhode Island Comprehensive Planning and Land Use Regulation Act.

Critical Facilities – A structure or other improvement that, because of its function, size, service area, or uniqueness, has the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if it is destroyed or damaged or if its functionality is impaired. Critical facilities include health and safety facilities, utilities, government facilities and hazardous materials facilities.

Drought – A natural climatic condition which occurs in virtually all climates, the consequence of a natural reduction in the amount of precipitation experienced over a long period of time, usually a season or more in length. High temperatures, prolonged winds, and low relative humidity can exacerbate the severity of drought.

Elevated Building – A building that has no basement and that has its lowest elevated floor raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns. Solid (perimeter) foundations walls are not an acceptable means of elevating buildings in V and VE zones.

Erosion – The collapse, undermining or subsidence of land along the shore of a lake or other body of water. Erosion is a covered peril if it is caused by waves or currents of water exceeding their cyclical levels which result in flooding.

Extent – The strength or magnitude of the hazard. Extent can be described in a combination of ways depending on the hazard.

Farm, Forest and Open Space Program – A tax incentive program that helps to achieve open space protection, but does not provide permanent protection. The program is intended to encourage property owners to manage their land for forestry, agriculture, and open space. Property owners enter into an agreement with the Town to keep their properties undeveloped for at least 15 years in exchange for lower property tax assessments.

Federal Emergency Management Agency (FEMA) – An agency within the U.S. Department of Homeland Security charged with responding to Presidentially-declared disasters.

Flash Flood – A flood that occurs when excessive water fills normally dry creeks or river beds along with currently flowing creeks and rivers, causing rapid rises of water in a short amount of time. They can happen with little or no warning.

Flood – A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from: Overflow of inland or tidal waters; unusual and rapid accumulation or runoff of surface waters from any source; mudflow; or 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.

Flood Insurance Rate Map (FIRM) – Official map of a community on which FEMA has delineated the Special Flood Hazard Areas (SFHAs), the Base Flood Elevations (BFEs) and the risk premium zones applicable to the community.

Floodplain – Any land area susceptible to being inundated by floodwaters from any source.

Floodplain Management – The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to, emergency preparedness plans, flood-control works and floodplain management regulations.

Floodproofing – Any combination of structural and non-structural additions, changes or adjustments to structures, which reduce or eliminate risk of flood damage to real estate or improved real property, water and sanitation facilities or structures with their contents.

Foundation Walls – Masonry walls, poured concrete walls or precast concrete walls, regardless of height, that extend above grade and support the weight of a building.

Freeboard (FEMA Definition for Flood Zones) – An additional amount of height above the Base Flood Elevation used as a factor of safety (e.g., 2 feet above the Base Flood) in determining the level at which a

structure's lowest floor must be elevated or flood-proofed to be in accordance with state or community floodplain management regulations.

Freeboard (bridge clearance) – The space between the bottom of a bridge's structure and the surface of the water underneath the bridge.

Fujita scale – Used to characterize tornadoes based on the damage they produce and relating that damage to the fastest quarter-mile wind at the height of a damaged structure. An Enhanced Fujita scale became operational in 2007 and improves upon the original scale by including more damage indicators, taking into account construction quality and variability, and providing a more definitive correlation between damage and wind speed

Geographic Information System (GIS) – A computer-based tool that analyzes, stores, manipulates and visualizes geographic information on a map.

Greenhouse Gas Emissions – Gases that trap heat in the atmosphere, including carbon dioxide and methane.

Hazard – A natural or man-made source or cause of harm or difficulty.

Hazard Identification – Identification of hazards relevant to Barrington.

Hazard Mitigation – Sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Hazard Mitigation Plan – A plan, written to comply with FEMA requirements, that identifies local policies and actions that can be implemented over the long term to reduce risk and future losses from hazards. These mitigation policies and actions are identified based on an assessment of hazards, vulnerabilities, and risks and the participation of a wide range of stakeholders and the public in the planning process.

Hazard Profiles – Profiles of each identified hazard.

Hurricane – A tropical cyclone in which the maximum sustained surface wind is 74 mph or more. The term hurricane is used for Northern Hemisphere tropical cyclones east of the International Dateline to the Greenwich Meridian. (The term typhoon is used for Pacific tropical cyclones north of the Equator west of the International Dateline.)

Impact – The effect of a hazard on the community and its assets.

Inland Flooding – Flooding that presents a risk within inland (non-coastal) areas, including riverine flooding and shallow flooding.

Inundation – The total water level that occurs on normally dry ground as a result of the storm tide, and is expressed in terms of height of water, in feet, above ground level.

Land Development & Subdivision Regulations – Town of Barrington regulations administered by the Planning Board. These regulations are applicable in all cases of subdivision of land, including resubdivision; in all cases of land development projects as provided for in § 45-24-47 of the Zoning Enabling Act of 1991; and in all cases of development plan review, as provided for in § 45-24-49 of the Zoning Enabling Act of 1991.

Letter of Map Amendment (LOMA) – An amendment to the currently effective FEMA map which establishes that a property is not located in a Special Flood Hazard Area (SFHA). A LOMA is issued only by FEMA.

Letter of Map Revision (LOMR) – An official amendment to the currently effective FEMA map. It is issued by FEMA and changes flood zones, delineations and elevations.

Location – The geographic areas within the planning area that are affected by the hazard, such as a floodplain.

Lowest Floor Elevation (LFE) – The measured distance of a building's lowest floor above the National Geodetic Vertical Datum (NGVD) or other datum specified on the FIRM for that location.

Mission Statement – A statement that drives the process and describes in a short, simple statement the intended outcome.

Mitigation – An effort to reduce the impact or loss from an incident.

Mitigation Strategy – The heart of the mitigation plan is the mitigation strategy, which serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy describes how the community will accomplish the overall purpose, or mission, of the planning process.

Modified Mercalli Intensity (MMI) Scale – An intensity scale created to evaluate the effects of earthquakes, the MMI is the one currently used in the United States. Developed in 1931 by seismologists this scale is composed of increasing levels of intensity that range from imperceptible shaking to catastrophic destruction. Each level is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

National Centers for Environmental Administration Information – Formerly the National Climatic Data Center, a division of the National Oceanic and Atmospheric Administration responsible for “preserving, monitoring, assessing, and providing public access to the Nation’s treasure of climate and historical weather data and information.”

National Flood Insurance Program (NFIP) – A program that makes federally-backed flood insurance available in those states and communities that agree to adopt and enforce flood-plain management ordinances to reduce future flood damage.

National Geodetic Vertical Datum (NGVD) of 1929 – National standard reference datum for elevations, formerly referred to as Mean Sea Level (MSL) of 1929. NGVD 1929 may be used as the reference datum on some Flood Insurance Rate Maps (FIRMs).

National Weather Service – A component of NOAA that provides weather, water, and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.

Natural Environment – Natural systems with limited human influence. Examples: freshwater wetlands, coastal marshes, woodlands.

Natural Grade – The grade unaffected by construction techniques such as fill, landscaping or berming.

Nor’easter – A storm along the East Coast of North America, so called because the winds over the coastal area are typically from the northeast. These storms may occur at any time of year but are most frequent and most violent between September and April.

North American Vertical Datum (NAVD) of 1988 – The vertical control datum established for vertical control surveying in the United States of America based upon the General Adjustment of the North American

Datum of 1988. It replaces the National Geodetic Vertical Datum (NGVD) of 1929.

Repetitive Loss Structure – An NFIP-insured structure that has had at least 2 paid flood losses of more than \$1,000 each in any 10-year period since 1978.

Resilience – The ability of systems, infrastructures, government, business, communities and individuals to resist, tolerate, absorb, recover from, prepare for, or adapt to an adverse occurrence that causes harm, destruction or loss.

Richter Scale – The Richter magnitude scale, developed in 1935 by Charles F. Richter, is a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes.

Risk – The potential for an unwanted outcome resulting from an incident, event or occurrence, as determined by its likelihood and the associated consequences.

Risk Assessment – A product or process that collects information and assigns values to risks for the purpose of informing priorities, developing or comparing courses of action, and informing decision making.

Riverine Flooding – Surface water runoff introduced into streams and rivers exceeds the capacity of the natural or constructed channels to accommodate the flow; as a result, water overflows the stream banks, spilling out into adjacent low lying areas.

Rossby waves – Horizontal waves that are found in winds at high-altitude. Also known as planetary waves, Rossby waves can influence weather patterns, including cyclones.

Save the Bay – A Providence-based nonprofit organization whose mission is to “protect and improve Narragansett Bay.”

Sea Level Rise – The upward trend in average sea level height.

Sea, Lake and Overland Surges from Hurricanes (SLOSH) Model – A computerized numerical model developed by the National Weather Service (NWS) to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes by tak-

ing into account the atmospheric pressure, size, forward speed, and track data. These parameters are used to create a model of the wind field which drives the storm surge. The SLOSH model consists of a set of physics equations which are applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads, levees and other physical features.

Shallow Flooding - For purposes of the National Flood Insurance Program (NFIP), shallow flooding is defined as that with a depth limited to 3.0 feet or less where no defined channel exists.

Shear Walls – Walls used for structural support but not structurally joined or enclosed at the ends (except by breakaway walls). Shear walls are parallel or nearly parallel, to the flow of the water and can be used in any flood zone.

Sheet Flow Hazard. A type of flood hazard with flooding depths of 1 to 3 feet that occurs in areas of sloping land. The sheet flow hazard is represented by the zone designation AO on the FIRM.

Special Flood Hazard Area (SFHA) – Flood hazard areas identified on FEMA Flood Insurance Rate Maps are identified as a Special Flood Hazard Area (SFHA). SFHA are defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year.

Shelter – A place of refuge that provides life-sustaining services in a congregate facility for individuals who have been displaced by an emergency or a disaster.

State Hazard Mitigation Plan (SHMP) – A Plan that provides comprehensive guidance for hazard mitigation in the State of Rhode Island.

Storm Surge – Storm surge is defined as the abnormal rise of water generated by a storm, over and above the normal astronomical tide, and is expressed in terms of height above predicted or expected tide levels. Since storm surge represents the deviation from normal tide levels, it is not referenced to a vertical or tidal datum.

Variance – A grant of relief by a participating community from the terms of its floodplain management regulations.

Velocity Zone (VE Zone) – Also known as the coastal high hazard areas, these are areas subject to high velocity water including waves; they are defined by the 1% annual chance (base) flood limits (also known as the 100-year flood) and wave effects 3 feet or greater. The hazard zone is mapped with base flood elevations (BFEs) that reflect the combined influence of stillwater flood elevations, primary frontal dunes, and wave effects 3 feet or greater.

Vertical Datum - A base elevation used as a reference from which to measure heights (or depths).

Vulnerability – Characteristics of community assets that make them susceptible to damage from a given hazard.

Vulnerability Analysis – An analysis of the risk of hazards impacting community assets.

Wetlands – Areas where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils.

Wetlands Overlay District – A Barrington zoning overlay district consisting of coastal wetlands, defined as salt marshes bordering on tidal waters, and freshwater wetlands, defined as those areas of 1/2 acre or greater, that are inundated or saturated with surface and/or ground water at a frequency or duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The boundaries of the Wetlands Overlay District are generally shown as Coastal Wetlands, Freshwater Wetlands or Hydric Soils on that map titled "Wetlands Area Map" (Town of Barrington, Rhode Island Comprehensive Community Plan) and filed at the office of the Building Official.

Wildfire – A wildfire is an unplanned, unwanted fire burning in a natural area, such as a forest, grassland, or prairie. Wildfires can damage natural resources, destroy homes, and threaten the safety of the public

and the firefighters who protect forests and communities.

Wildland Urban Interface (WUI) Zone – As building development expands into natural areas, homes and business may be situated in or near areas susceptible to wildfires.

Wind Chill Index – Wind chill index is an attempt 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.

X Zone (shaded) – On the FIRM maps, this consists of the coastal (or riverine) floodplain areas between the 100- year flood and 0.2% annual chance (500-year) flood. These areas are located outside the SFHA, but are depicted on the FIRM unless map scale limitations prevent detailed mapping of this area. They were formerly mapped and depicted as Zone B.

X Zone (unshaded) – Areas on the FIRM that are located outside the limits of the 500-year flooding. They were formerly mapped and depicted as Zone C.

Zoning Ordinance – Regulations that define how property can be used within zones as mapped on a Zoning Map. Regulations specify how property may be used and establish dimensional requirements including lot size, building placement, bulk (or density) and the height of structures.

Sources:: Glossary

Town of Barrington

Barrington Zoning Ordinance

Coastal Resources Management Council

<http://www.crmc.ri.gov/aboutcrmc.html>

Statewide Planning (RI Dept. of Administration)

http://www.planning.ri.gov/documents/sea_level/2016/TP167.pdf

Save the Bay

<https://www.savebay.org/>

Environmental Protection Agency

<https://www.epa.gov/wetlands/what-wetland>

Federal Emergency Management Agency

FEMA Local Mitigation Planning Handbook, March 2013, Pages 2-4, 5-1, 5-3, 6-1

https://www.fema.gov/media-library-data/20130726-1541-20490-5411/frm_p1zones.pdf

<http://www.crsresources.org/self-assessment/what-is-a-critical-facility/>

<http://gisgeography.com/what-gis-geographic-information-systems/>

https://www.fema.gov/media-library-data/1409003859391-0e8ad1ed42c129f11fbc23d008d1ee85/how_to_prepare_wildfire_033014_508.pdf

National Oceanic and Atmospheric Administration

<http://www.nhc.noaa.gov/aboutgloss.shtml>

<http://www.nssl.noaa.gov/education/svrwx101/floods/>

www.nhc.noaa.gov/surge/slosh.ph

<http://www.nws.noaa.gov/om/winter/noreaster.shtm>

http://www.nhc.noaa.gov/news/20130806_pa_defineSurge.pdf

U.S. Geological Survey

<https://earthquake.usgs.gov/learn/topics/mercalli.php>

Technical and Financial Assistance Resources

State Sources of Technical Assistance and Funding

The Rhode Island State Hazard Mitigation Officer (SHMO) and State Mitigation Planner(s) can provide guidance regarding grants, technical assistance, available publications, and training opportunities. Contact the Rhode Island Emergency Management Agency (RIEMA) and the Rhode Island Division of Planning for further assistance. View agency websites for contact information at <http://www.riema.ri.gov/planning/hazardmitigation/index.php> and <http://www.planning.ri.gov/>.

Refer to the Rhode Island State Hazard Mitigation Plan Update (Section 4.3) which identifies a number of potential funding sources for various mitigation activities at <http://www.riema.ri.gov/planning/hazardmitigation/planning/index.php>. Communities are encouraged to work with the State to maximize use of every 406 Hazard Mitigation opportunity when available during federally declared disasters. A better alignment and increasing the effectiveness of 406 and 404 Mitigation funds, greatly benefit the community in the long run.

- **STORMTOOLS**

The U.S. Army Corps of Engineers completed the North Atlantic Comprehensive Study (NACCS) in 2015, which provides new tools and information to assess coastal storm and flood risks. Information from the NACCS was integrated into STORMTOOLS (<http://www.rigis.org/data/stormtools>). These coastal inundation modeling results can be used by the state government and local communities to identify storm surge flooding risks and develop adaptation strategies to reduce those risks now and into the future. The vision for STORMTOOLS is to provide access to a suite of high-resolution coastal planning tools that can be used to develop adaptation policies and actions to reduce storm surge vulnerability. The STORMTOOLS inundation mapping effort represents the first step in the development of an integrated toolset that includes the development of simplified flood maps for varying storm return periods and sea level rise scenarios, incorporating the effects of

both storm surge and tide as derived from the NACCS.

- **RI e911 Exposure Assessment**

The RI e911 Exposure Assessment page (<http://www.beachsamp.org/stormtools/e911/>) offers a summary of all exposed structures in each of the 21 coastal municipalities in Rhode Island within a variety of coastal flooding scenarios: (1) from twice-daily tides based on sea level rise projections to the year 2100; and, (2) from coastal storm events with and without sea level rise scenarios. The data contained in the spreadsheets present the e911 structure type data sorted by coastal flooding scenario.

Federal and Non-Profit Sources of Technical Assistance and Funding

- **Federal Grants Resource Center and Grants.gov**
Federal agencies may support integrated planning efforts such as rural development, sustainable communities and smart growth, climate change and adaptation, historic preservation, risk analyses, wildfire mitigation, conservation, Federal Highways pilot projects, etc. The Federal Grants Resource Center is located on the website of the national non-profit Reconnecting America, and provides a compilation of key funding sources for projects in your community. Examples are HUD, DOT/FHWA, EPA, and Sustainable Communities grant programs. For more information visit: <http://reconnectingamerica.org/resource-center/federal-grant-opportunities/> or www.grants.gov.
- **GrantWatch.com**
The website posts current foundation, local, state, and federal grants on one website. When seeking funding opportunities for mitigation, consider a variety of sources for grants, guidance, and partnerships, including academic institutions, non-profits, community organizations, and businesses, in addition to governmental agencies. Examples are The Partnership for Resilient Communities, the Institute for Sustainable Communities, the Rockefeller Foundation Resilience, The Nature Conservancy, The Kresge Climate-Resilient Initiative, the Threshold Foundation's Thriving Resilient Communities funding, the RAND Corporation, and ICLEI Local Governments for Sustainability.

<http://www.grantwatch.com>

- **FEMA Hazard Mitigation Assistance**
FEMA's Hazard Mitigation Assistance provides funding for projects under the Hazard Mitigation Grant Program (HMGP), Pre-Disaster Mitigation (PDM), and Flood Mitigation Assistance (FMA). Individuals and businesses are not eligible to apply for HMA funds; however, an eligible applicant or sub-applicant may apply on their behalf.
<http://www.fema.gov/hazard-mitigation-assistance>

Recommended FEMA Publications and Websites

- **Hazard Mitigation Planning Online Bibliography, FEMA Region I**
This compilation of government and private online sites is a useful source of information for developing and implementing hazard mitigation programs and plans in New England.
<http://www.fema.gov/about-region-i/about-region-i/hazard-mitigation-planning-webliography>
- **FEMA Library**
FEMA publications can be downloaded for free from its Library website. This repository contains a wealth of information that can be especially useful in public information and outreach programs. Search by keyword to find documents related to a particular topic. Examples include building and construction techniques, the NFIP, integrating historic preservation and cultural resource protection with mitigation, and helpful fact sheets.
<http://www.fema.gov/library>
- **FEMA RiskMAP**
Technical assistance is available through RiskMAP to assist communities in identifying, selecting, and implementing activities to support mitigation planning and risk reduction. Attend any RiskMAP discovery meetings that may be scheduled in the state (or neighboring communities with shared watersheds boundaries) in the future.
<https://www.fema.gov/risk-mapping-assessment-and-planning-risk-map>
- **FEMA Climate Change Website**
Provides resources that address climate change.
<http://www.fema.gov/climate-change>

Other Recommended Publications & Websites

- **U.S. Climate Resilience Toolkit**
Scientific tools, information, and expertise are provided to help manage climate-related risks and improve resilience to extreme events. This aid assists planning through links to a wide-variety of web-tools covering topics, including coastal flood risk, ecosystem vulnerability, and water resources. Experts can be located in the NOAA, USDA, and Department of Interior.
<https://toolkit.climate.gov>
- **EPA's Resilience and Adaptation in New England (RAINE) Climate Change Program**
A collection of vulnerability, resilience and adaptation reports, plans, and webpages at the state, regional, and community levels. Communities can use the RAINE database to learn from nearby communities about building resiliency and adapting to climate change.
<http://www.epa.gov/raine>
- **USDA Rural Community Development Grant Programs**
USDA operates over fifty financial assistance programs for a variety of rural applications.
<http://www.rd.usda.gov/programs-services>
- **NOAA Sea Grant**
Sea Grant's mission is to provide integrated research, communication, education, extension and legal programs to coastal communities that lead to the responsible use of the nation's ocean, coastal and Great Lakes resources through informed personal, policy and management decisions. Examples of the resources available help communities plan, adapt, and recovery are the Community Resilience Map of Projects and the National Sea Grant Resilience Toolkit, both located on this website.
<http://seagrants.noaa.gov>
- **USDA, Natural Resources Conservation Service (NRCS)**
Provides conservation technical assistance, financial assistance, and conservation innovation grants.
<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/>

Maps

Map 1: Structures in Flood Zones

Map 2: Structures in Areas Susceptible to Storm Surge

Map 3: Structures in SLR Inundation Areas

Map 4: Vulnerability Assessment: Critical Facilities—Hurricane Evacuation

Map 5: Vulnerability Assessment: Critical Facilities—Hazard: Flooding

Map 6: Vulnerability Assessment: Critical Facilities—Hazard: Storm Surge

Map 7: Vulnerability Assessment: Critical Facilities—Hazard: Sea Level Rise

Map 8: Roadway Elevations in Barrington

Map 9: SLR Inundation Areas: Wampanoag Trail

Map 10: SLR Inundation Areas: Lincoln Avenue/County Road

Map 11: SLR Inundation Areas: Palmer River

Map 12: SLR Inundation Areas: Tyler Point/Mathewson Road

Map 13: SLR Inundation Areas: Allin's Cove/Bay Spring

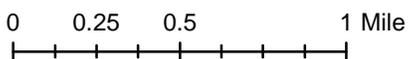
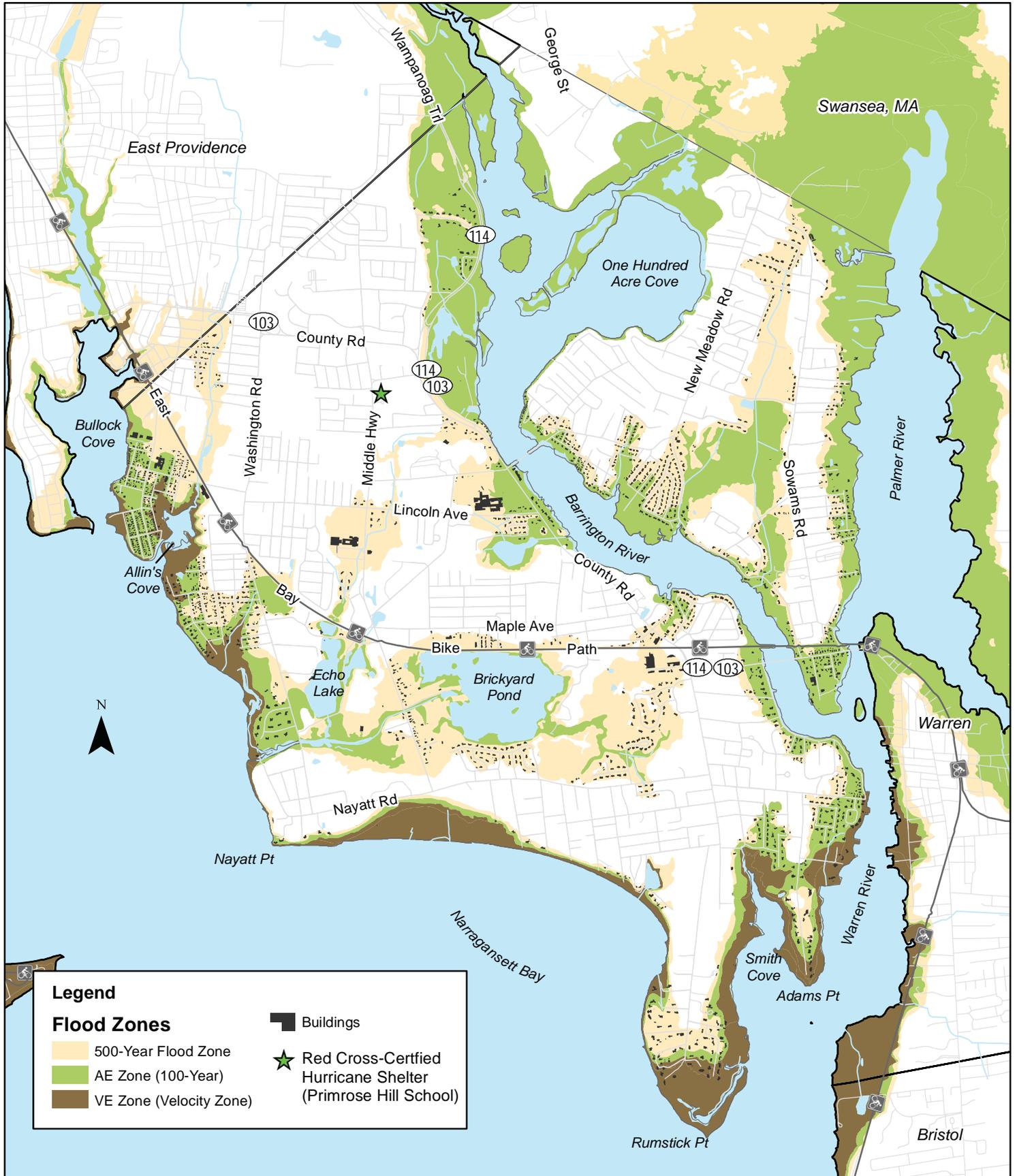
Map 14: SLR Inundation Areas: Town Beach/RI Country Club

Map 15: SLR Inundation Areas: New Meadow Road

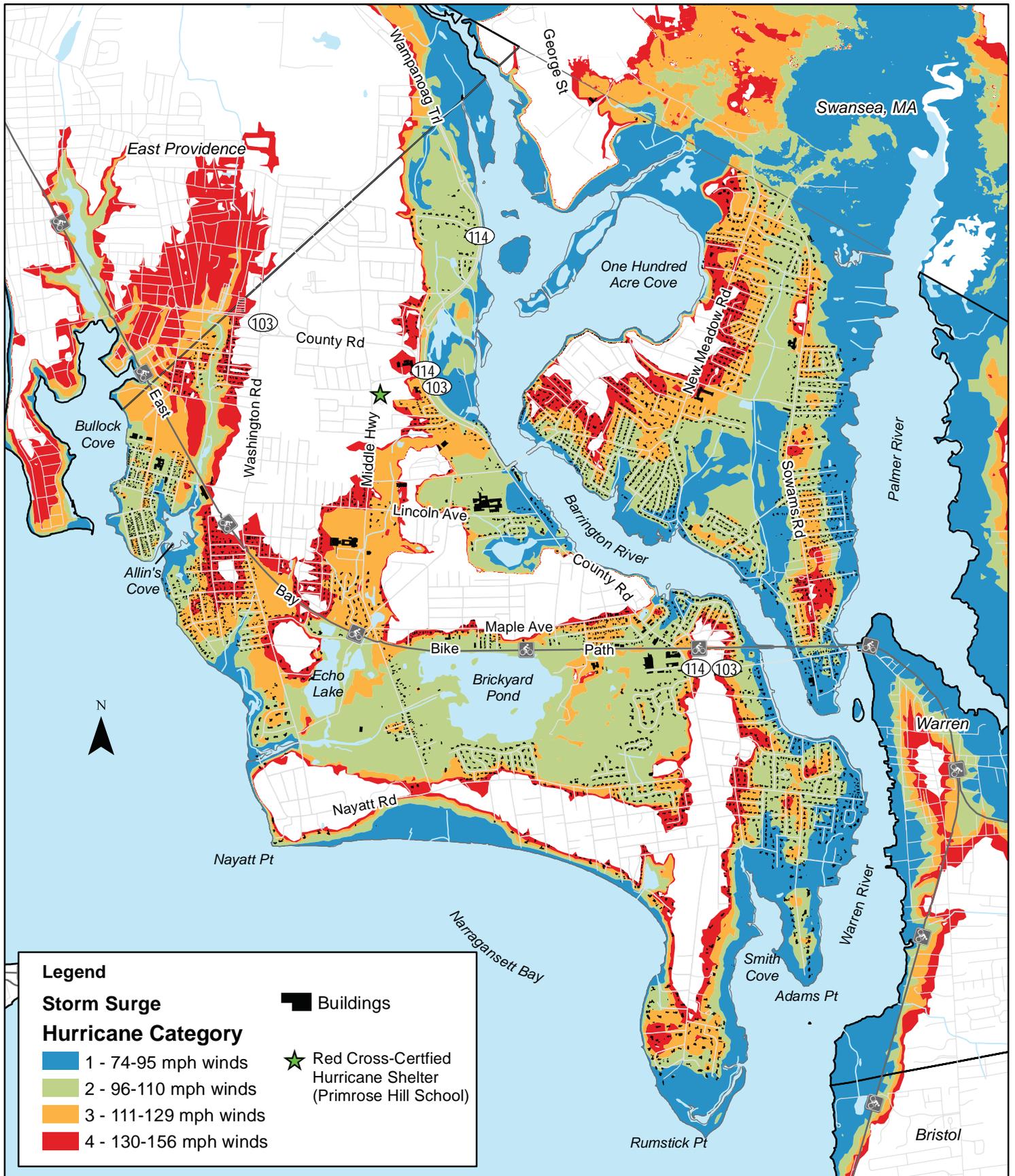
Map 16: SLAMM Map 11—Current Conditions

Map 17: SLAMM Map 11—5-Foot SLR

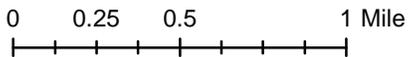
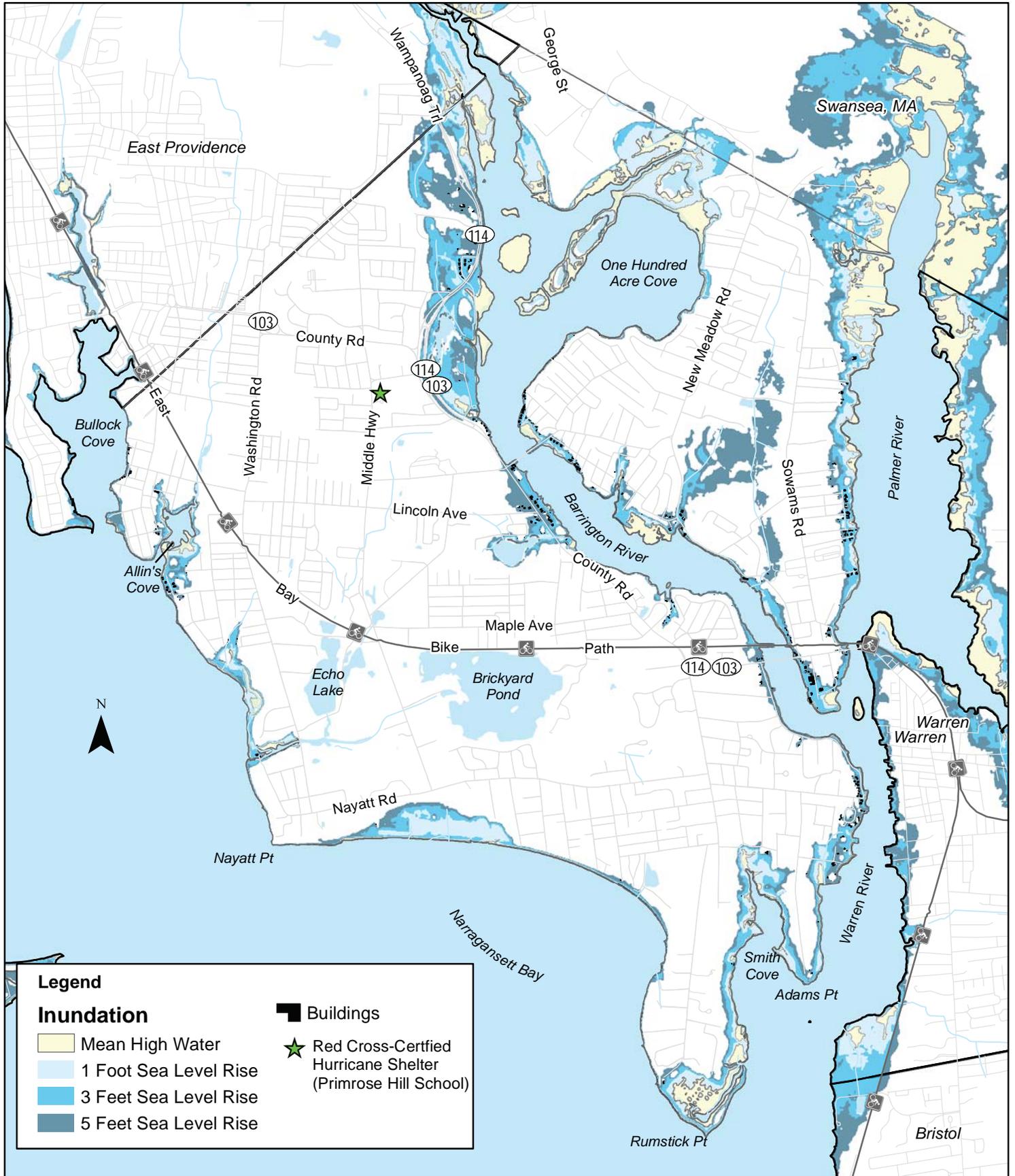
Structures in Flood Zones



Structures in Areas Susceptible to Storm Surge

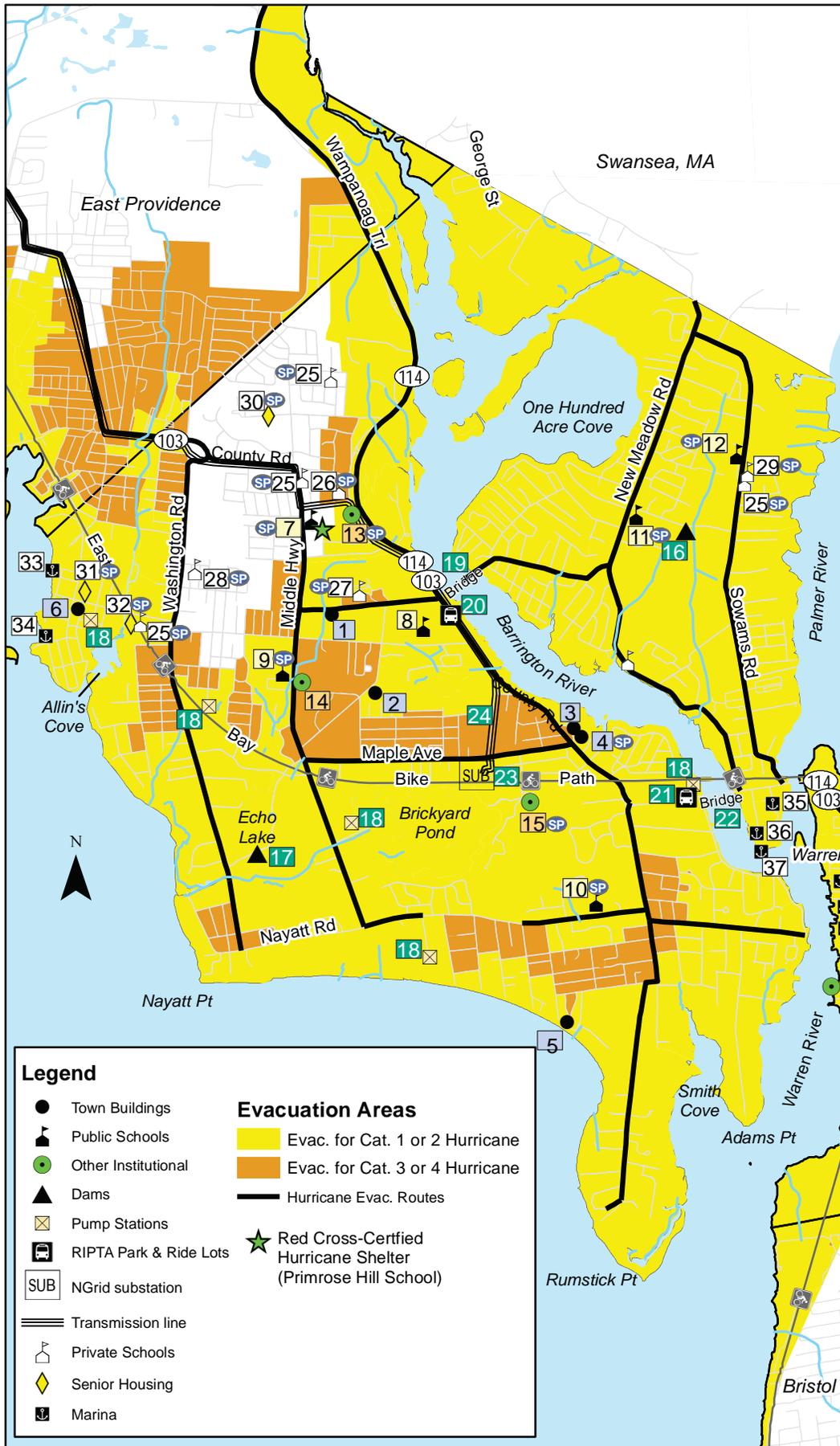


Structures in SLR Inundation Areas



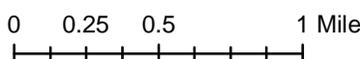
Vulnerability Assessment: Critical Facilities

Hurricane Evacuation



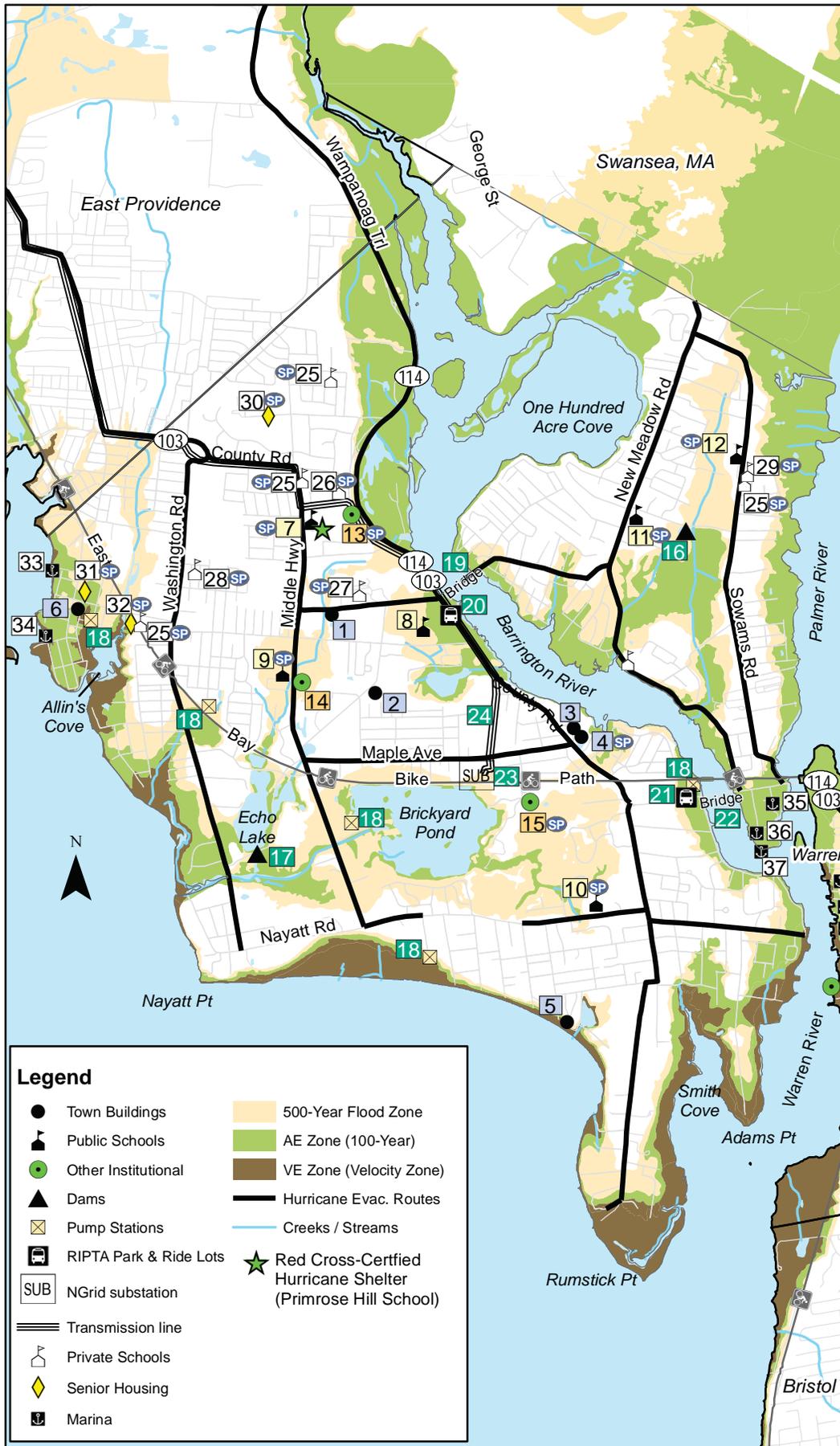
- Municipal Buildings
 - 1. Public Safety Building (Police/Fire/EMS)
 - Other Town Buildings
 - 2. Public Works
 - 3. Town Hall
 - 4. Library/Senior Center **SP**
 - 5. Town Beach Bathhouse
 - 6. Bay Spring Comm. Ctr.
- Public Schools
 - 7. Primrose Hill School ★
 - 8. High School
 - 9. Middle School
 - 10. Nayatt School
 - 11. Hampden Mdws School
 - 12. Sowams School
- Other Institutional
 - 13. East Bay Center **SP**
 - 14. Post Office
 - 15. Bayside Y **SP**
- Infrastructure
 - 16. Kent Street Dam ▲
 - 17. Echo Lake Dam ▲
 - 18. Pump Stations ⊠
 - 19. Central Bridge
 - 20. White Church Park & Ride 🚌
 - 21. Police Cove Park & Ride 🚌
 - 22. Barrington River Bridge
 - 23. National Grid Substation **SUB**
 - 24. Transmission Line ≡≡≡
- Critical Facilities - Private
 - Private Schools/Day Care ⏏ **SP**
 - 25. Day cares (multiple sites)
 - 26. Barrington Christian Acad.
 - 27. St. Andrews School
 - 28. St. Luke's School
 - 29. Montessori
 - Elderly Housing ◆ **SP**
 - 30. Senior Housing (proposed)
 - 31. Atria Assisted Living
 - 32. Barrington Cove Apts.
 - Marinas ⚓
 - 33. Cove Haven
 - 34. Lighthouse
 - 35. Striper
 - 36. Stanley's Boat Yard
 - 37. Yacht Club

SP Special Populations

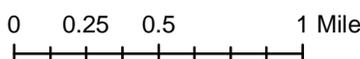


Vulnerability Assessment: Critical Facilities

Hazard: Flooding

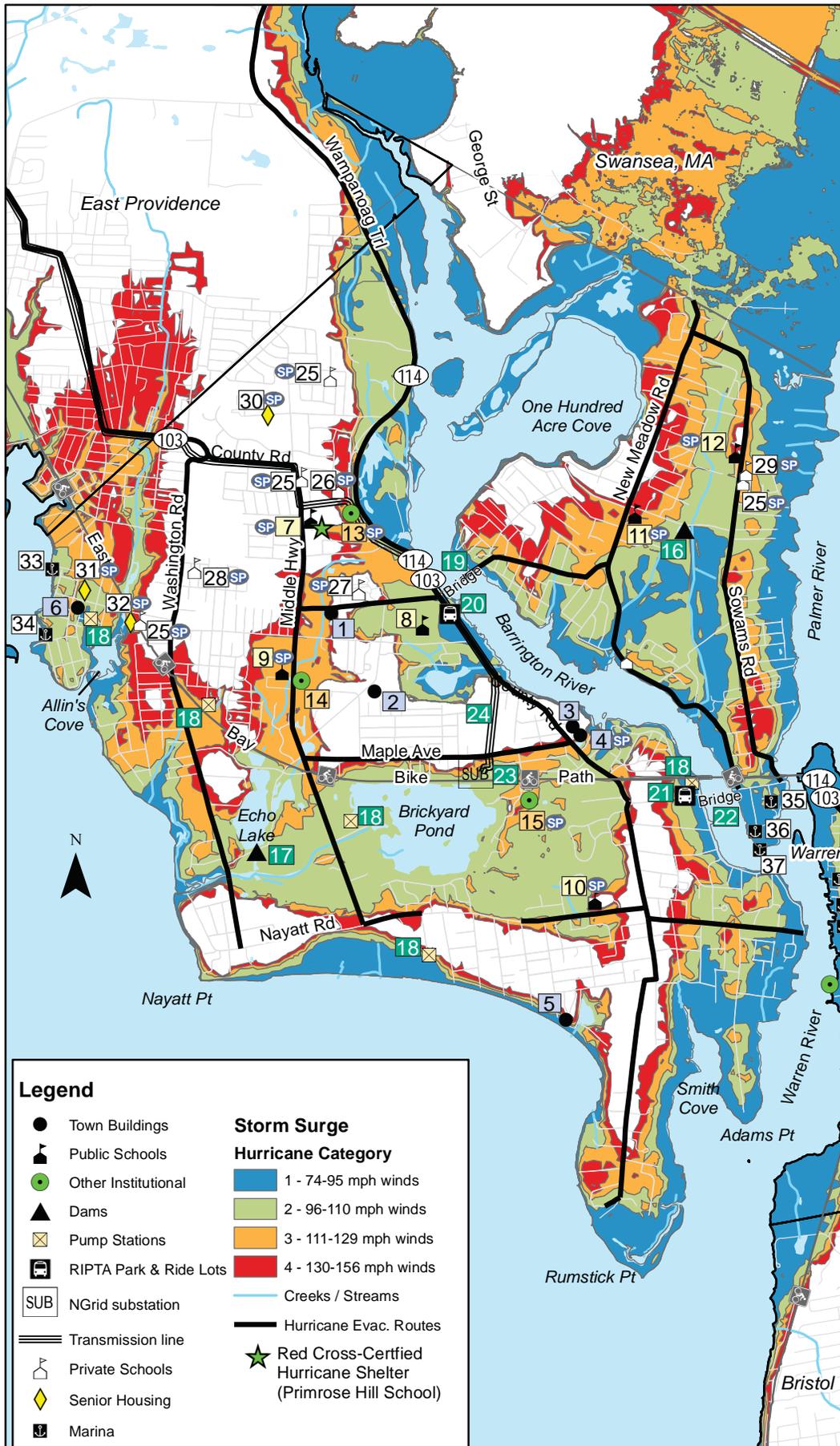


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Vulnerability Assessment: Critical Facilities

Hazard: Storm Surge



- Municipal Buildings**
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 - 2. Public Works
 - 3. Town Hall
 - 4. Library/Senior Center **SP**
 - 5. Town Beach Bathhouse
 - 6. Bay Spring Comm. Ctr.
- Public Schools**
 - 7. Primrose Hill School **SP** ★
 - 8. High School
 - 9. Middle School
 - 10. Nayatt School
 - 11. Hampden Mdws School
 - 12. Sowams School
- Other Institutional**
 - 13. East Bay Center **SP**
 - 14. Post Office
 - 15. Bayside Y **SP**
- Infrastructure**
 - 16. Kent Street Dam ▲
 - 17. Echo Lake Dam ▲
 - 18. Pump Stations ☒
 - 19. Central Bridge
 - 20. White Church Park & Ride 🚗
 - 21. Police Cove Park & Ride 🚗
 - 22. Barrington River Bridge
 - 23. National Grid Substation **SUB**
 - 24. Transmission Line ≡
- Critical Facilities - Private**
 - Private Schools/Day Care **SP** 🏠
 - 25. Day cares (multiple sites)
 - 26. Barrington Christian Acad.
 - 27. St. Andrews School
 - 28. St. Luke's School
 - 29. Montessori
 - Elderly Housing **SP** ⬡
 - 30. Senior Housing (proposed)
 - 31. Atria Assisted Living
 - 32. Barrington Cove Apts.
 - Marinas 🚤
 - 33. Cove Haven
 - 34. Lighthouse
 - 35. Striper
 - 36. Stanley's Boat Yard
 - 37. Yacht Club

SP Special Populations

Legend

- Town Buildings
 - 🏠 Public Schools
 - Other Institutional
 - ▲ Dams
 - ☒ Pump Stations
 - 🚗 RIPTA Park & Ride Lots
 - SUB** NGrid substation
 - ≡ Transmission line
 - 🏠 Private Schools
 - ⬡ Senior Housing
 - 🚤 Marina
- Storm Surge**

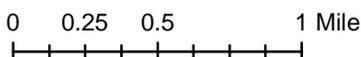
Hurricane Category

 - 1 - 74-95 mph winds
 - 2 - 96-110 mph winds
 - 3 - 111-129 mph winds
 - 4 - 130-156 mph winds

— Creeks / Streams

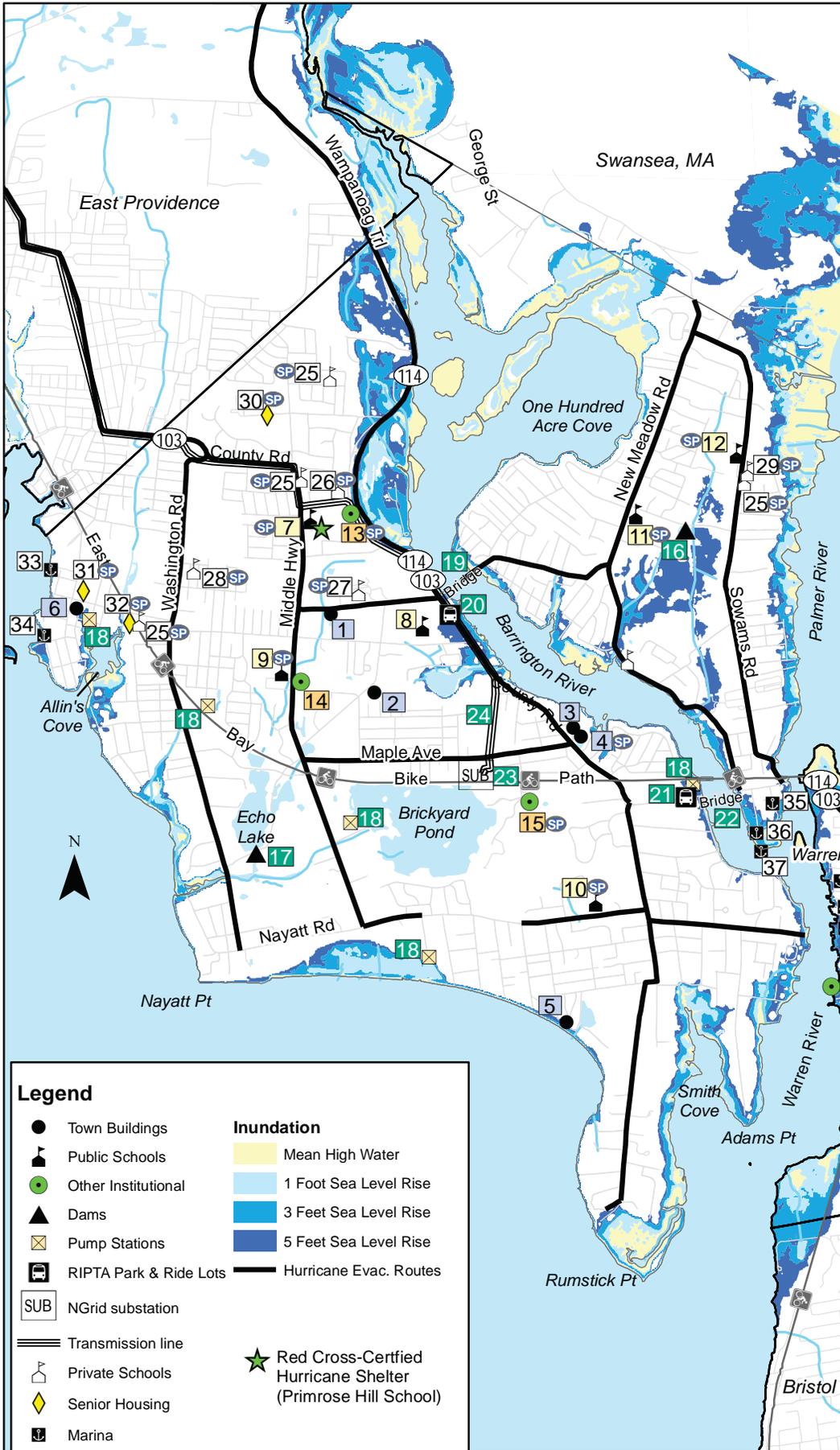
— Hurricane Evac. Routes

★ Red Cross-Certified Hurricane Shelter (Primrose Hill School)



Vulnerability Assessment: Critical Facilities

Hazard: Sea Level Rise



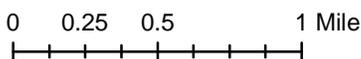
- Municipal Buildings** ●
 - 1. Public Safety Building (Police/Fire/EMS)
 - Other Town Buildings
 - 2. Public Works
 - 3. Town Hall
 - 4. Library/Senior Center **SP**
 - 5. Town Beach Bathhouse
 - 6. Bay Spring Comm. Ctr.
- Public Schools** ▲ **SP**
 - 7. Primrose Hill School ★
 - 8. High School
 - 9. Middle School
 - 10. Nayatt School
 - 11. Hampden Mdws School
 - 12. Sowams School
- Other Institutional** ● **SP**
 - 13. East Bay Center **SP**
 - 14. Post Office
 - 15. Bayside Y **SP**
- Infrastructure**
 - 16. Kent Street Dam ▲
 - 17. Echo Lake Dam ▲
 - 18. Pump Stations ☒
 - 19. Central Bridge
 - 20. White Church Park & Ride 🚗
 - 21. Police Cove Park & Ride 🚗
 - 22. Barrington River Bridge
 - 23. National Grid Substation **SUB**
 - 24. Transmission Line ≡
- Critical Facilities - Private**
 - Private Schools/Day Care 🏠 **SP**
 - 25. Day cares (multiple sites)
 - 26. Barrington Christian Acad.
 - 27. St. Andrews School
 - 28. St. Luke's School
 - 29. Montessori
 - Elderly Housing ⬡ **SP**
 - 30. Senior Housing (proposed)
 - 31. Atria Assisted Living
 - 32. Barrington Cove Apts.
 - Marinas 🚤
 - 33. Cove Haven
 - 34. Lighthouse
 - 35. Striper
 - 36. Stanley's Boat Yard
 - 37. Yacht Club

SP Special Populations

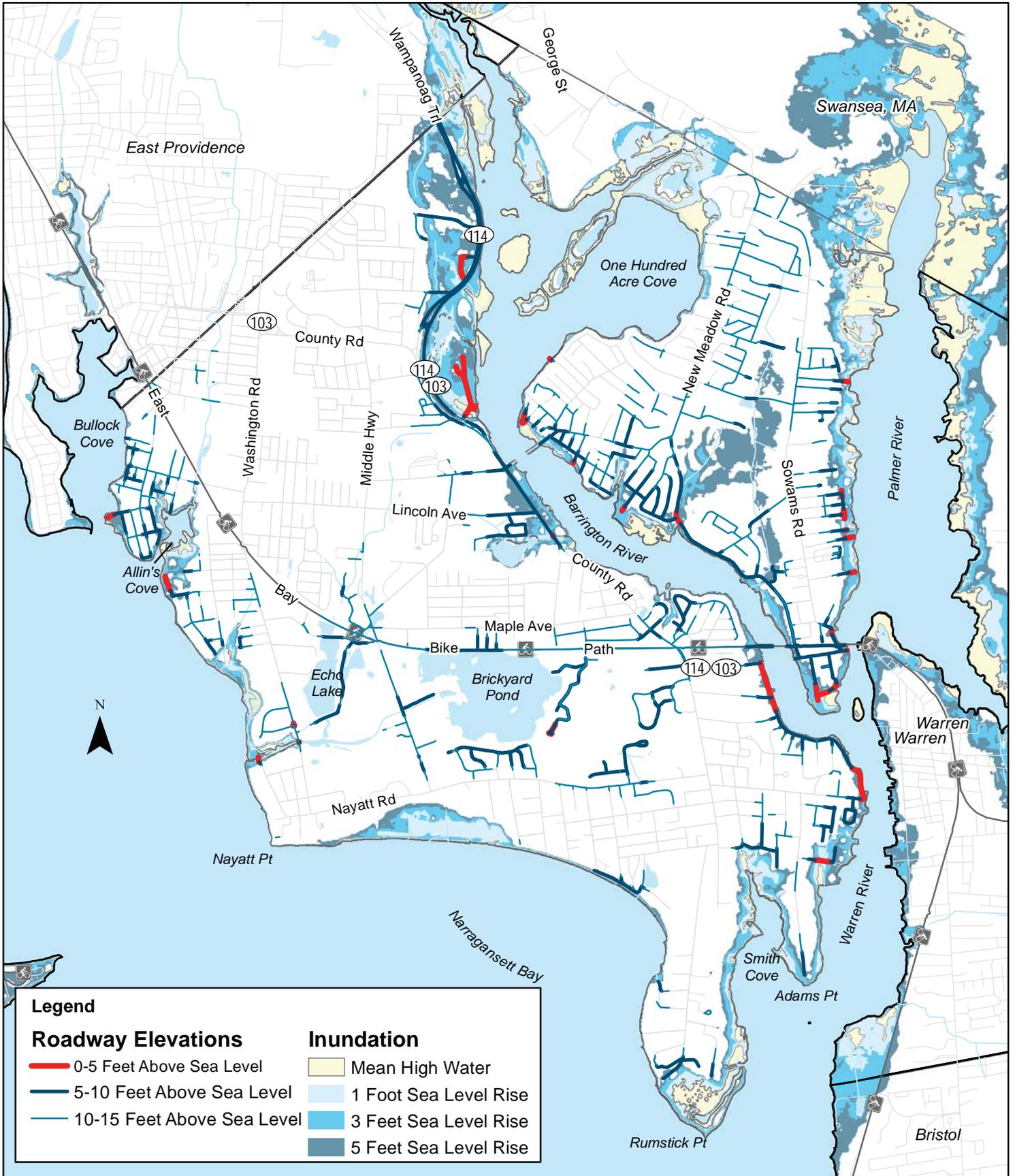
Legend

- Town Buildings
 - ▲ Public Schools
 - Other Institutional
 - ▲ Dams
 - ☒ Pump Stations
 - 🚗 RIPTA Park & Ride Lots
 - SUB** NGrid substation
 - ≡ Transmission line
 - 🏠 Private Schools
 - ⬡ Senior Housing
 - 🚤 Marina
- Inundation**

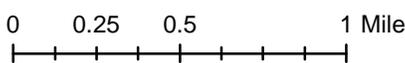
 - Mean High Water
 - 1 Foot Sea Level Rise
 - 3 Feet Sea Level Rise
 - 5 Feet Sea Level Rise
- ★ Red Cross-Certified Hurricane Shelter (Primrose Hill School)



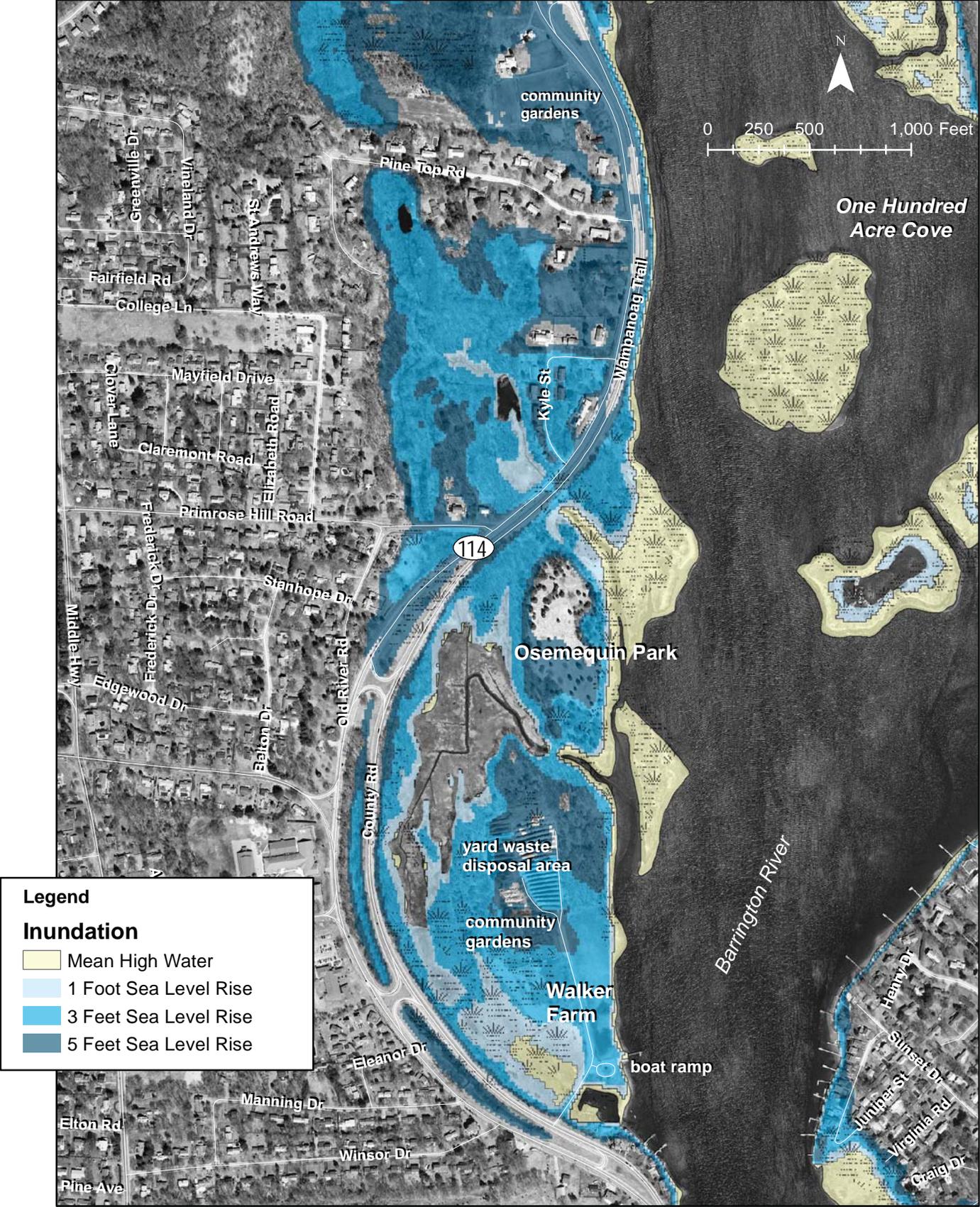
Roadway Elevations - Less than 15 feet



Legend	
Roadway Elevations	Inundation
0-5 Feet Above Sea Level	Mean High Water
5-10 Feet Above Sea Level	1 Foot Sea Level Rise
10-15 Feet Above Sea Level	3 Feet Sea Level Rise
	5 Feet Sea Level Rise



SLR Inundation Areas: Wampanoag Trail



SLR Inundation Areas: Lincoln Avenue/County Road



Legend

Inundation

- Mean High Water
- 1 Foot Sea Level Rise
- 3 Feet Sea Level Rise
- 5 Feet Sea Level Rise

2017 Hazard Mitigation Plan
Town of Barrington, RI

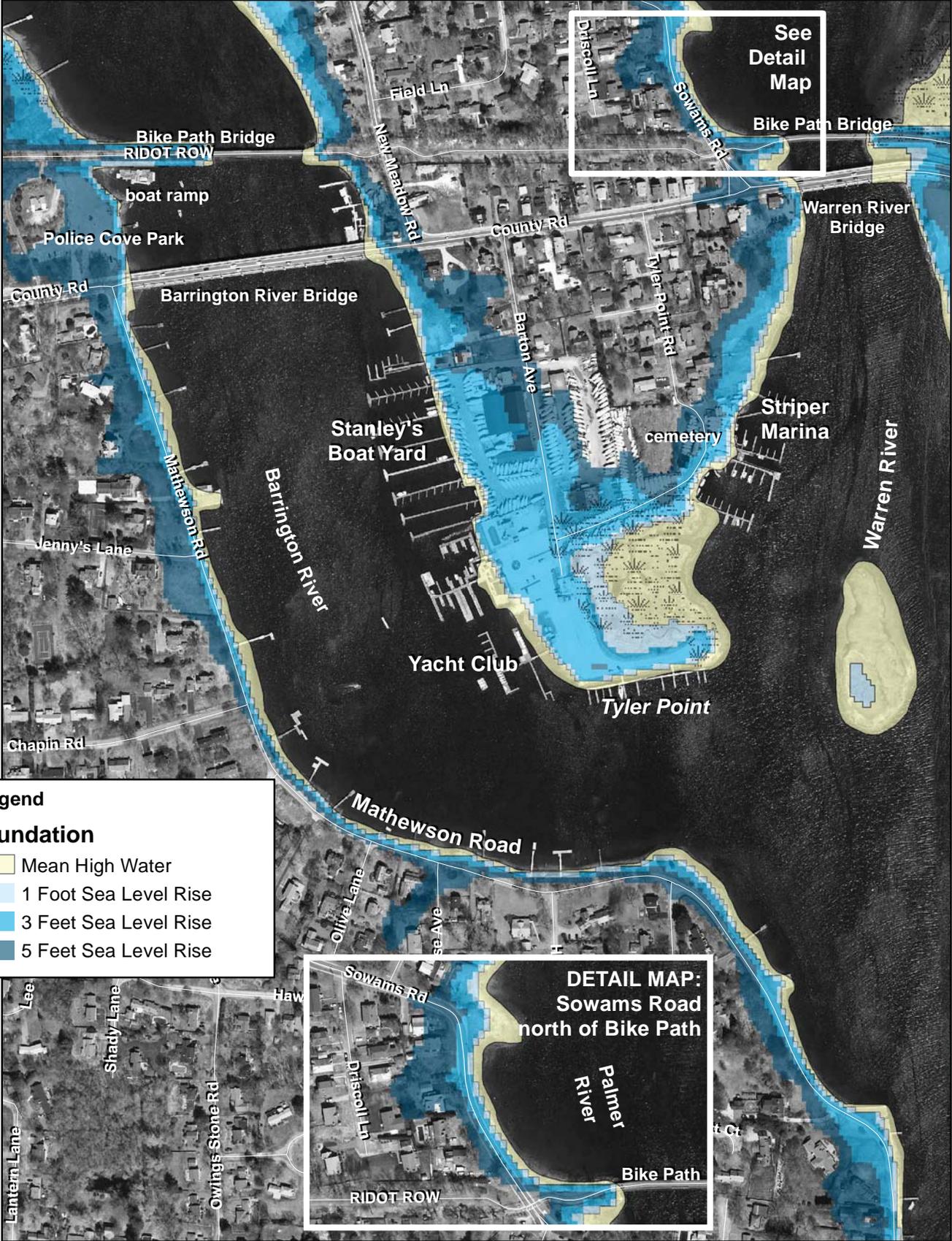
Map Prepared by Town of Barrington - February 2017

Sources: RIGIS, Town GIS

SLR Inundation Areas: Palmer River



SLR Inundation Areas: Tyler Point/Mathewson Road



Legend

Inundation

- Mean High Water
- 1 Foot Sea Level Rise
- 3 Feet Sea Level Rise
- 5 Feet Sea Level Rise

DETAIL MAP:
Sowams Road
north of Bike Path

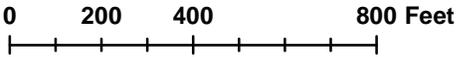
Palmer River

Bike Path

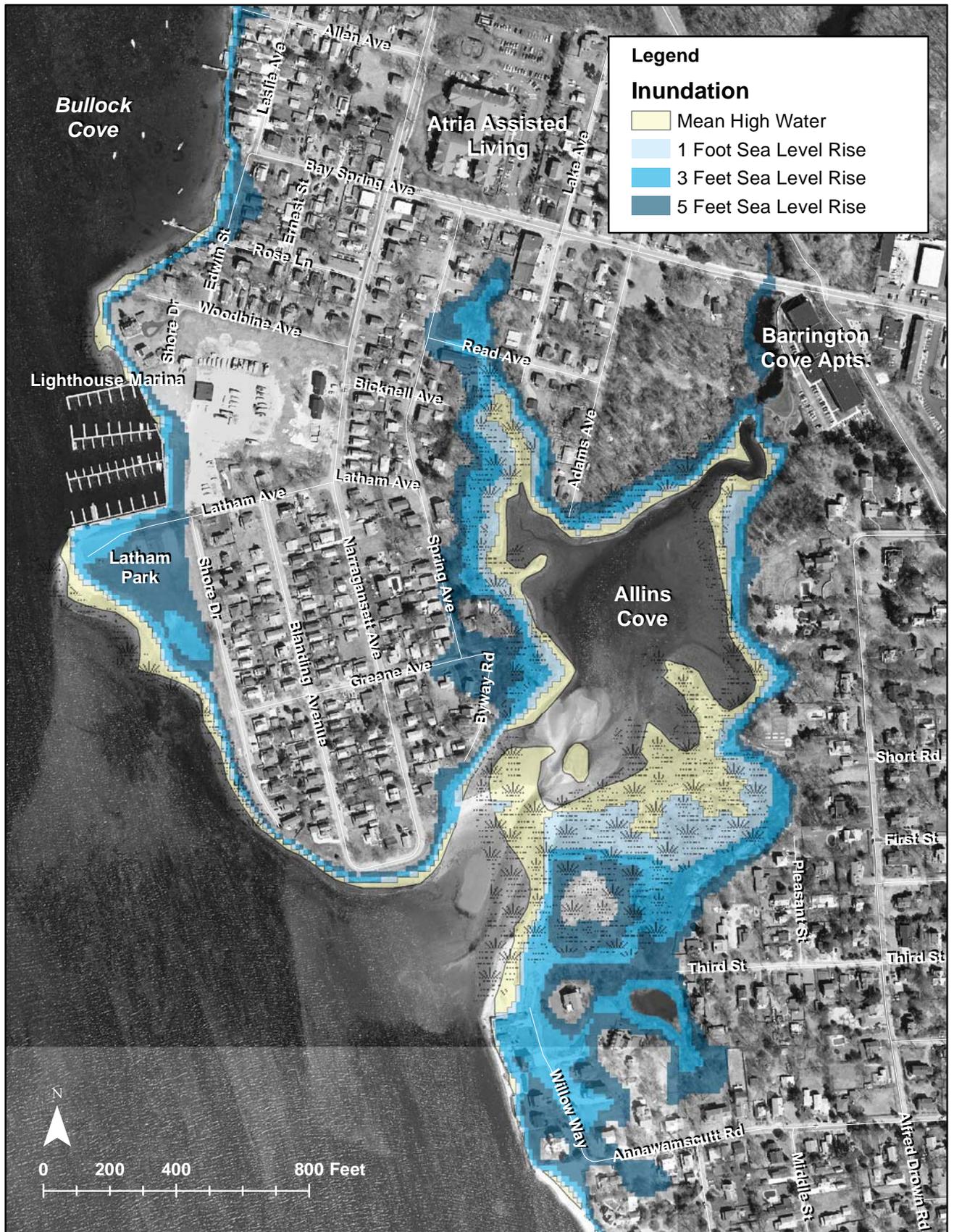
RIDOT ROW

Discoll Ln

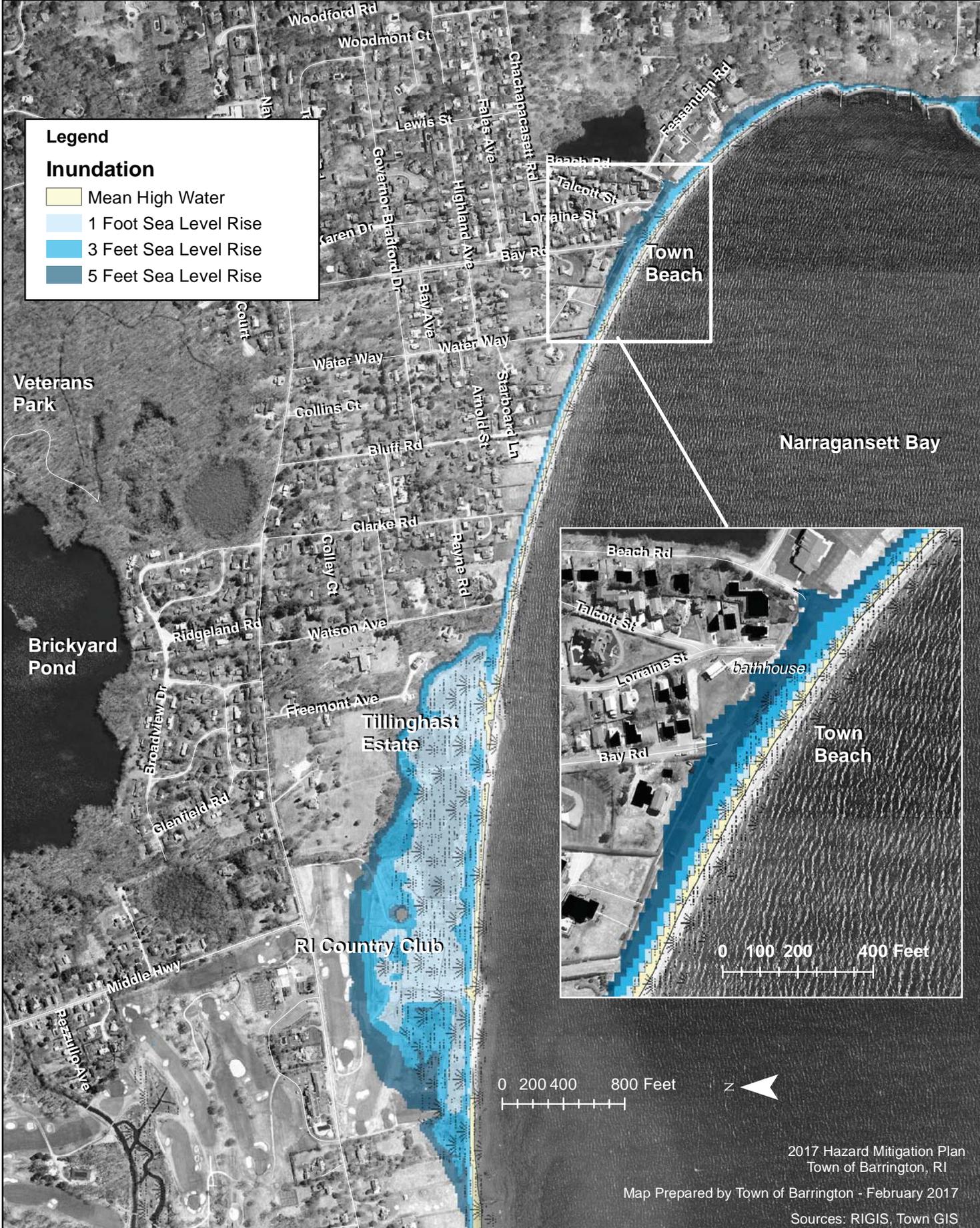
Sowams Rd



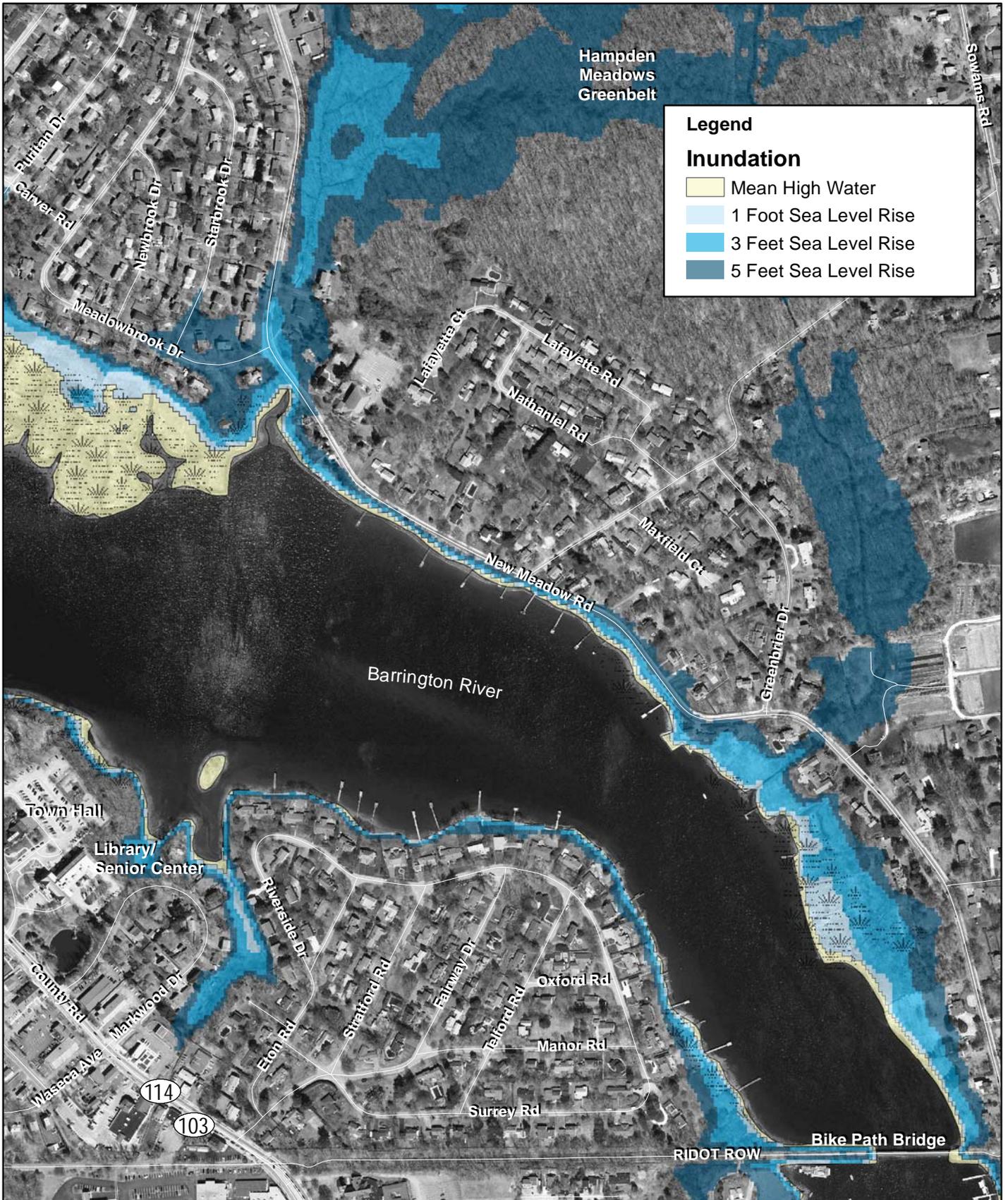
SLR Inundation Areas: Allins Cove/Bay Spring

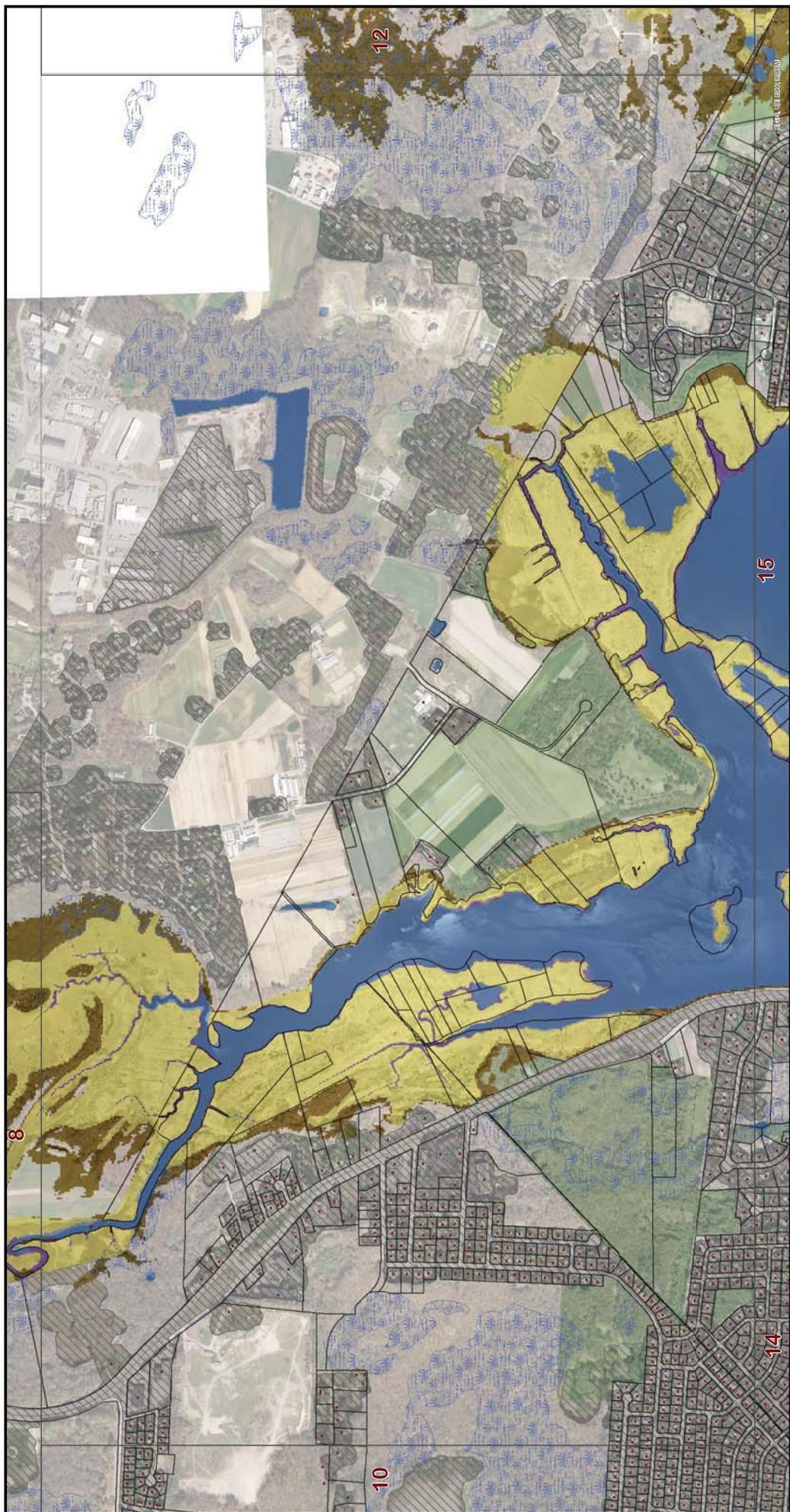


SLR Inundation Areas: Town Beach to RI Country Club



SLR Inundation Areas: New Meadow Road





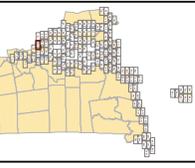
Tidal Marsh Vulnerability Analysis: One Foot Sea Level Rise Model

- Potential Marsh Zone
- Persistent Marsh Zone
- Potential Marsh Loss
- Open Water and Tidal Flat
- Current Fresh Wetlands
- Protected Open Space
- Hardened Shores
- Buildings
- Parcel Boundaries
- Developed Land
- CRMC Coastal Barriers

1:10,000

0 500 1,000 1,500 2,000 Feet

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Map
11

NOAA PARTNER OF NATURE CONSERVATION

CRMC

The Nature Conservancy

Map produced by Kevin Ruddock. 4/7/2014

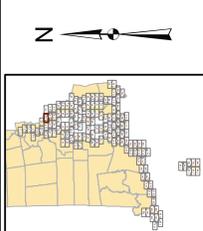


Tidal Marsh Vulnerability Analysis: Three Foot Sea Level Rise Model

- Potential Marsh Zone
- Persistent Marsh Zone
- Potential Marsh Loss
- Open Water and Tidal Flat
- Current Fresh Wetlands
- Protected Open Space
- Hardened Shores
- Buildings
- Parcel Boundaries
- Developed Land
- CRMC Coastal Barriers

1:10,000

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Map 11



Map produced by Kevin Ruddock. 4/7/2014

Appendices

Appendix 1: Resolution of Adoption

Appendix 2: Public Engagement Process

Appendix 3: Vulnerability Analysis —Criteria

Appendix 4: Critical Assets—Natural Hazards

Appendix 5: Vulnerability Analysis of Transportation Assets—Sea Level Rise (Statewide Planning Program)

Appendix 6: Presentation—Adaptation Projects

Appendix 7: Description of STAPLEE Criterion

Appendix 8: Local Mitigation Plan Review Tool

Appendix 1: Resolution of Adoption

TOWN OF BARRINGTON, RI
BRISTOL COUNTY, RHODE ISLAND

A RESOLUTION ADOPTING THE
TOWN OF BARRINGTON, RI – HAZARD MITIGATION PLAN

WHEREAS the Barrington Town Council recognizes the threat that natural hazards pose to people and property within Barrington; and

WHEREAS the Town of Barrington has prepared a multi-hazard mitigation plan, hereby known as the Town of Barrington Hazard Mitigation Plan, June 2017 in accordance with the Disaster Mitigation Act of 2000; and

WHEREAS the Town of Barrington Hazard Mitigation Plan identifies mitigation goals and actions to reduce or eliminate long-term risk to people and property in Barrington from the impacts of future hazards and disasters; and

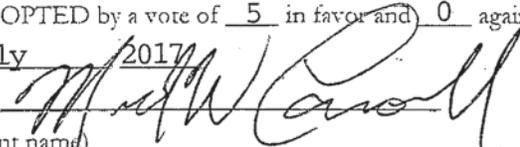
WHEREAS adoption by the Barrington Town Council demonstrates their commitment to the hazard mitigation and achieving the goals outlined in the Barrington Hazard Mitigation Plan, June 2017.

NOW THEREFORE, BE IT RESOLVED BY THE TOWN OF BARRINGTON, RHODE ISLAND,
THAT

The Town Council adopts the Barrington Hazard Mitigation Plan, June 2017

ADOPTED by a vote of 5 in favor and 0 against, and 0 abstaining, this 31st day of

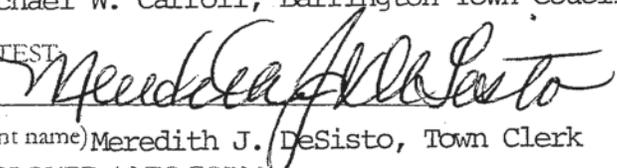
July 2017

By: 

(print name)

Michael W. Carroll, Barrington Town Council President

ATTEST

By: 

(print name) Meredith J. DeSisto, Town Clerk

APPROVED AS TO FORM:

By: _____

(print name)

Appendix 2: Public Engagement Process

Hazard Mitigation Plan On-Line Survey Results (Summary) - June-October 2015

Individual Comments from On-Line Survey, with Plan References

Postcard Mailing—Comprehensive Plan Workshops, Sept. 2014

Map – Comprehensive Plan Workshop Participants

Comprehensive Plan Workshop: Votes on Proposed Natural Hazards Element Strategies and Actions, with Hazard Mitigation Plan References

Minutes – August 4, 2015 Planning Board Meeting

Letters to East Providence and Warren Forwarding Plan for Comment

Flyer—May 31, 2017 Coastal Response Workshop Flyer

Meeting Summary—Hazard Mitigation Plan Committee, June 2017



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Hazard Mitigation

- Summary
- Design Survey
- Collect Responses
- Analyze Results

CURRENT VIEW

- + FILTER
- + COMPARE
- + SHOW

No rules applied

Rules allow you to FILTER, COMPARE and SHOW results to see trends and patterns. [Learn more](#) »

SAVED VIEWS (1)



Original View (No rules applied)

+ Save as...

EXPORTS

SHARED DATA

No shared data

Sharing allows you to share your survey results with others. You can share all data, a saved view, or a single question summary. [Learn more](#) »

Share All

RESPONDENTS: 31 of 31

Export All Share All

- Question Summaries
- Data Trends
- Individual Responses

All Pages

PAGE 1

Q1

Export

Where do you live? (street name only)

Answered: 31 Skipped: 0

- Responses (31)
- Text Analysis
- My Categories

PRO FEATURE

Use text analysis to search and categorize responses; see frequently-used words and phrases. To use Text Analysis, upgrade to a GOLD or PLATINUM plan.

Upgrade Learn more »

- Categorize as...
- Filter by Category

Search responses

Showing 31 responses

- Chachapacassett
12/17/2015 2:07 PM [View respondent's answers](#)
- Ferry Lane
9/10/2015 2:47 PM [View respondent's answers](#)
- Ferry
8/26/2015 1:26 PM [View respondent's answers](#)
- North lake drive
8/23/2015 12:17 PM [View respondent's answers](#)
- 68 Middle Highway
8/5/2015 11:52 AM [View respondent's answers](#)
- Sowams Rd
8/4/2015 11:18 PM [View respondent's answers](#)
- Lincoln Avenue
8/3/2015 7:38 AM [View respondent's answers](#)

PAGE 2

Q2

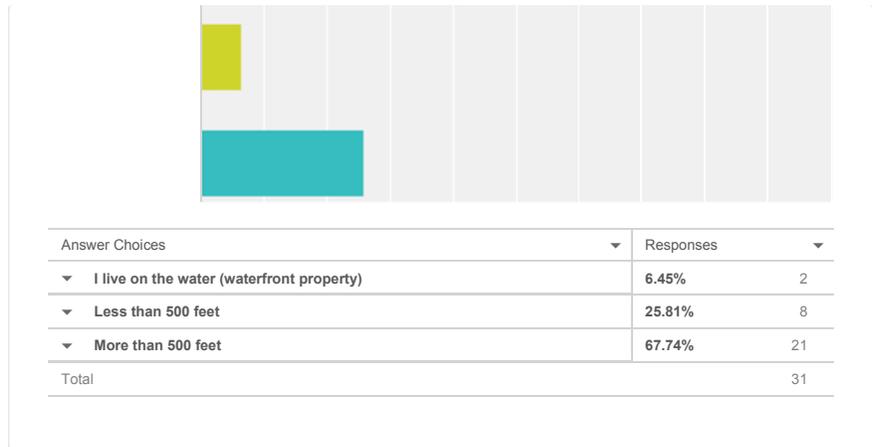
Customize Export

About how far is your house from the shore (Barrington River, Narragansett Bay, Palmer/Warren River, 100-Acre Cove)?

Answered: 31 Skipped: 0

I live on the water...

Less than 500 feet



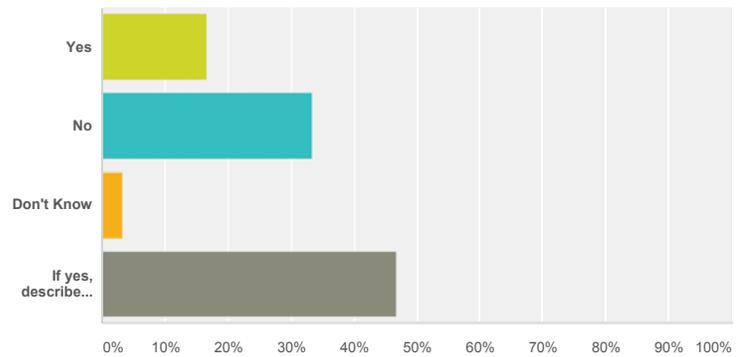
PAGE 3

Q3

Customize Export

Have you experienced or been impacted by a natural disaster in Barrington?

Answered: 30 Skipped: 1



Answer Choices	Responses
Yes	16.67% 5
No	33.33% 10
Don't Know	3.33% 1
If yes, describe hazard.	46.67% 14
Total	30

Q4

Customize Export

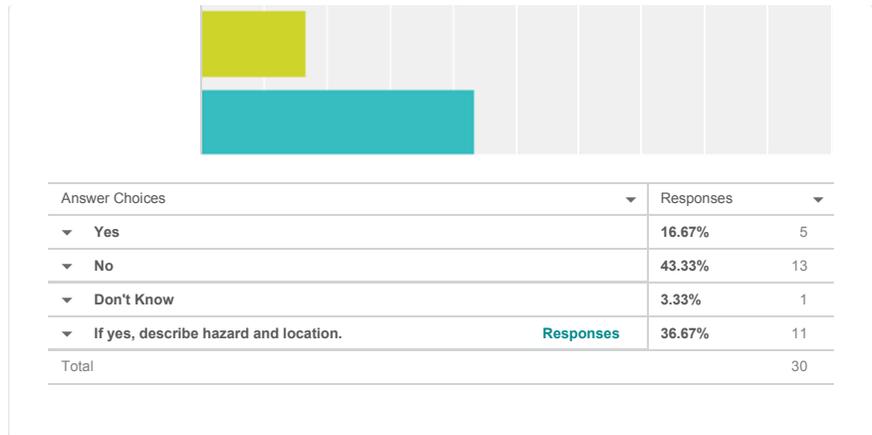
Have you experienced or been impacted by a natural disaster in another location?

Answered: 30 Skipped: 1

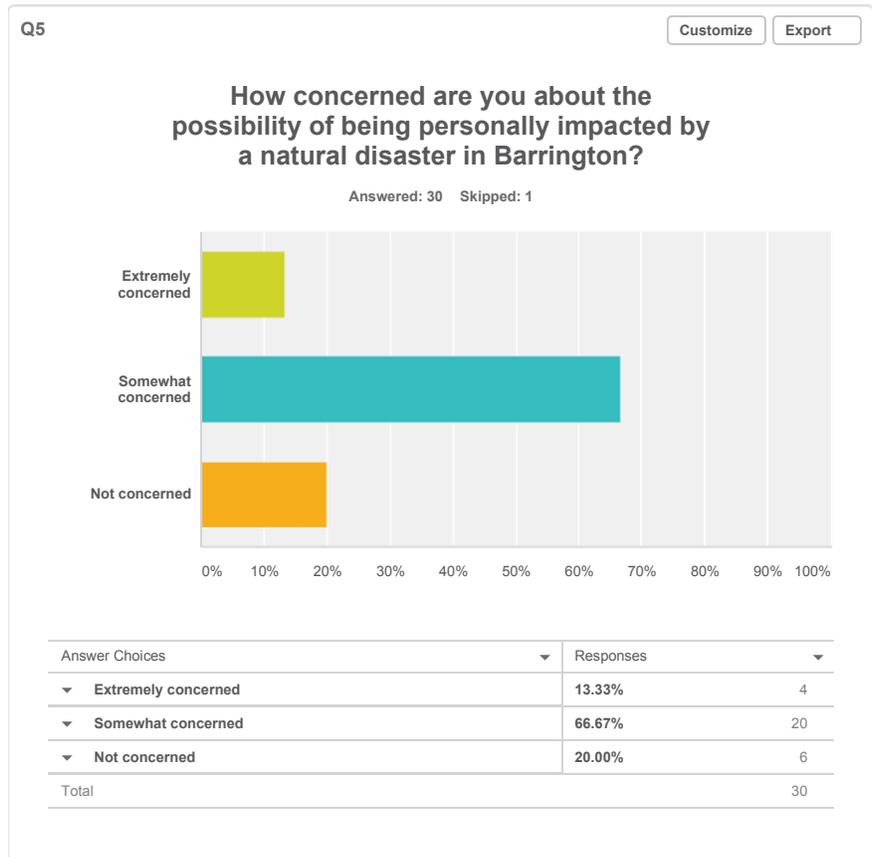
Yes

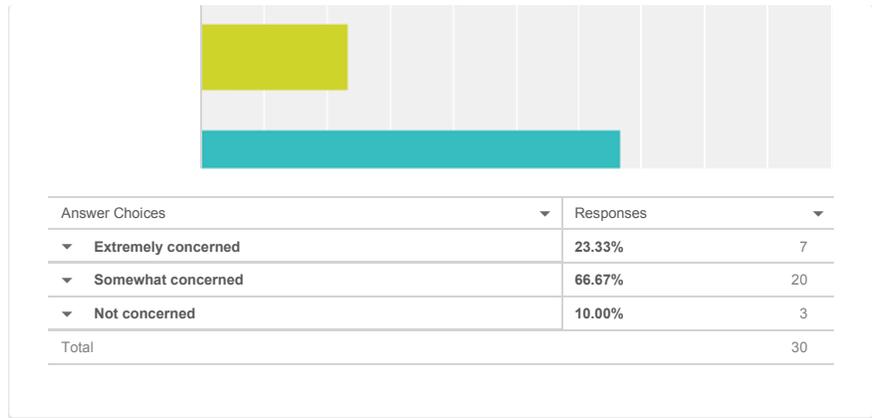
No

Don't Know



PAGE 4





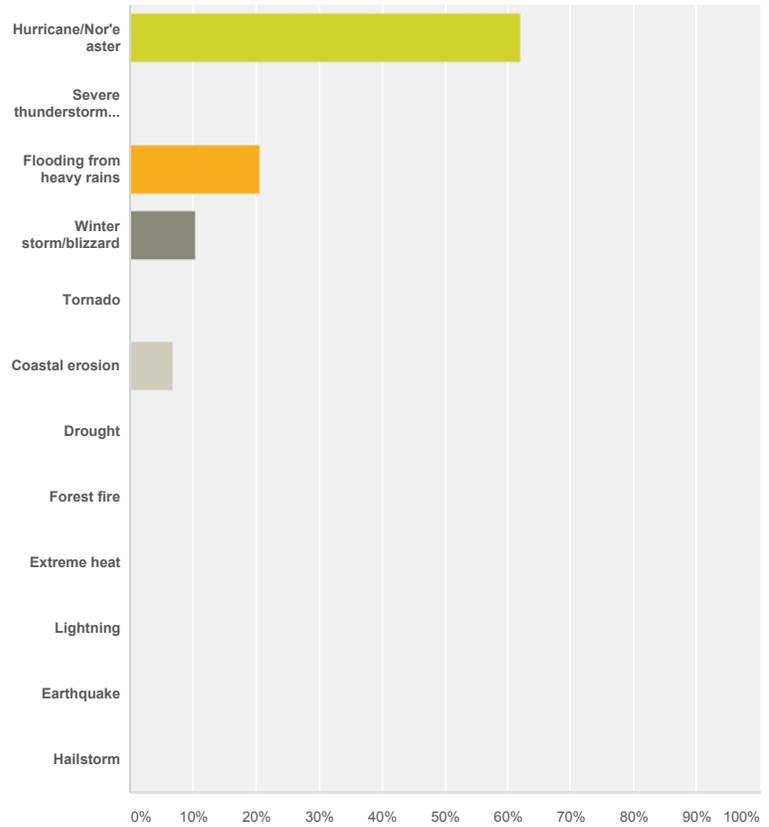
PAGE 5

Q7

Customize Export

Select the one hazard you consider the GREATEST threat to your neighborhood

Answered: 29 Skipped: 2



Answer Choices	Responses
Hurricane/Nor'easter	62.07% 18
Severe thunderstorm with high wind	0.00% 0
Flooding from heavy rains	20.69% 6
Winter storm/blizzard	10.34% 3
Tornado	0.00% 0
Coastal erosion	6.90% 2
Total	29

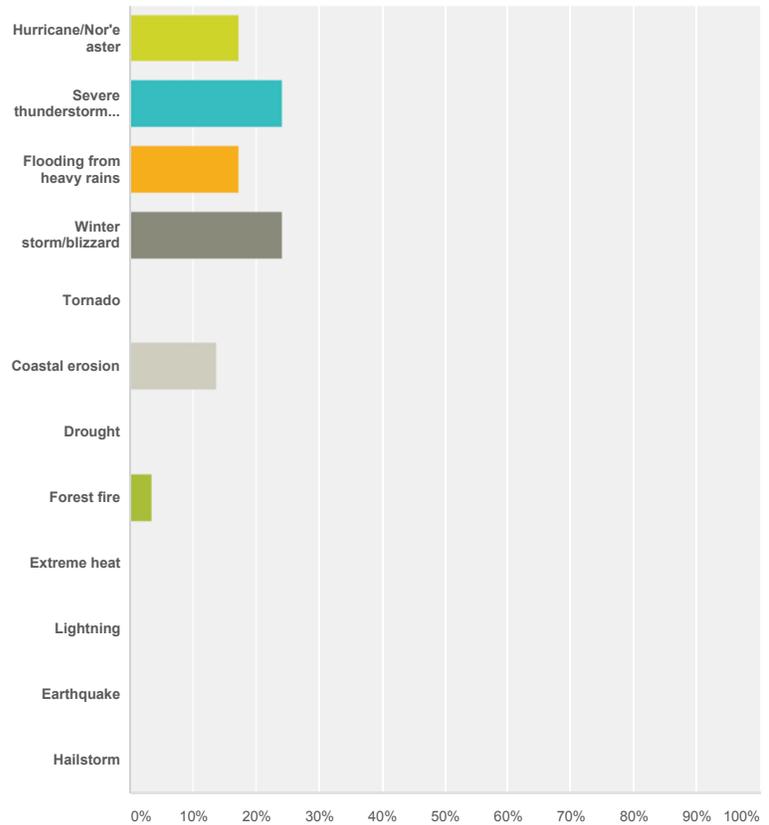
Answer Choices	Responses
▼ Drought	0.00% 0
▼ Forest fire	0.00% 0
▼ Extreme heat	0.00% 0
▼ Lightning	0.00% 0
▼ Earthquake	0.00% 0
▼ Hailstorm	0.00% 0
Total	29

Q8

Customize Export

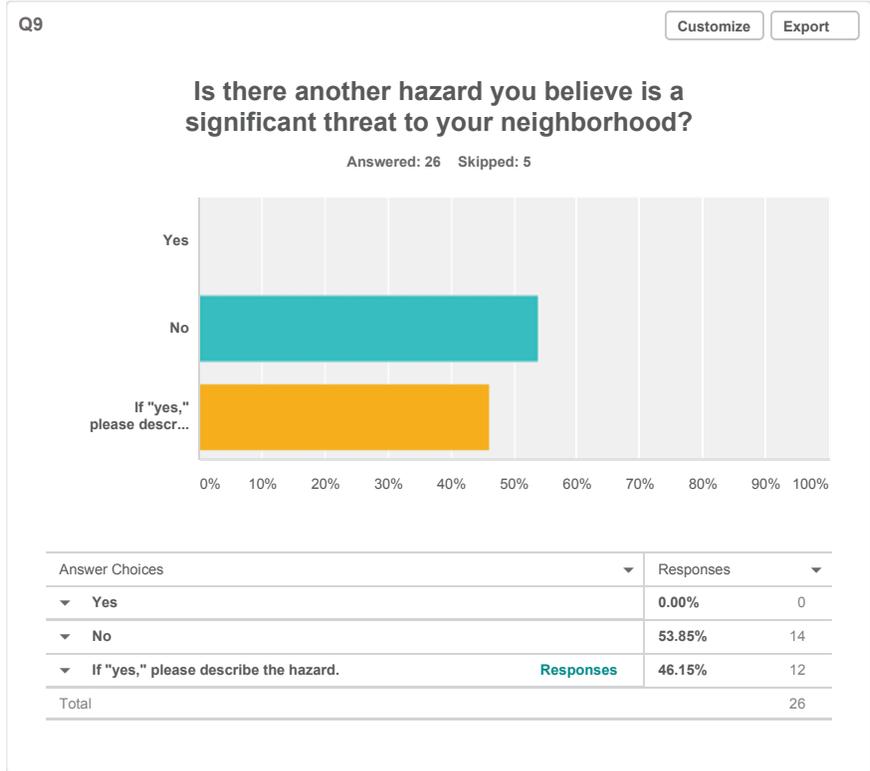
Select the one hazard you consider the **SECOND** highest threat to your neighborhood

Answered: 29 Skipped: 2

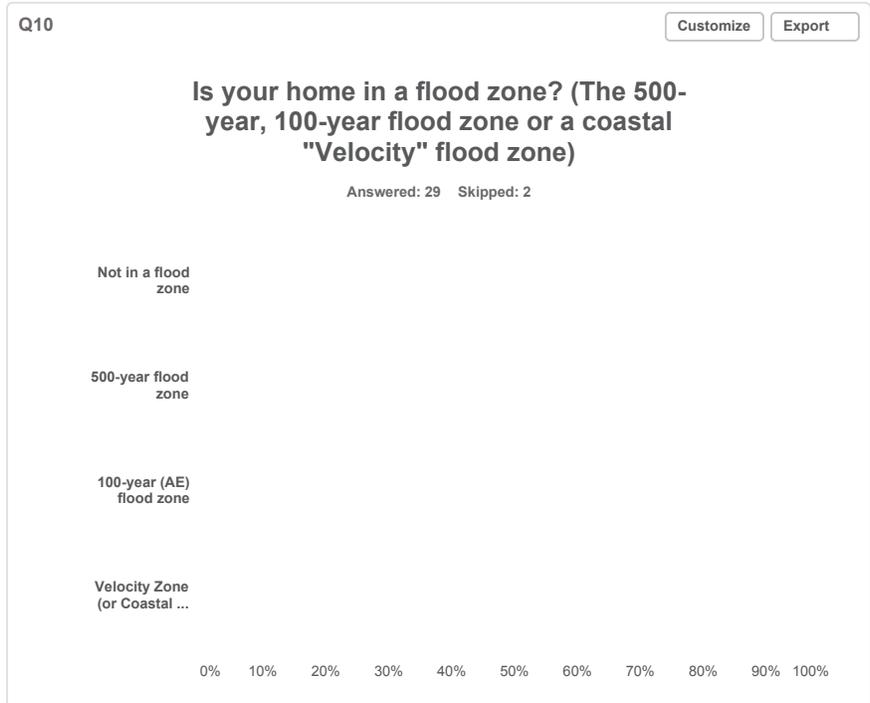


Answer Choices	Responses
▼ Hurricane/Nor'easter	17.24% 5
▼ Severe thunderstorm with high wind	24.14% 7
▼ Flooding from heavy rains	17.24% 5
▼ Winter storm/blizzard	24.14% 7
▼ Tornado	0.00% 0
▼ Coastal erosion	13.79% 4
▼ Drought	0.00% 0
▼ Forest fire	3.45% 1
▼ Total	29

Answer Choices	Responses
Extreme heat	0.00% 0
Lightning	0.00% 0
Earthquake	0.00% 0
Hailstorm	0.00% 0
Total	29



PAGE 6: Flood zone?



Answer Choices	Responses	
▼ Not in a flood zone	51.72%	15
▼ 500-year flood zone	20.69%	6
▼ 100-year (AE) flood zone	20.69%	6
▼ Velocity Zone (or Coastal AE zone)	6.90%	2
Total		29

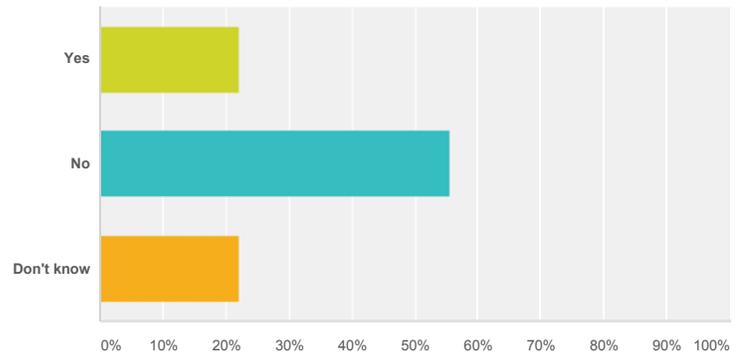
PAGE 7: Flood Insurance - Properties IN Flood Zones

Q11

Customize Export

Do you have flood insurance?

Answered: 9 Skipped: 22



Answer Choices	Responses	
▼ Yes	22.22%	2
▼ No	55.56%	5
▼ Don't know	22.22%	2
Total		9

PAGE 8: Cost of Insurance - Properties IN Flood Zones

Q12

Customize Export

How much does your flood insurance policy cost per year?

Answered: 2 Skipped: 29

- Less than \$1,000
- \$1,000 to \$2,000
- \$2,000 to \$4,000
- More than \$4,000



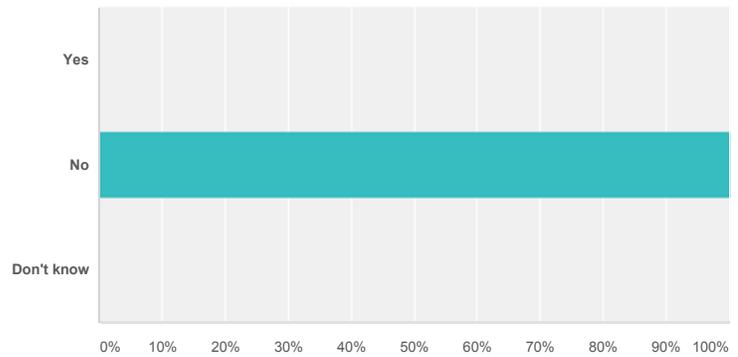
Answer Choices	Responses
Less than \$1,000	50.00% 1
\$1,000 to \$2,000	0.00% 0
\$2,000 to \$4,000	50.00% 1
More than \$4,000	0.00% 0
Total	2

Q13

[Customize](#) [Export](#)

Have you ever filed a flood insurance claim for flood damage to your home in Barrington?

Answered: 2 Skipped: 29



Answer Choices	Responses
Yes	0.00% 0
No	100.00% 2
Don't know	0.00% 0
Total	2

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Individual Comments from On-Line Survey, with Plan References (June-October 2015)

What should the Town of Barrington do to mitigate natural hazards in the future?	Plan References: Mitigation Strategy
more education to residents	Goal 4, Policy 4.1.1, Actions 4A, 4B, 4C
require new construction including additions & rehab to be well above flood levels, consider roof lines and height limitations in high wind areas too.	Suggested requirements not included in HMP. Refer to wind standards in existing building code requirements
Improve natural and man made drainage.	Goal 2, Policy 2.1.2, Actions 2A, 2C, 2D
retreat from shoreline and expanded coastal buffers	Action 2E
keep any new building above the 5 foot sea level rise impact zone	Action 1A to provide specific strategies for SLR
Not sure there is anything that can be done practically and economically	NA
Provide better maintenance of areas subject to flooding.	Maintenance item; not applicable as HMP strategy
Develop and implement hazard mitigation plans.	Plan includes implementation strategy and ongoing tracking of progress (Action 3C)
Preserve wetlands! They'll help with flooding.	Actions 2A, 2E
Burying electric lines would be helpful, not essential.	Not included as HMP strategy - cost-prohibitive to bury existing power lines. However, Town standards require underground electrical in new development
Restrict construction in at-risk zones, including flood zones.	Goal 1, Policy 1.1.2, Action 1C
Prepare public shelters and other infrastructure to assist in relief and recovery processes.	No new action. Primrose Hill School is the Town's Red Cross-certified shelter. Other public buildings are less suitable due to potential storm surge impacts. Town also has access to East Providence shelters.
Encourage residents to be better prepared than we are at present.	Goal 4, Policy 4.1.1, Actions 4A, 4B, 4C
I wish I would have been given some warning that conditions were ripe for ice dams. I was caught by surprise this winter when it happened.	Action 4B includes public outreach related to potential risks related to ice dams.
Educate the community and train volunteers as shelter workers	Action 4B calls on Town to train volunteers for shelters
Have a plan to help those in need?	Action 4C
Be aggressive in determining which trees have a lot of rot and contact homeowners. Remove decaying street trees.	Action 2B
Keep sidewalks and street drains clear.	NA (maintenance). This is performed by the Town's Department of Public Works.
I don't believe you can prepare for all natural disasters. We just need proper drainage and grading for the primrose hill field, during heavy rains it floods a large portion of our property and my neighbors.	See Action 1G
1) work with National Grid to keep power on 2) central resource to communicate re: natural disasters 3) designate more shelters	These procedures are already in place. Town has no additional public buildings other than Primrose Hill School that are suitable as shelters.
What should the Town of Barrington do to prepare for impacts of future sea level rise?	Inclusion in Plan: Action
Re-establish natural drainage areas particularly coastal for high tide relief	Action 2A

Continued on following page

Individual Comments from On-Line Survey, with Plan References (June-October 2015) - Continued

What should the Town of Barrington do to mitigate natural hazards in the future?	Plan References: Mitigation Strategy
Require all new street paving to incorporate improved drainage (could be as simple as road side grassy swales)	Action 1F. (Town already improves drainage as needed when completing street improvement projects)
Require sump pumps to tie into a dry well	Town requires houses in new subdivisions to capture roof runoff in dry wells. No new action recommended.
Rent or buy equipment to re-establish beach after severe storm erosion events (Florida-Siesta Key has done this regularly).	Town has equipment for maintaining beach and repairing erosion. No new action recommended.
retreat from shoreline and expanded coastal buffers	To be considered per Action 1A
all town planning should respect the 5 ft. sea level rise impact zone	To be considered per Action 1A
Improve drainage. Stop new construction in new flood prone areas.	Actions 1F, 1G
Consider changes to zoning code to protect coastal flood zones.	Action 1C
route 114 needs attention	Action 1B
Improve and maintain walls for properties where town facilities have removed natural barriers to wave/tide action (e.g., properties fronting the Town Beach parking lot)	Action 1B
Limit coastal development. If it doesn't have a house on it by now, there is very likely a reason. New housing in high frequency flood zones should be elevated	Action 1C (buildings already required to meet flood elevation requirements)
Restrict further development in town, and construction in at-risk zones.	1C
Commission and then publicize results of hazard assessments that include predicted water level rise.	1A
Stricter laws about building on the coast.	State/federal issue
Sea wall?	Action 1B
Coastal Water experts and engineers should meet with appropriate town committees, and if necessary a task force should be formed. All meetings should be open to the public.	Action 1A
Ensure coastal structures are built high enough to withstand strong storms at high tide.	No new action recommended. Already a requirement for development in VE zones, Coastal AE zones.
1) Limit coastal building	Action 1C
2) plant grasslands	Action 2A
3) curb carbon footprint	See Town's Strategic Energy Plan and Energy element of the 2015 Comprehensive Community Plan.

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BARRINGTON RI 02806-1234

Town of Barrington Comprehensive Plan Public Workshops

Learn about the Town's 10-year
plan update and share your ideas

Housing • Economic Development
Streets/Sidewalks/Transit/Bike Facilities
Open Space & Recreation
Energy • Natural Hazards
Natural & Cultural Resources
Community Facilities & Services

7 p.m. Sept. 22, 2014
Hampten Meadows School
297 New Meadow Rd

7 p.m. Sept. 25, 2014
Atria Bay Spring Village
147 Bay Spring Ave.
2nd Floor Activities Room

7 p.m. Sept. 30, 2014
Nayatt School
400 Nayatt Rd.

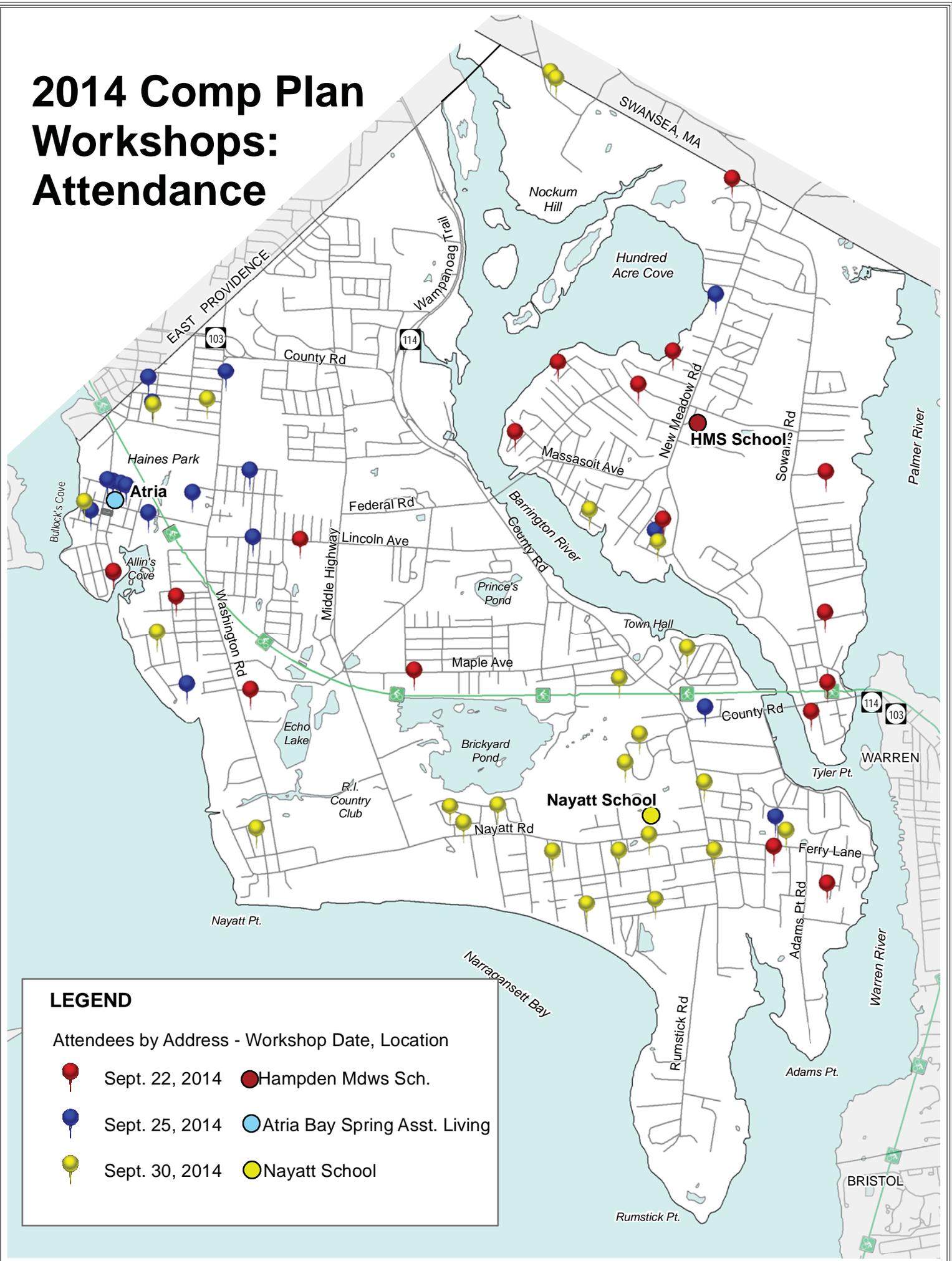
**Questions? Call the Planning
Office at 247-1900 x326**

**Review draft: barrington.ri.gov, Public Library reference desk,
Town Hall - Clerk's Office, Senior Center**



Follow Town of Barrington on Twitter @RI_Barrington

2014 Comp Plan Workshops: Attendance



Comprehensive Plan: September 2014 Public Workshops: Votes on Proposed Natural Hazards Element Strategies and Actions (with Hazard Mitigation Plan References)

Goal/Objective/Action	Votes		HMP Reference - Mitigation Strategy
	In Favor	Against	
Goal 1: Reduce current and future risk of natural hazards and sea level rise to the built environment.			Goal 1
Objective 1.1: By 2018 complete a town-wide assessment of the potential impacts to structures and infrastructure resulting from projected sea-level rise.	2		Objective 1.1
Actions			
A. Assess potential impacts, including physical and financial, of projected sea-level rise on publicly and privately owned buildings and sites and infrastructure	4		Action 1A
B. Include in capital improvement program critical projects required to mitigate threats to infrastructure and properties			Action 1B
C. Consider amending the Zoning Ordinance and subdivision regulations to require design standards that exceed FEMA's requirements			Action 1C
D. Provide support for property owners to help take advantage of funding opportunities	1		Action 3D
E. Publish illustrated design guidelines to provide ideas for designing building elevations that are compatible with the surrounding neighborhood			Action 1E
F. Adopt low-impact development standards to reduce the amount of impervious coverage			Action 1F
G. Provide measures to improve stormwater retention in planning and design of park improvements and construction of schools and other new public buildings			Action 1G
H. Amend stormwater management system regs to enhance infiltration, expand stormwater retention areas			Action 1F
I. Evaluate the condition of and impacts of dams	1		Action 2C
Goal 2: Preserve and enhance the capacity of the natural environment to improve Barrington's resilience against impacts of natural hazards.	1		Goal 2
Actions			
A. Prioritize and implement coastal adaptation projects to reduce flood risk and potential damage to vulnerable infrastructure, allow expansion of wetlands and other purposes	1		Action 2A
B. Identify tree species that will be most resilient to climate change and use these species in public projects			Action 2B
C. Assess streams and dams and prioritize projects needed to maintain/improve water flow	2		Action 2C
D. Develop plan to allow restoration of natural areas at Walker Farm			Action 2D
E. Implement tree management program to reduce risk to property due to winds, heavy snow/ice or other natural hazard impacts.			Action 2B
F. Work with local land trust and other stakeholders to identify low-lying vulnerable land that could be designated as permanently protected open space	2		Action 2E
Goal 3: Participate in FEMA's Community Ratings System to reduce risk and the cost of flood insurance within Barrington.	1		Action 3A

Continued on following page

Comprehensive Plan: September 2014 Public Workshops: Votes on Proposed Natural Hazards Element Strategies and Actions (with Hazard Mitigation Plan References) - Continued

Goal/Objective/Action	Votes		HMP Reference - Mitigation Strategy
	In Favor	Against	
Objective 3.1: Achieve a Community Rating System score of “7” or better by 2020 (with “1” being the top score).			Objective 3.1
Actions			
A. Complete steps required to enroll in National Flood Insurance Program Community Rating System	8		Action 3A
B. Engage consultant or provide staff training for a certified floodplain manager to coordinate implementation of CRS activities and implement Hazard Mitigation Plan.	1		Action 3B
C. Complete the required Hazard Mitigation Plan five-year update that addresses effects of climate change and includes activities that would achieve CRS goal of “7” by 2020	1		Action 3C
D. Update Hazard Mitigation Plan as necessary to address impacts of new significant natural hazard events such as severe flooding, wind damage and storm surge	1		Action 3C
E. Establish an administrative team to meet quarterly to review progress on implementation of Hazard Mitigation Plan and activities resulting in CRS credit	3		Action 3C
Goal 4: Improve the community’s awareness of threats to minimize risk to the public due to natural hazards.			Goal 4
Actions			
A. Use informational signs at areas of historic flooding showing the 1938 surge elevations along the bay and rivers and update as necessary based on March 2010 flooding	1		Action 4A
B. Outreach to community members through orchestrated public forums, TV, and the Town website to inform public about emergency preparedness during hurricane season immediately before an event	3		Action 4B
C. Establish process to directly contact special populations to ensure their understanding of procedures immediately before and after an event			Action 4C
D. Expand the “Emergency Information” section of the Town’s website to provide information on minimizing risk to private property and on general preparedness			Action 4B

TOWN OF BARRINGTON PLANNING BOARD

Regular Business Meeting
Minutes of the August 4, 2015 Meeting
Council Chamber – Second Floor, Barrington Town Hall

Open Meeting: The meeting was called to order at 7:27 p.m. by Mr. Trim.

Present: Lawrence Trim, Jr. – Vice Chair (Acting Chair), Timothy Lang, Edgar Adams, Jean Robertson, Paul Dulchinos,

Absent: Anne Galbraith, Christine O’Grady, Adamson Streit

Also Present: Solicitor Andy Teitz, Town Planner Philip Hervey, Council liaison Michael Carroll, Mary Ann Rosenlof, secretary

Consent Agenda

Item 3.1: Approve Minutes: July 7, 2015 Regular Business Meeting

Motion: Mr. Adams made a motion to approve the minutes as submitted; Mr. Lang seconded the motion, which carried unanimously (5-0).

Mr. Teitz suggested that due to the hot conditions in the Council Chamber, that all Agenda items be postponed except for the Bluemead Farm Subdivision application (6.1), the Hazard Mitigation Plan Update (6.4) and the Election of Officers (6.3).

Motion: Mr. Dulchinos made a motion to amend the agenda as suggested by Mr. Teitz .

Ms. Robertson seconded the above motion, which carried unanimously (5-0).

New Business

6.1 Request to Release Portion of Improvement Guaranty – Bluemead Farm Subdivision, Chachapacassett and Beach Roads

Present: Bruce Cox, Esq., Sleprow, Sleprow and Associates, Inc., 1481 Wampanoag Trail, East Providence, RI 02915

Mr. Cox said the Bluemead Family Limited Liability Partnership is requesting Planning Board approval of an agreement establishing an administrative process to release portions of the \$525,565 cash bond to allow for payments to the contractor building the roadway and preparing lots for construction. The contractor, ELJ Inc. of Bristol, is ready to start construction, with the goal of completion of the roadway (binder coat) in November. The contractor seeks to have assurances that progress payments will be made as the road is built. Mr. Cox said that to facilitate the construction and the payment, the applicant will be paying the initial cost of \$50,000. Bluemead is seeking Board approval of an agreement, provided by Mr. Cox, to release the bond in installments upon request and verification by the Town that the phase has been completed.

The applicant’s proposed process would include:

1. A sign off on the phase by the Director of Public Works
2. Sign off by the Town’s reviewing engineer
3. Certification from the contractor that they have received no notice of liens or intent to file a lien

4. Certification of title by Bluemead Family, LLP's counsel that title remains clear with no notice of lien or intent to file a lien upon the property.

Mr. Hervey said that the Town will need additional fees for the Town's engineering consultant review/inspections, as there may not be enough money remaining to cover this cost.

Mr. Cox discussed the proposed road development timetable as noted in the draft that he submitted of the agreement between ELJ and Bluemead.

Mr. Teitz suggested that the amount of the bond release delegated to the administrative officer, Mr. Hervey, should not exceed \$335,000 – enough to cover the applicant's first two installment payments to the contractor. The applicant would need to return to the Planning Board, with reports and other information, to request Board approval of the release of the bond in excess of the \$335,000 total. The Town's payments to any consulting engineers should come out of this fund, Mr. Teitz said.

Motion: Mr. Adams made a motion to delegate the release of the cash bond to Bluemead Family Partnership in amounts not to exceed \$335,000 total; authorize payment of the Town's consulting engineer review fees from the bond funds held by the Town; and to not act on any further release at this time.

Mr. Dulchinos seconded the above motion and a vote was held:

L. Trim – Yea	T. Lang - Yea
P. Dulchinos – Yea	J. Robertson - Yea
Edgar Adams – Yea	

Motion carried, 5-0.

6.4 Discuss Hazard Mitigation Plan Update, Including Planning for Impacts of Sea Level Rise

Present: Peter C. Cusolito, Senior. Security & Emergency Management Planner, Vanasse Hangen Brustlin, Inc., Providence, RI

Mr. Cusolito noted that VHB was hired by the Town to update the five-year Hazard Mitigation Plan update, as required to maintain a FEMA-approved plan. He noted VHB also assisted the Town with writing the plan update in 2010. The planning process is prescribed by FEMA. Part of this plan includes an assessment of the risk from sea level rise and measures to mitigate that risk over time.

Mr. Cusolito presented a PowerPoint which addressed the following:

- Mitigation Planning Process
- Hazard Identification
- Mitigation Strategy
- Mitigation Goals
- 2010 Mitigation Actions

Questions from Board members were addressed during this presentation.

The Hazard Mitigation Plan must be submitted to FEMA by November 2015. Mr. Cusolito noted that the Town of Barrington has one of the best Comprehensive Plans that he has seen and having a plan that has been recently updated is a huge benefit when going into the hazard mitigation plan process.

Sandra Wyatt, 28 Byway Road, asked why the Town is having this presentation tonight since the Comprehensive Plan has covered all of this information. Mr. Hervey explained that the Hazard Mitigation Plan, which is different than the Comprehensive Plan, must be updated and approved by FEMA in order for the Town to remain eligible for hazard mitigation grants.

6.3 Elect Officers

Nomination and election of Planning Board Officers:

- Nomination made by Mr. Dulchinos to elect Mr. Trim as Chairman. The nomination carried unanimously.
- Nomination made by Mr. Trim to elect Mr. Dulchinos as Vice Chairman. The nomination carried unanimously.
- Nomination made by Mr. Trim to elect Mr. Adams as Secretary. The nomination carried unanimously.

Reports & Special Items

Police Cove Park: Mr. Hervey reported that the park construction is progressing well, but a few minor issues have slowed things the completion schedule somewhat, including removal of a lot of buried concrete that remained from the old foundation of the police station. The Town is also seeking additional funding from the state to add the construction of a new boat ramp to the construction contract. The existing design includes electrical hook-ups for food trucks. Water and sewer connections for a new restroom will also be added.

Mr. Carroll said that the Blue Star Memorial Marker was approved by the Town Council and will be located near County Road to the east of the bike path connector.

Ms. Robertson asked that consideration be given to local businesses for providing food trucks at Police Cove since they pay property taxes and give to local charities.

Comments from Board Members, Council Liaison, Town Planner

No comments.

Adjournment

Upon a motion by Mr. Dulchinos, seconded by Mr. Trim, the Board voted to adjourn the meeting at 9:02 p.m.



OFFICE OF THE TOWN PLANNER

TOWN OF BARRINGTON
RHODE ISLAND

May 22, 2017

Wayne Barnes
Senior Planner
Deputy EMA Director
City of East Providence
145 Taunton Avenue
East Providence, RI 02914

RE: Town of Barrington –Hazard Mitigation Plan: 2017 Update

Dear Mr. Barnes:

Enclosed please find the Town of Barrington's draft 2017 Hazard Mitigation Plan. We are sharing in order to invite the City of East Providence to review and comment on the Plan. The Town anticipates forwarding the Plan to FEMA later this summer. Please direct comments to the Office of the Town Planner, 283 County Road, Barrington, RI, or to me via email: phervey@barrington.ri.gov.

Feel free to call me if you have questions.

Sincerely,

Philip Hervey, AICP
Town Planner



OFFICE OF THE TOWN PLANNER

TOWN OF BARRINGTON
RHODE ISLAND

May 22, 2017

Kate Michaud
Town Planner
Town of Warren, RI
514 Main Street
Warren, RI 02885

RE: Town of Barrington – Hazard Mitigation Plan: 2017 Update

Dear Ms. Michaud:

Enclosed please find the Town of Barrington's draft 2017 Hazard Mitigation Plan. We are sharing in order to invite the Town of Warren to review and comment on the Plan. The Town of Barrington anticipates forwarding the Plan to FEMA later this summer. Please direct comments to the Office of the Town Planner, 283 County Road, Barrington, RI, or to me via email: phervey@barrington.ri.gov.

Feel free to call me if you have questions.

Sincerely,

Philip Hervey, AICP
Town Planner

CLIMATE RESPONSE

Join us for a panel discussion about sea level rise and increased storm impacts on the town of Barrington and information about Barrington and Warren's selection as a climate change demonstration site.

With extensive coastline and low-lying areas near the water, Barrington and Warren are among the most vulnerable communities at risk of significant impact from sea level rise over the coming decades.

A panel of coastal experts will join town officials at this public workshop focusing on Barrington to discuss sea level rise and storm surge; state plans, policies and actions on shoreline change; tools for evaluating future impacts; and current and future adaptation strategies to enhance ecosystem and community resilience.

The overall purpose of this workshop is to discuss tools and options for state, city, and town governments, planners and policymakers, businesses, homeowners to address storm surge, flooding, sea-level rise, and other climate change factors.

PUBLIC WORKSHOP

7-9 p.m. Wednesday, May 31, 2017
Town Council Chamber at Barrington Town Hall
283 County Road

FREE

**Registration
not required**

Presentation and Panel Discussion by:

URI Coastal Institute, URI Coastal Resources Center,
CRMC, Save the Bay, Town of Barrington

**For more information, contact Barrington Town Planner
Philip Hervey: phervey@barrington.ri.gov**



Agenda

- 7:00 Welcome (Town Manager Jim Cunha)
- 7:10 Introduction of Panel (Town Planner Philip Hervey)
- 7:15 Sea Level Rise and Storm Surge (Charles Roman)
- 7:30 Online Tools to Assess Coastal Risk (Teresa Crean)
- 7:45 CRMC Climate Policies (Janet Freedman)
- 8:00 Coastal Adaptation Projects in Barrington (Wenley Ferguson)
- 8:15 Questions and Discussion

About the Panel

Philip Hervey, AICP, Town Planner for Barrington, has a Bachelor of Arts degree from the University of Maryland at College Park (1990) and a Master of Regional Planning degree from the University of North Carolina at Chapel Hill (2000). From 2000 to 2005 he was a long-range planner in the Town of Chapel Hill, NC, Planning Department. He has served as Barrington's Town Planner since September 2005.

Charles Roman is an Associate Director of the URI Coastal Institute and Research Professor in the URI Department of Natural Resources Science. He recently retired from the US National Park Service serving as a senior coastal scientist for over 25 years. He is currently engaged in the Coastal Institute's Climate Response Demonstration Site initiative, a program working with local communities and partners to investigate approaches for adapting to sea level rise, storm surge and flooding.

Teresa Crean, AICP, is a Coastal Community Planner at the URI Graduate School of Oceanography's Coastal Resources Center & RI Sea Grant. Teresa facilitates municipal-scale projects that address coastal adaptation to climate change and sea level rise. This work involves evaluating spatial data to identify challenges and opportunities with municipal stakeholders, while collaboratively considering policies and projects that may increase coastal resiliency. She earned a Master of Landscape Architecture from SUNY College of Environmental Science and Forestry at Syracuse, a B.S. in Environmental Policy/Natural Resource Management from the University of Michigan.

Janet Freedman is a Coastal Geologist with the R.I. Coastal Resources Management Council. She is currently working with several partners at URI, RI Sea Grant and Eastern Connecticut State University on developing and implementing the Shoreline Change Special Area Management Plan (BeachSAMP). The BeachSAMP will incorporate shoreline erosion, sea level rise, and storm surge impacts into CRMC policy in order to increase coastal resilience under changing conditions.

Wenley Ferguson is Save The Bay's Restoration Coordinator. Wenley has worked at Save The Bay since 1990 on a variety of habitat and water quality assessment and restoration projects throughout Narragansett Bay and its watershed. Projects have included salt marsh and coastal buffer restoration projects, coastal adaptation projects and stormwater infiltration projects.

Meeting Summary

Hazard Mitigation Plan Committee

11 a.m. Monday, June 5, 2017

School Committee Room, Barrington Town Hall, 283 County Road

Committee Members in Attendance:

Philip Hervey (Chair), Town Planner; James J. Cunha, Town Manager; Joe Piccerelli, Public Works Director; Fire Chief Gerald Bessette; Building Official Bob Speaker; Police Chief John LaCross; Harbormaster Ray Sousa; Matt Amaral, president of the Barrington Business Association and insurance agent at OceanPoint Insurance.

Mr. Hervey convened the meeting at 11:04 a.m. He said the purpose of the meeting is to complete the final review of the Hazard Mitigation Plan (June 2017) prior to the Town Council's meeting. Edits recommended by the committee will be submitted to the Council for consideration.

Mr. Sousa requested changing "harbor patrol" at the top of page to "waterways management." He suggested adding that the coastline includes 11.5 miles of tidal shoreline (page 10).

(Page 51) Chief Bessette said the number of firefighters is 28, reflecting the addition of four personnel authorized in the 2017-18 budget. Chief LaCrosse said the 800 MHz system went online in 2017, not 2016. Chief Bessette said the Primrose Hill School shelter is Red Cross certified but the main shelter for the Town is at East Providence High School, under a memorandum of understanding between East Providence and Barrington.

Mr. Amaral suggested expanding the communication piece to include, for example, texting to get the message out in cases of emergency. The School Department relies on text messages in events of emergency.

The Committee was in consensus supporting adoption of the plan, to include the edits as discussed.

Appendix 3: Vulnerability Analysis - Criteria

Table A3.1 Exposure Analysis

Subjective Description	Area Impact Score
Less than 10 percent of planning area or isolated single-point occurrences	Negligible
10 to 25 percent of the planning area or limited single-point occurrences	Limited
25 to 75 percent of planning area or frequent single-point occurrences	Significant
75 to 100 percent of planning area or consistent single-point occurrences	Extensive

Table A3.2 Extent

Subjective Description	Extent Score
Limited classification on scientific scale, slow speed of onset or short duration of event, resulting in little to no damage	Weak
Moderate classification on scientific scale, moderate speed of onset or moderate duration of event, resulting in some damage and loss of services for days	Moderate
Severe classification on scientific scale, fast speed of onset or long duration of event, resulting in devastating damage and loss of services for weeks or months	Severe
Extreme classification on scientific scale, immediate onset or extended duration of event, resulting in catastrophic damage and uninhabitable conditions	Extreme

Table A3.3 Frequency

Approximate Annual Probability	Subjective Description	Frequency Score
90-100%	Frequently recurring hazards, multiple recurrences in one lifetime	Highly Likely
10-90%	Probability of occurrence in the next year or a recurrence interval of 1 to 10 years	Likely
1-10%	Probability of occurrence in the next year or a recurrence interval of 11 to 100 years.	Occasional
< 1%	Less than 1% probability occurring in the next year or recurrence interval greater than 100 years	Unlikely

Appendix 4: Critical Sites—Natural Hazards

Critical Asset	Location	Ownership	Primary Natural Hazards	Primary Threat
SPECIAL POPULATION CENTERS				
Senior Center (Ground Floor Public Library)	281 County Road	Town	Earthquake	Structural damage
Bay Spring Assisted Living Facility	Bay Spring Avenue	Private	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Barrington Cove Apartments	Bay Spring Avenue	Private	Hurricane – Category 3 storm surge	Flooding
SCHOOLS				
Barrington Christian Academy	9 Old County Road	Private	Hurricane – Category 4 storm surge	Flooding
Barrington Early Childhood Center	448 College Lane	Private	N/A	N/A
Kids Quarters	64 Bay Spring Avenue	Private	Hurricane – Category 4 storm surge	Flooding
Montessori Centre of Barrington	303 Sowams Road	Private	Hurricane – Category 2 storm surge	Flooding
Nayatt School	400 Nayatt Road	Town	Hurricane – Category 2 storm surge	Flooding
Barrington High School	220 Lincoln Avenue	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Barrington Middle School	Middle Highway	Town	Hurricane – Category 3 storm surge	Flooding
Primrose Hill School*	Middle Highway	Town	N/A	
Hampden Meadows School	New Meadow Road	Town	Hurricane – Category 4 storm surge	Flooding
Sowams Elementary School	364 Sowams Road	Town	Hurricane – Category 2 storm surge	Flooding
JCC at Temple Habonim-Barrington	165 New Meadow Road	Private	Hurricane – Category 2 storm surge	Flooding
Red Brick School	50 Middle Highway	Private	N/A	N/A
St. Andrew's School	63 Federal Road	Private	N/A	N/A
Tot's Cooperative Nursery School	461 County Road	Private	Flood – 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding
St. Luke School	10 Waldron Avenue	Private	N/A	N/A
EMERGENCY/OPERATING CENTERS				
Fire Station	100 Federal Road	Town	Hurricane – Category 3 storm surge	Flooding
Hampden Meadows Volunteer Fire Department	Sowams Road	Town	Hurricane – Category 2 storm surge	Flooding
Police Station/Public Safety	100 Federal Road	Town	Hurricane – Category 4 storm surge	Flooding
Town Hall	285 County Road	Town	Earthquake	Structural damage
Bay Spring Community Center	17 Blanding Avenue	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Department of Public Works	Upland Way	Town	N/A	N/A

*Red Cross shelter

Appendix 4: Critical Sites—Natural Hazards (Continued)

Critical Asset	Location	Ownership	Primary Natural Hazards	Primary Threat
RESIDENTIAL & COMMERCIAL PROPERTIES				
Various	Various	Private	Flood – Coastal flood (Zone VE), 100-year Flood Zone (AE) Hurricane – Category 1-4 storm surge	Flooding
DAMS				
Echo Lake Dam	South Lake Drive	R.I. Country Club	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Rhode Island Country Club Dam	Washington Road	R.I. Country Club	Flood – 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding
Unnamed Dam at Barrington Cove Apartments	Bay Spring Avenue	Private	Flood – Coastal flood w/ velocity hazard (Zone VE), 100-year Flood Zone (AE) Hurricane – Category 1/2 storm surge	Flooding
UTILITIES				
Bay Spring Ave Pump Station	Bay Spring Ave	Town	Flood – Coastal flood w/ velocity hazard (Zone VE), 100-year Flood Zone (AE) Hurricane – Category 1/2 storm surge	Flooding
Brickyard Pond Pump Station	Brickyard Pond	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Freemont Pump Station	Freemont Ave	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 1/2 storm surge	Flooding
Police Station Pump Station	Police Cove	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding
Prince’s Pond Pump Station	County Road/ Prince’s Pond	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding
Walnut Road Pump Station	Walnut Road	Town	Hurricane – Category 3/4 storm surge	Flooding
Adam’s Point Ejector Station	Adam’s Point Road	Town	Flood – Coastal flood (Zone VE) Hurricane – Category 1 storm surge	Flooding
Juniper Street Ejector Station	Juniper Street	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding
Nayatt Point Ejector Station	Washington Road	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 1/2 storm surge	Flooding
Rumstick Ejector Station	Rumstick Road	Town	Flood – Coastal flood w/ velocity hazard (Zone VE) Hurricane – Category 1/2 storm surge	Flooding
Wampanoag Ejector Station	Wampanoag Trail	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding
Elm Lane Grinder Station	Elm Lane	Town	Hurricane – Category 4 storm surge	Flooding
Nayatt Road Grinder Station	Nayatt Road	Town	Hurricane – Category 4 storm surge	Flooding
Pheasant Lane Grinder Station	Pheasant Lane	Town	Flood – 100-year Flood Zone (AE) Hurricane – Category 2 storm surge	Flooding

Appendix 4: Critical Sites—Natural Hazards

Critical Asset	Location	Ownership	Primary Natural Hazards	Primary Threat
Strawberry Drive Grinder Station	Strawberry Drive	Town	Flood – 100-year Flood Zone (AE)	Flooding
National Grid Substation	Maple Avenue	National Grid	Hurricane – Category 2 storm surge Winter Storms	Wind, ice and snow
TRANSPORTATION				
Massasoit Avenue Bridge	Massasoit Avenue	State	Flood – 100-year Flood Zone (AE) Hurricane – Category 1/2 storm surge	Flooding
Barrington River Bridge	County Road/Rte. 114/103	State	Flood – 100-year Flood Zone (AE)	Flooding
Warren River Bridge	County Road/Rte. 114/103	State	Flood – 100-year Flood Zone (AE)	Flooding
Warren River Bike Path Bridge	Warren River north of Rte. 114/103	State	Flood – 100-year Flood Zone (AE)	Flooding
Barrington River Bike Path Bridge	Barrington River north of Rte. 114/103	State	Flood – 100-year Flood Zone (AE)	Flooding
Evacuation Routes	Various / Wampanoag Trail in particular	Town, State	Flood – 100-year Flood Zone (AE)	Flooding
NATURAL RESOURCES				
Town Beach		Town	Flood – Coastal flood (Zone VE), 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding, Coastal erosion
Latham Park		Town	Flood – Coastal flood (Zone VE), 100-year Flood Zone (AE) Hurricane – Category 1 storm surge	Flooding, Coastal erosion

Appendix 5: Vulnerability Analysis of Transportation Assets—Sea Level Rise

STATEWIDE PLANNING INVENTORY OF RHODE ISLAND TRANSPORTATION ASSETS EXPOSED TO TIDAL WATER AT 1, 3, AND 5 FEET OF SEA LEVEL RISE (Source: <http://www.planning.ri.gov/geodeminfo/data/slr.php>)

Assets are listed once under each SLR scenario under which they will flood. Ports and harbors are grouped by general purpose according to the methodology detailed in Technical Paper XX. Major individual port and harbor facilities are pulled out individually, and are also included in ports/harbors listed only by general purpose.

SLR Scenario	Asset Name	SLR Scenario	Asset Name
1	Belvedere Ave	3	Stanley Ave
1	Federal Rd	3	Wallis Ave
1	Massasoit Ave	3	Watson Ave
1	Mathewson Rd	3	Willow Way
1	Nayatt Rd	3	County Rd/Rte 103
1	County Rd/Rte 103	3	Wampanoag Trl/Rte 114
3	Allen Ave	5	3rd St
3	Baron Rd	5	Adams Ave
3	Barton Ave	5	Adams Point Rd
3	Belvedere Ave	5	Allen Ave
3	Bluff Rd	5	Anchorage Way
3	Bourne Ln	5	Annawamscutt Rd
3	Clarke Rd	5	Appian Way
3	Commonwealth Ave	5	Arvin Ave
3	Edwin St	5	Baron Rd
3	Federal Rd	5	Barton Ave
3	Ferry Ln	5	Bay Rd
3	Garden Ave	5	Bay Spring Ave
3	Jennys Ln	5	Beach Rd
3	Juniper St	5	Belvedere Ave
3	King Philip Ave	5	Blount Cir
3	Kyle Cir	5	Bluff Rd
3	Latham Ave	5	Bourne Ln
3	Lillis Ave	5	Bowden Ave
3	Massasoit Ave	5	Byway Rd
3	Mathewson Rd	5	Carver Rd
3	Meadowbrook Dr	5	Chapin Rd
3	Nayatt Rd	5	Clarke Rd
3	New Meadow Rd	5	Commonwealth Ave
3	Orchard Av	5	Edwin St
3	Palmer St	5	Federal Rd
3	Peck Ln	5	Federal Rd
3	Primrose Hill Rd	5	Ferry Ln
3	Puritan Dr	5	Garden Ave
3	Read Ave	5	Greene Ave
3	Riverview Dr	5	Jennys Ln
3	Sowams Rd	5	Juniper St

Appendix 5: Vulnerability Analysis of Transportation Assets—Sea Level Rise

STATEWIDE PLANNING INVENTORY OF RHODE ISLAND TRANSPORTATION ASSETS EXPOSED TO TIDAL WATER AT 1, 3, AND 5 FEET OF SEA LEVEL RISE (Source: <http://www.planning.ri.gov/geodeminfo/data/slr.php>)

Assets are listed once under each SLR scenario under which they will flood. Ports and harbors are grouped by general purpose according to the methodology detailed in Technical Paper XX. Major individual port and harbor facilities are pulled out individually, and are also included in ports/harbors listed only by general purpose.

SLR Scenario	Asset Name	SLR Scenario	Asset Name
5	King Philip Ave	5	Puritan Dr
5	Kyle Cir	5	Quincy Adams Rd
5	Latham Ave	5	Read Ave
5	Lillis Ave	5	Riverview Dr
5	Lincoln Ave	5	Rose Ln
5	Linden Rd	5	Samoset Ave
5	Massasoit Ave	5	Seabrook Ct
5	Mathewson Rd	5	Seaview Dr
5	Meadowbrook Dr	5	Sowams Rd
5	Melrose Ave	5	Spring Ave
5	Nayatt Rd	5	Stanley Ave
5	New Meadow Rd	5	Starbrook Dr
5	Oak Grove Ave	5	Stone Tower Ln
5	Olive Ln	5	Tiffany Cir
5	Opechee Dr	5	Virginia Rd
5	Orchard Av	5	Wallis Ave
5	Oyster Shell Ln	5	Wampanoag Trl
5	Palmer Ln	5	Watson Ave
5	Palmer St	5	Willow Way
5	Peck Ln	5	Woodward Ave
5	Pinetop Rd	5	County Rd/Rte 103
5	Plymouth Dr	5	Wampanoag Trl/Rte114
5	Primrose Hill Rd		
5	Priscilla Dr		

Appendix 6: Presentation—Adaptation Projects

Save the Bay presented a PowerPoint to the Barrington Planning Board on April 2, 2013, which illustrating potential adaptation projects throughout town to accommodate increasingly higher tides from rising seas. The presentation is on the following pages.

Save The Bay Coastal Adaptation Project Barrington Assessment

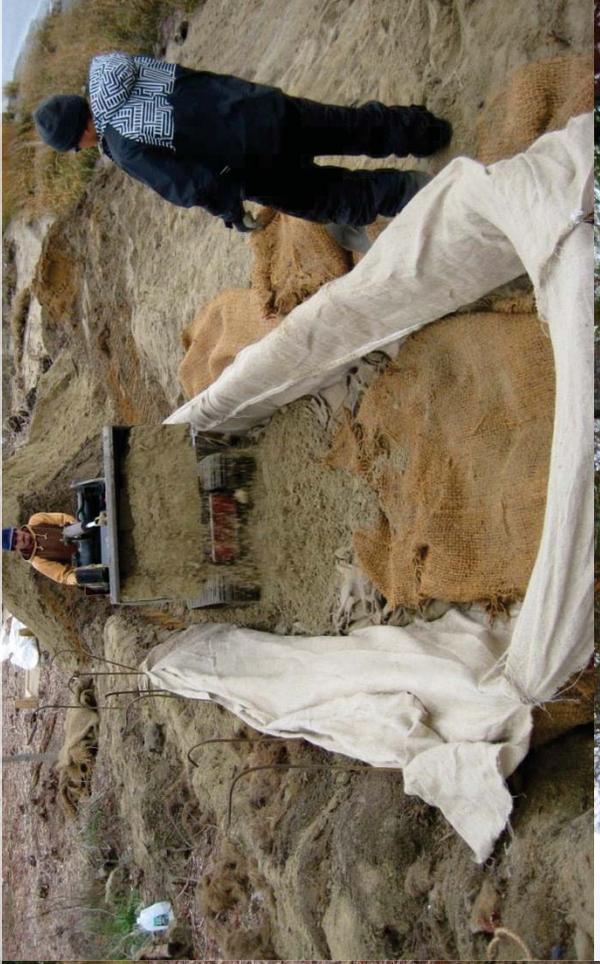
1. Bioengineering
2. Re-grade shoreline and plant buffer
3. Remove pavement
4. Move utility poles
5. Runoff infiltration and pavement removal
6. Shoreline re-grading
7. Remove section of road
8. Install larger culvert
9. Bank stabilization along roadway
10. Remove section of road
11. Remove end of road pavement
12. Marsh adaptation
13. Stormwater infiltration



1. Byway Road – bioengineering (coir envelopes) used to prevent erosion and protect a sewer line.



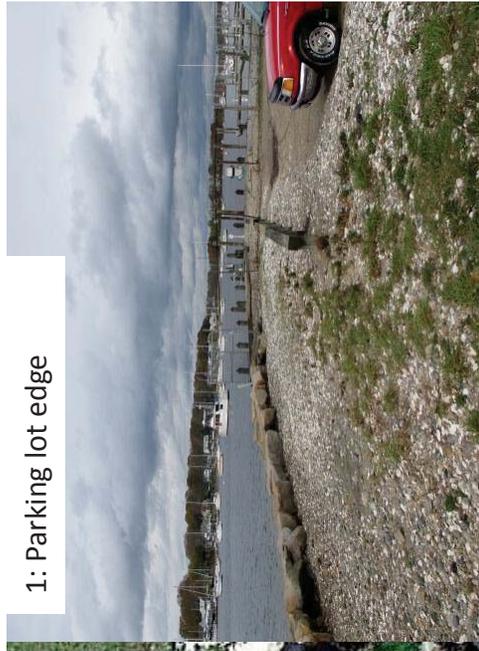
Non structural shoreline protection, Byway Road



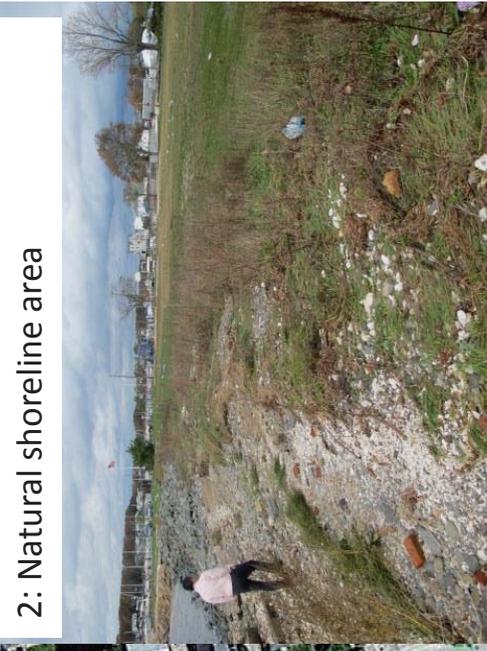
2: Latham Park: allow natural shoreline to erode and low lying area to become salt marsh over time; enhance buffer; opportunity to move parking lot inland and create a filter strip to infiltrate runoff; repair existing walls to protect infrastructure



© 2011 Europa Technologies
© 2011 Google
41° 44' 45.07" N, 71° 21' 06.67" W elev 8 ft
Imagery Date 4/30/2010



1: Parking lot edge

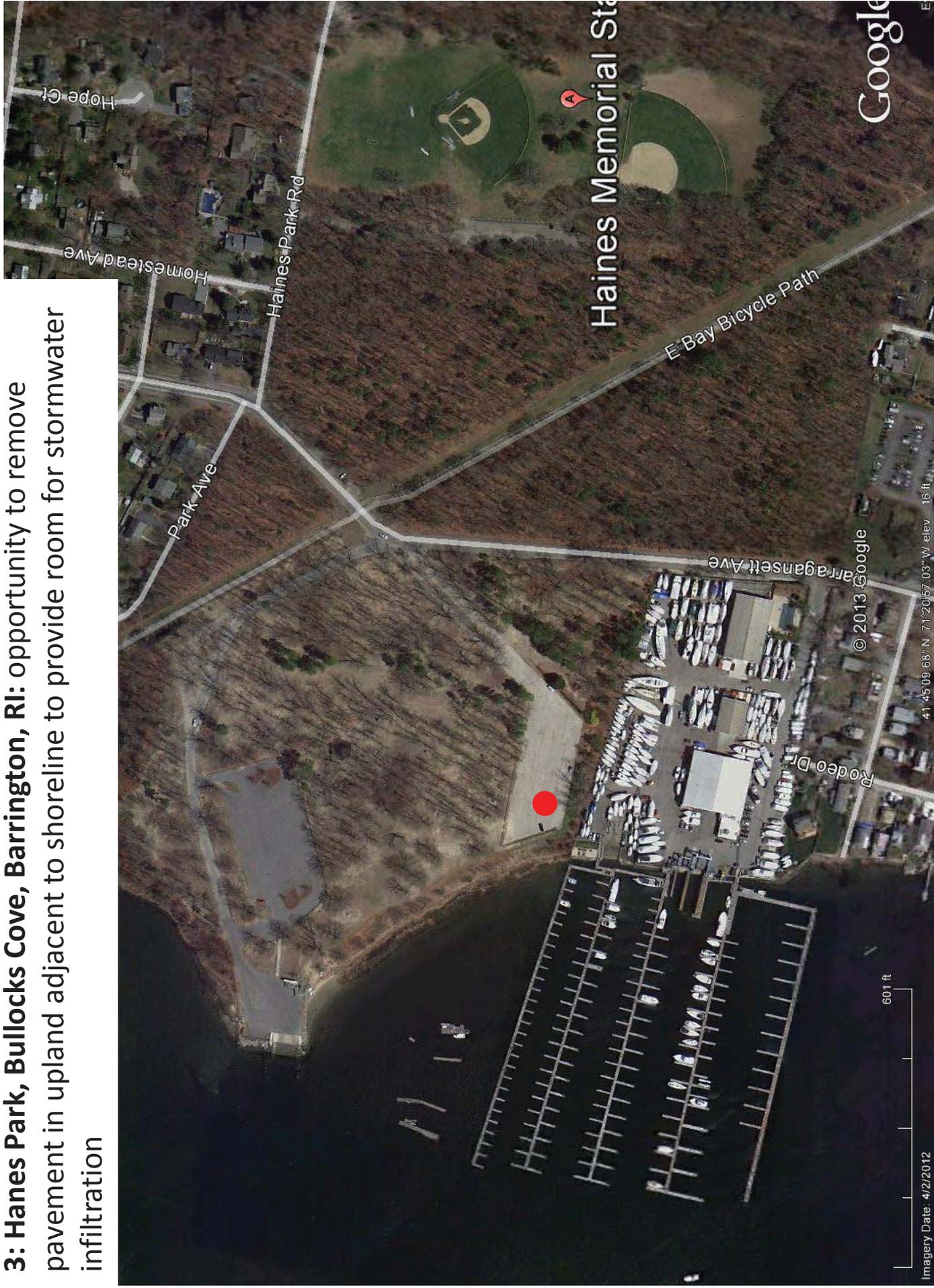


2: Natural shoreline area



3: Former marsh area that floods during coastal storms

3: Hanes Park, Bullocks Cove, Barrington, RI: opportunity to remove pavement in upland adjacent to shoreline to provide room for stormwater infiltration



1: Storm drain at SW edge of parking lot



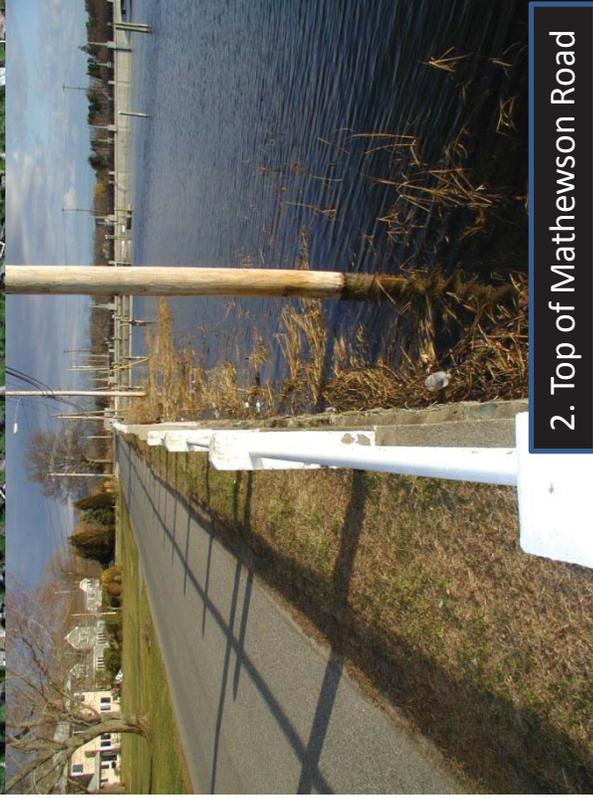
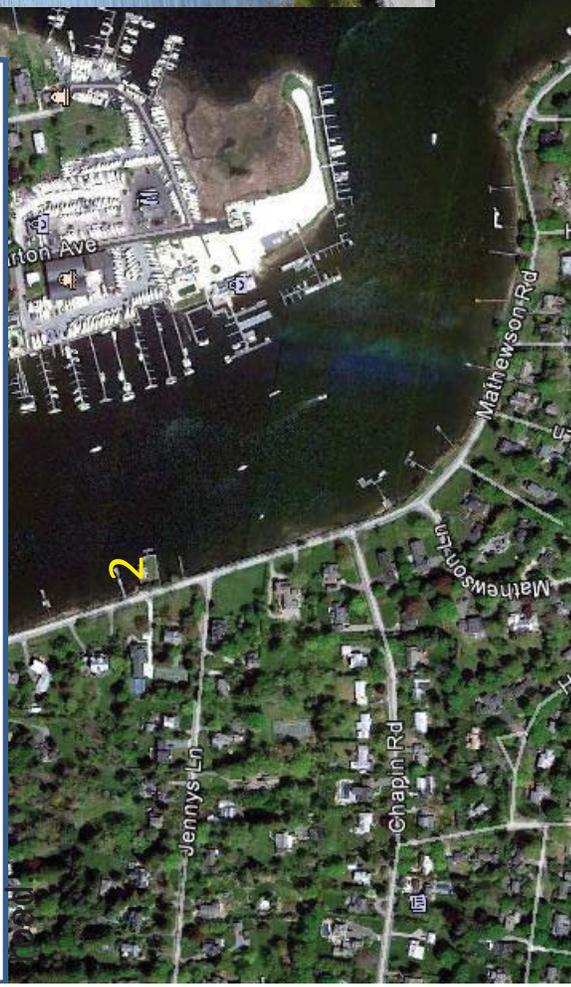
2: Sheet flow runoff from parking, opportunity to remove pavement and create infiltration area upland of catch basin



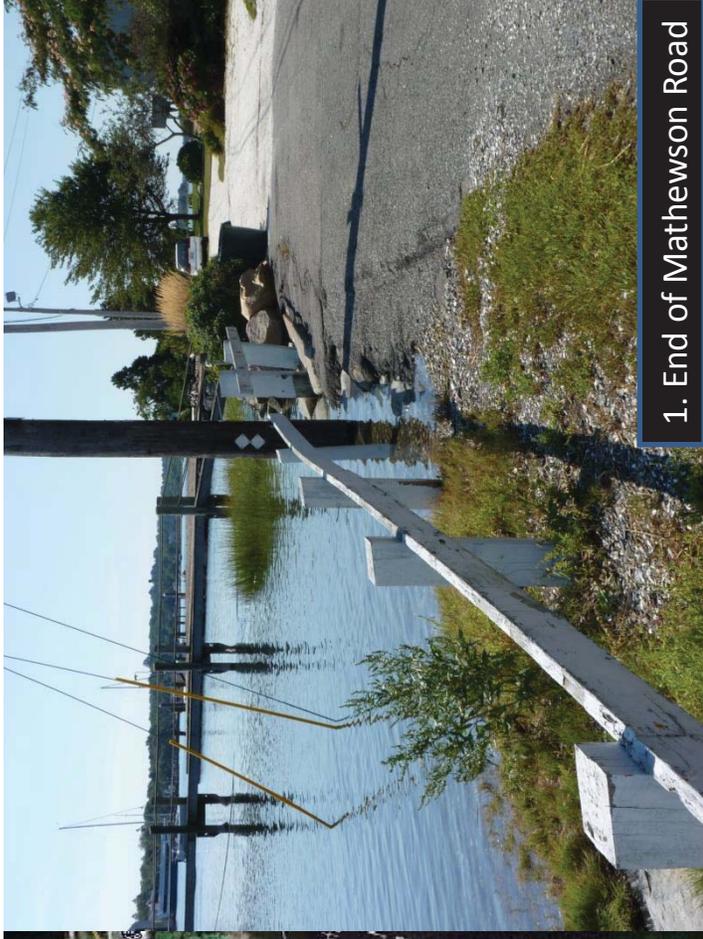
3: Stormwater discharge to Bullocks Cove: headwall hidden by Phragmites



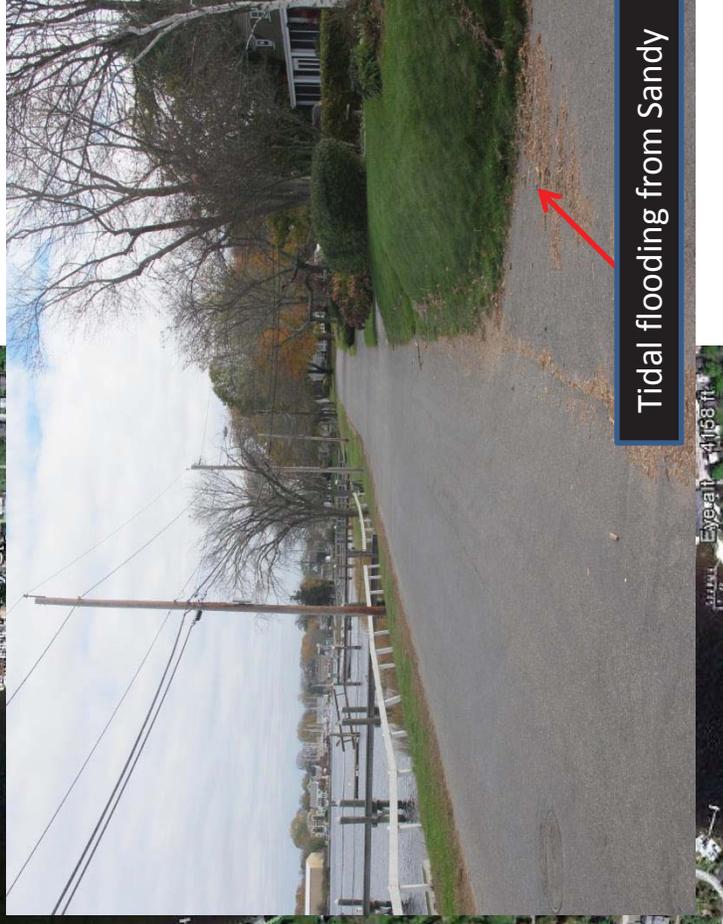
4. Mathewson Road, Barrington – Utility
poles are under water at high tide for most of the length of this road. The road is also vulnerable to sea level rise and flooding. Poles should be moved to the opposite side of the



2. Top of Mathewson Road



1. End of Mathewson Road



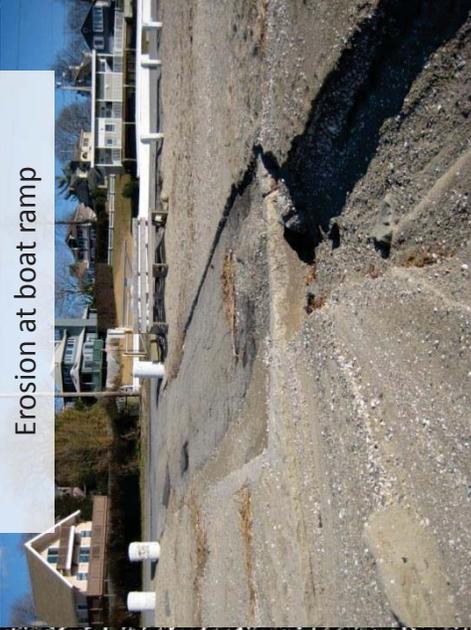
Tidal flooding from Sandy

3/1/11 Eyeall 4168 ft

43° W elev 2 ft



Erosion at end of Beach Road



Erosion at boat ramp

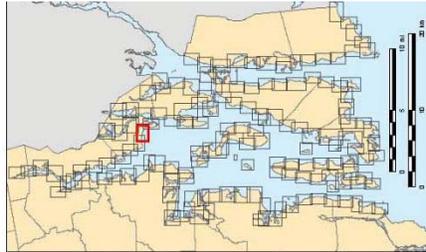


Erosion of western parking area



NARRAGANSETT BAY, RHODE ISLAND: Barrington, Barrington Beach

SHORELINE CHANGE 1939-2003 Rachel E. Hehre and Jon C. Boothroyd

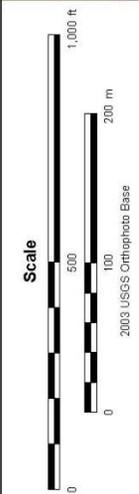


EXPLANATION

DIGITAL SHORELINE ANALYSIS
DSAS Transect
Baseline

SHORELINE
High Water Lines
1939
1975
2003

SHORELINE CHANGE
End Point Distance: 27.5 ft / 8.4 m
End Point Rate: 0.4 ft / 0.13 m

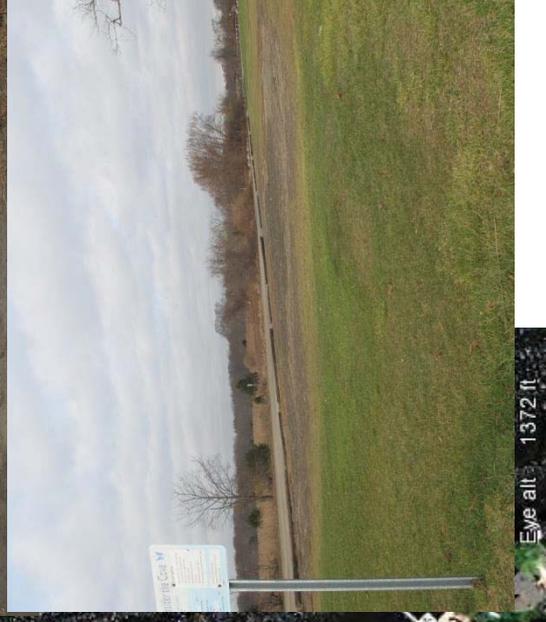


Red line: 1939 shoreline
Yellow line: 1975 shoreline
Green line: 2003 shoreline
Red numbers: shoreline change since 1939
Yellow numbers: Rate of change per year



Shoreline change since 1939 8.3 to 10.3 feet

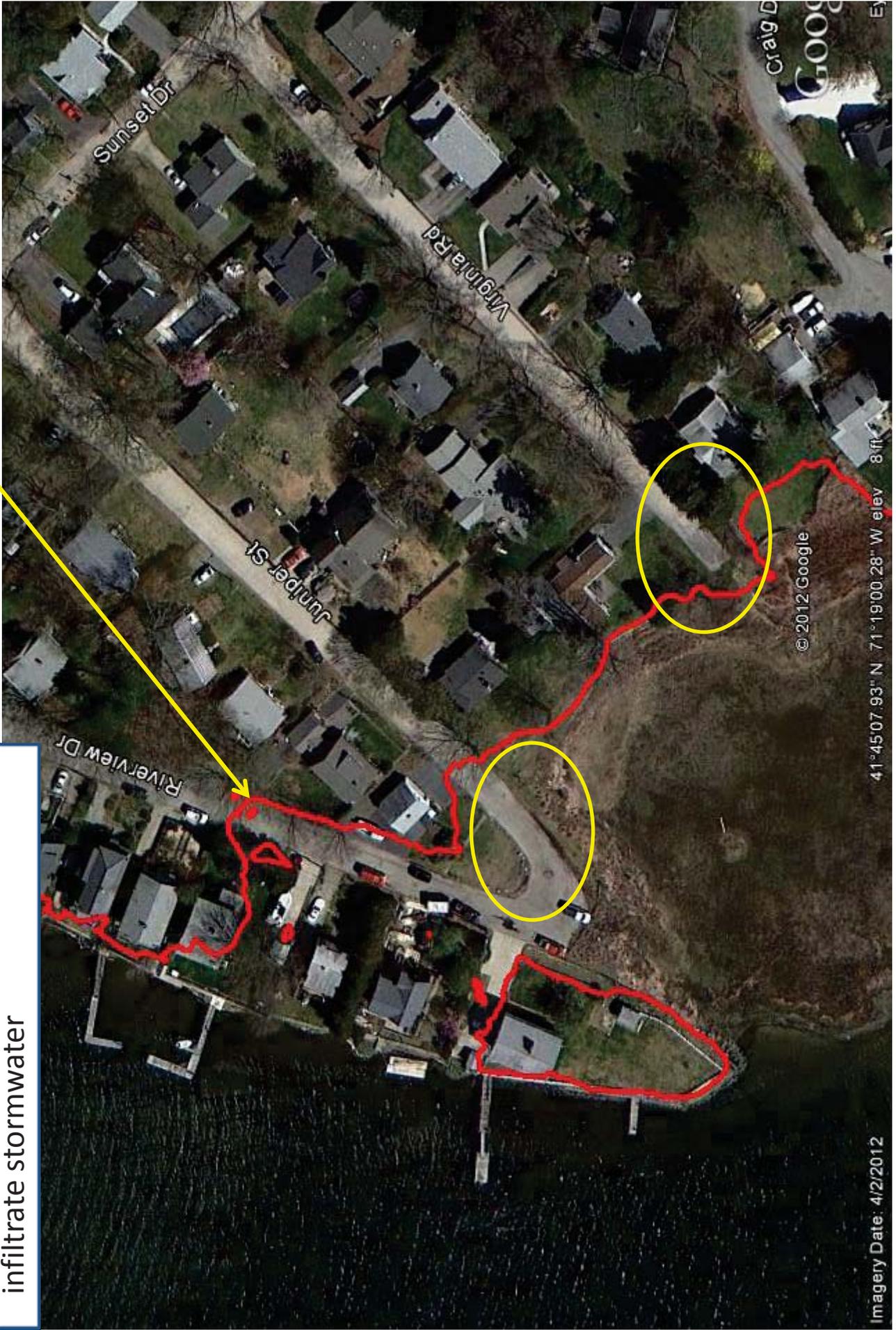
6. Walker Farm – Allow salt marsh to become established north of boat ramp; stop mowing marsh; relocate benches inland to allow for erosion.



Eye alt: 1372 ft

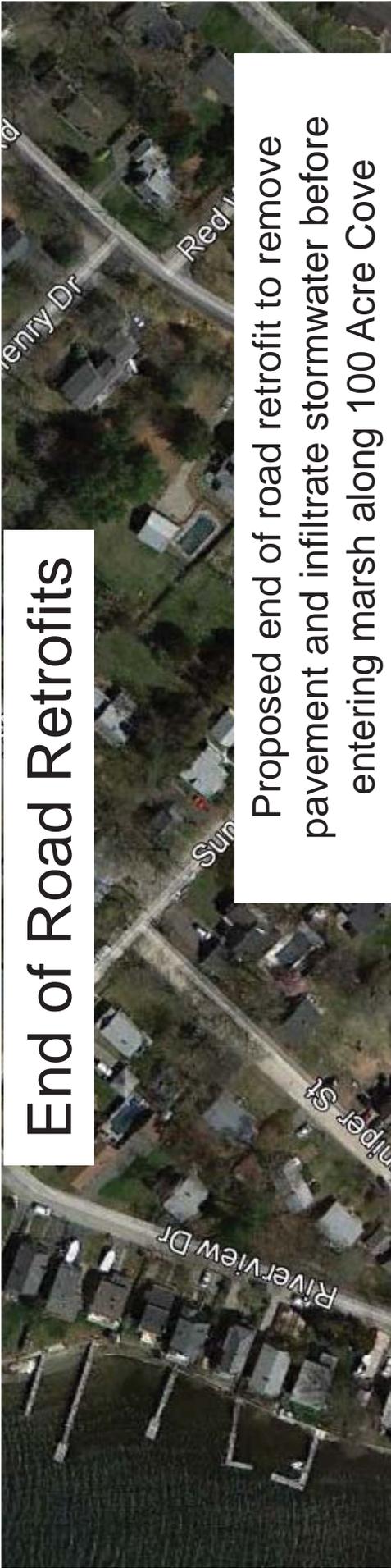
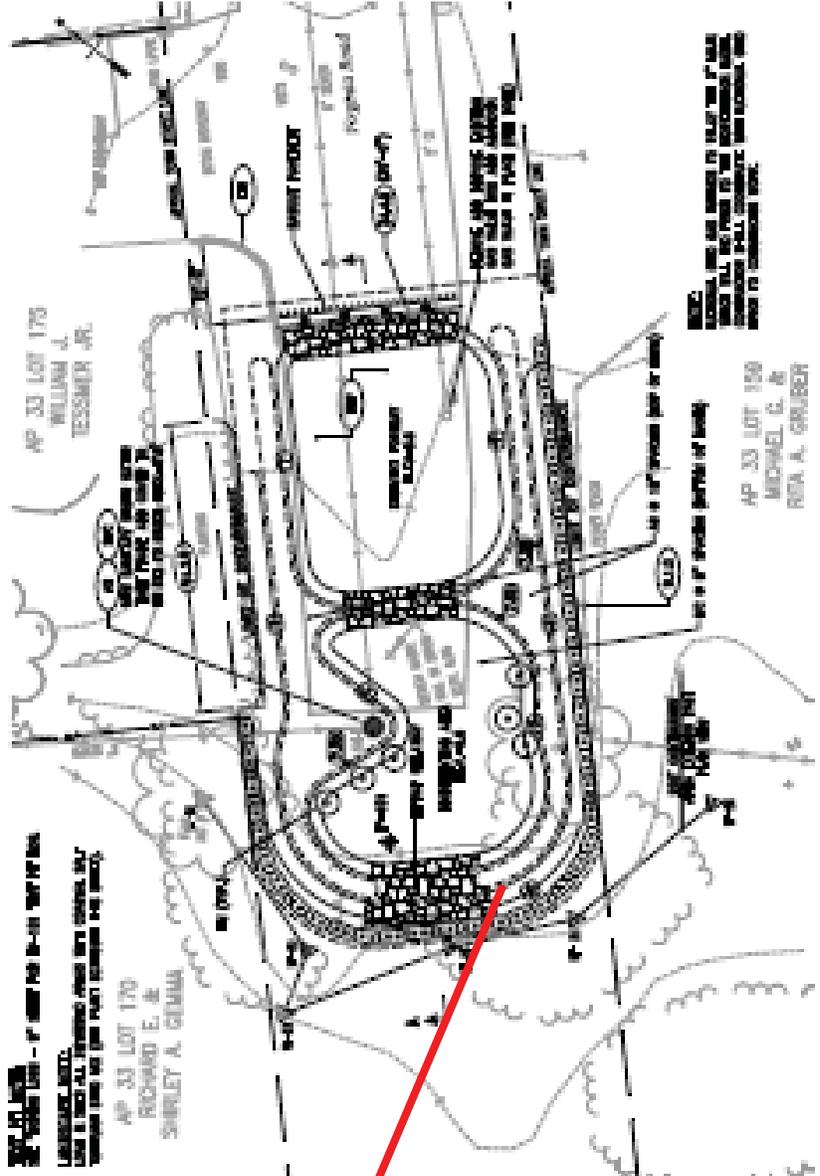
7. Juniper Street and Virginia Road –
remove pavement at end of road,
infiltrate stormwater

Five foot elevation contour



End of Road Retrofits

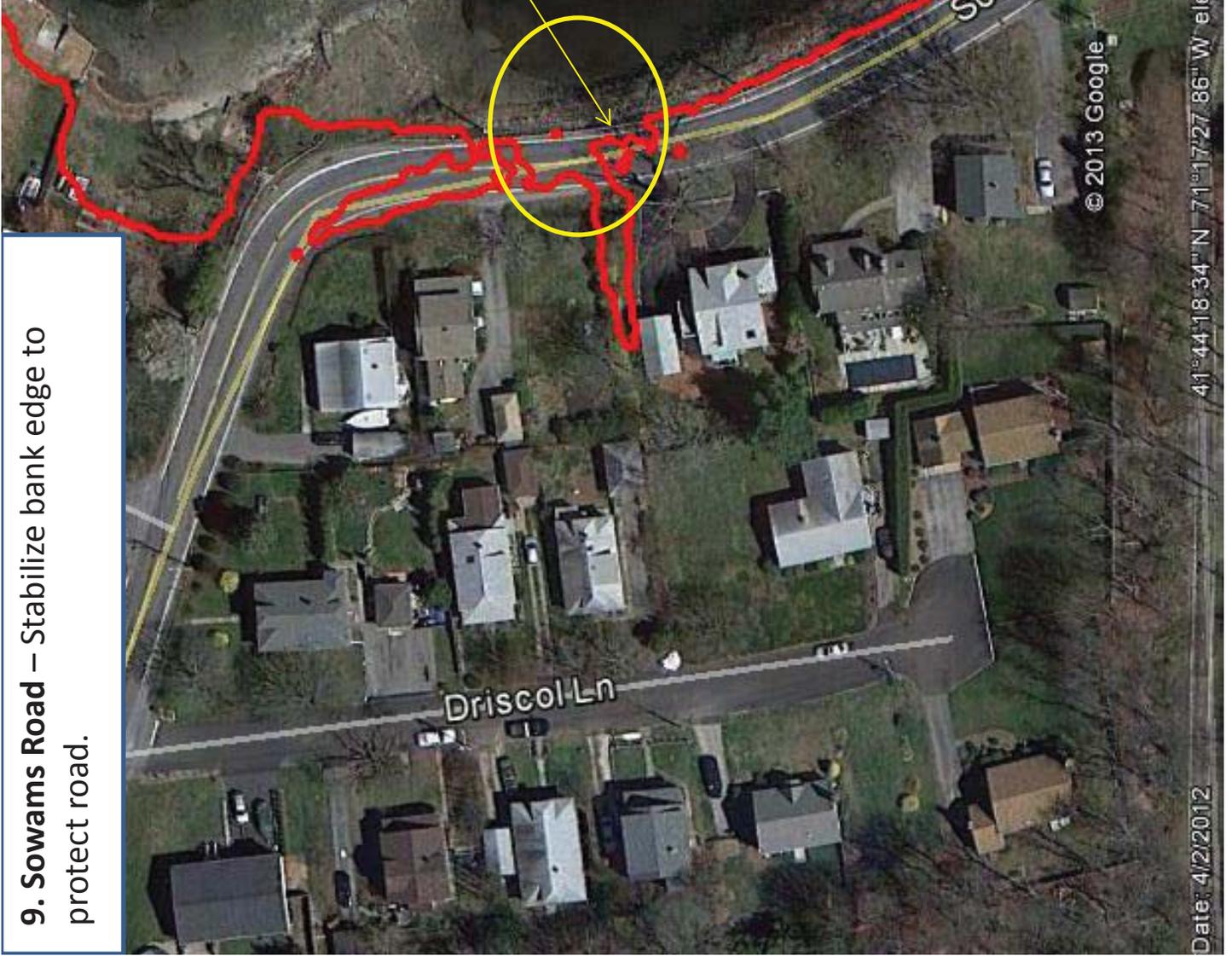
Proposed end of road retrofit to remove pavement and infiltrate stormwater before entering marsh along 100 Acre Cove



8. Prince's Pond – Install larger culvert that can accommodate larger tidal flows and that has a natural bottom.



9. Sowams Road – Stabilize bank edge to protect road.

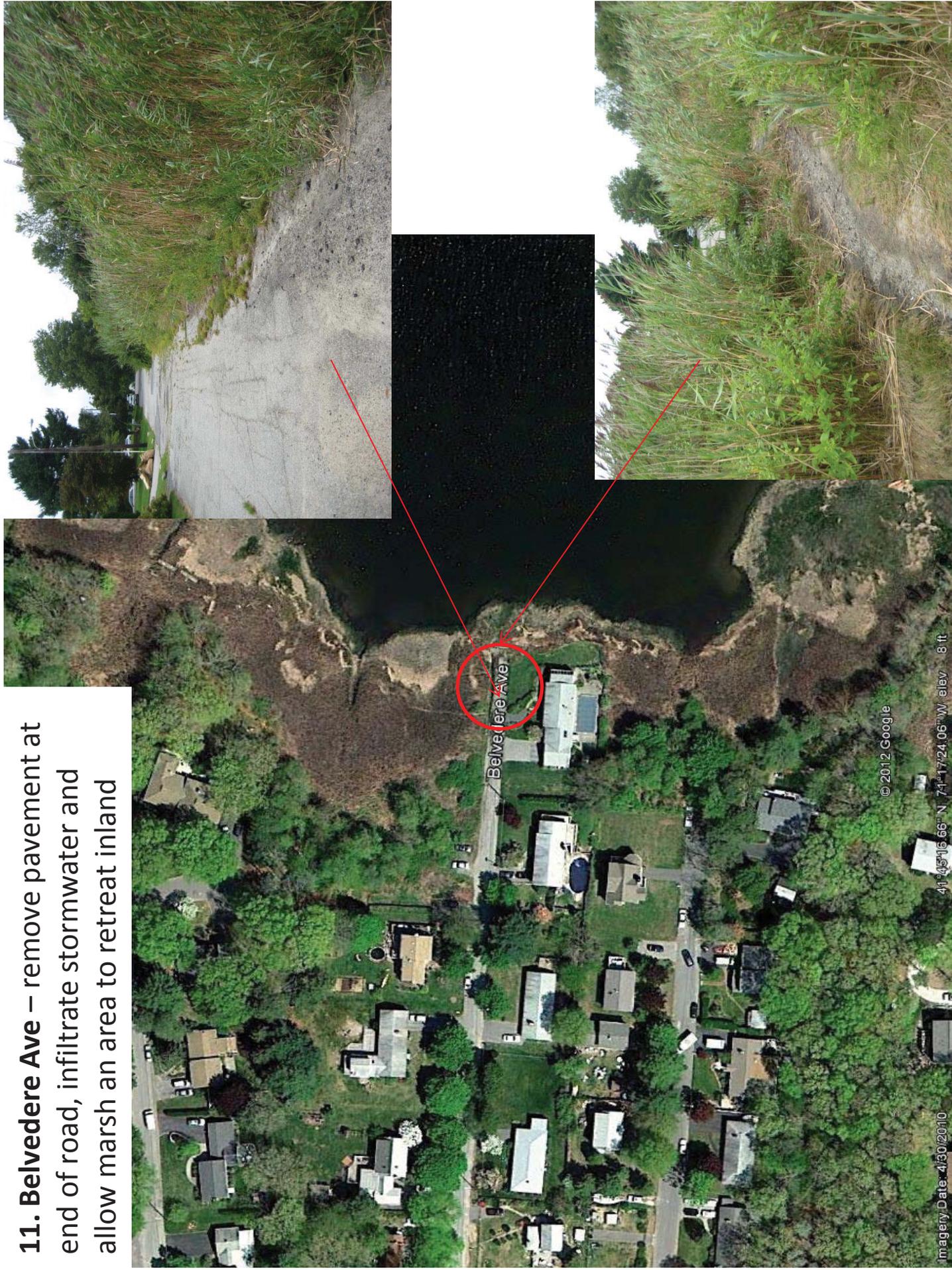


Five foot elevation contour

10. Arvin Ave – create dead end from either side of Arvin & remove section of road to allow area for marsh retreat



11. Belvedere Ave – remove pavement at end of road, infiltrate stormwater and allow marsh an area to retreat inland



11: Woodbine Ave.: east side of Bullocks Cove



Opportunity to carve back pavement and to create infiltration area; could potentially move outlet inland and daylight in grass slope

12. Barrington Beach Salt Marsh: RISD Beach: create new creeks to allow impounded water to drain off marsh area, plant beach grass to encourage dune establishment at southern end of footpath



Water impounded on former marsh area

Culvert under footpath blocked

2007

© 2012 Google

31.67°N 71.19°21.02"W elev 13 ft

Google

Eye

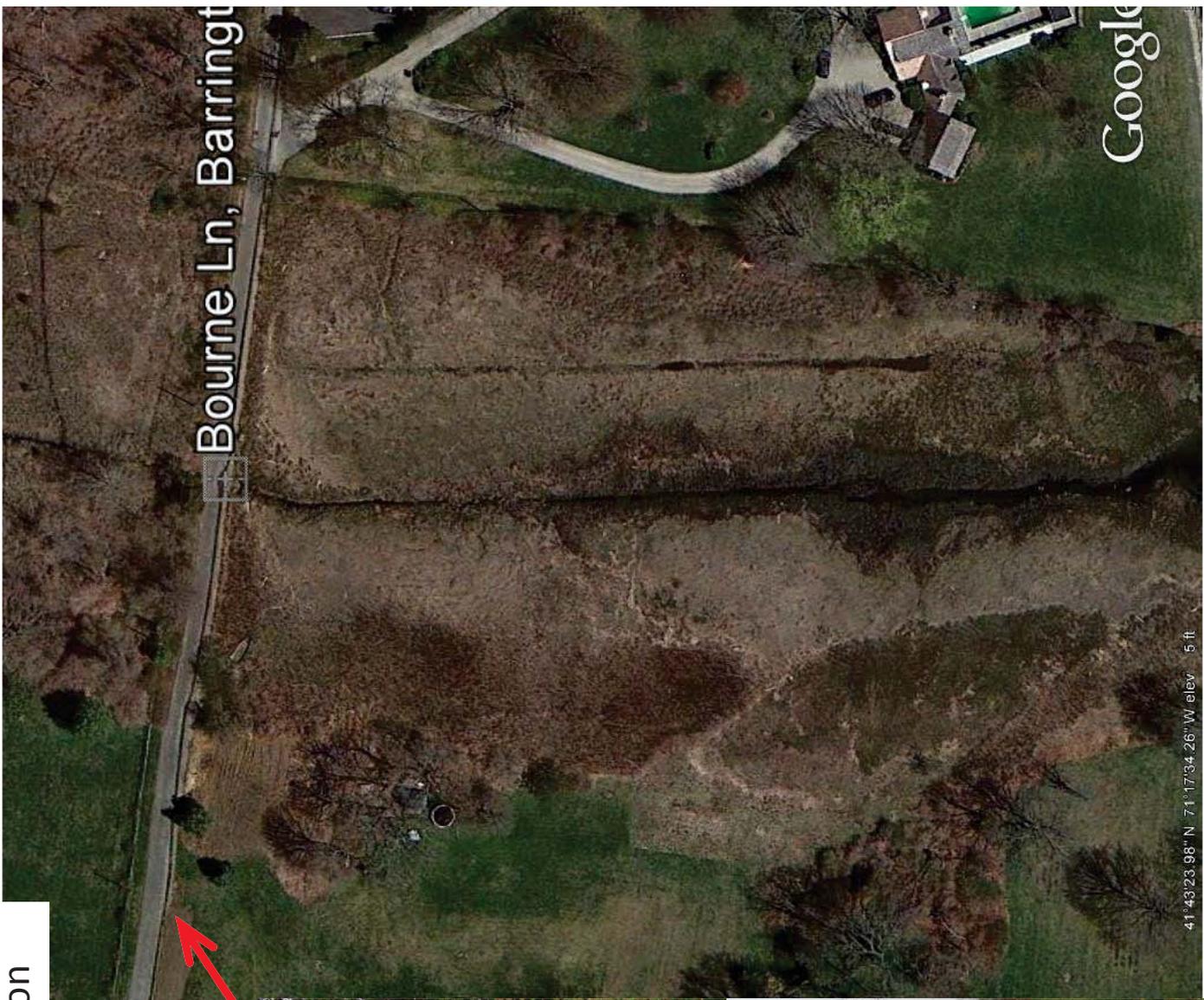
© 2012 Google

43.433182°N 71.182102°W elev 13 ft

Google earth

Eye 2008.8

13. Bourne Lane: stormwater infiltration



Potential site for stormwater infiltration along edge of road prior to entering marsh



~4800 sq ft of impervious surface (need to determine if runoff also from Adams Point Road



Tidal section of the Palmer River



Brackish marsh area of Palmer River



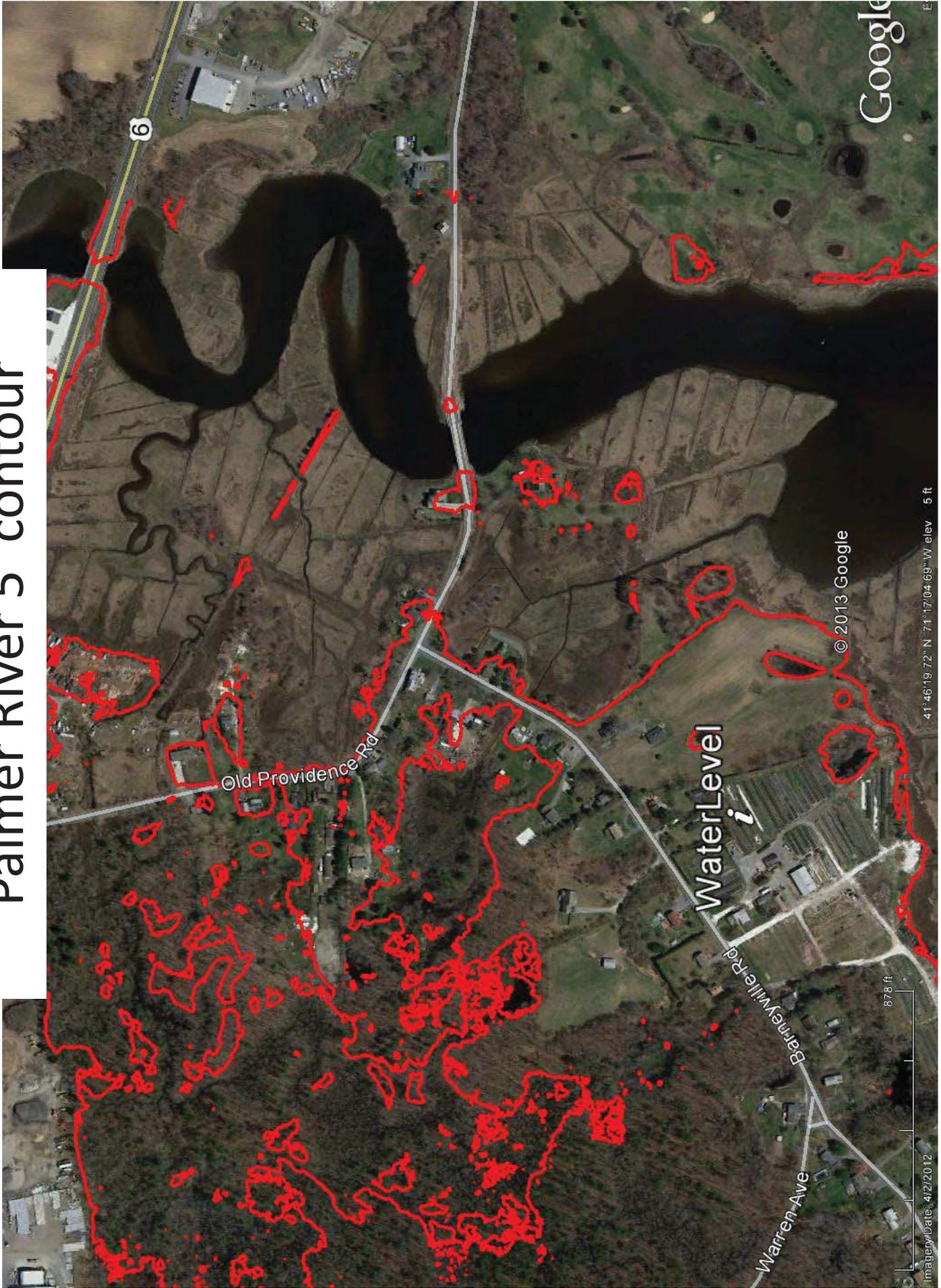
Example of areas where brackish marsh could migrate inland



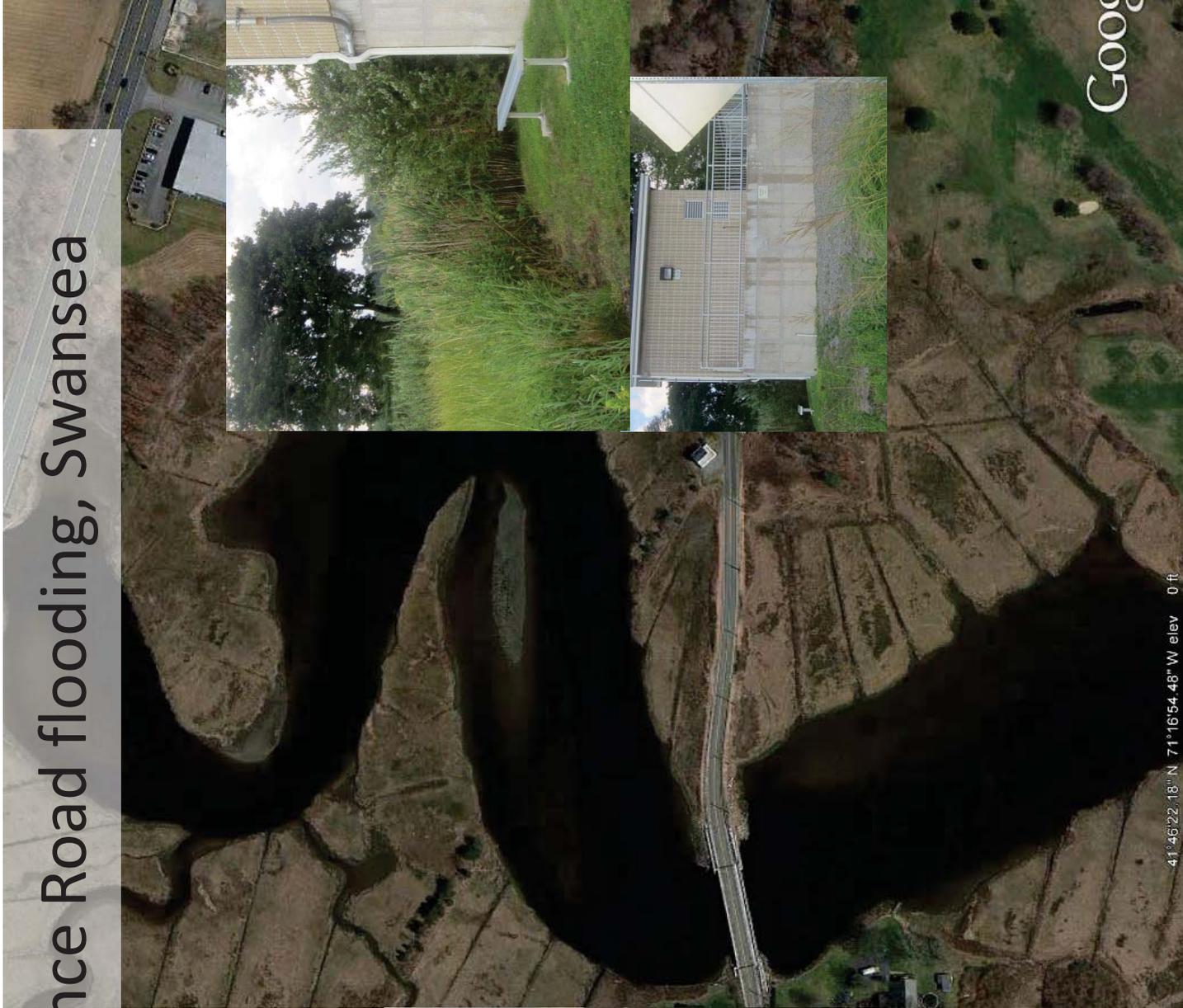
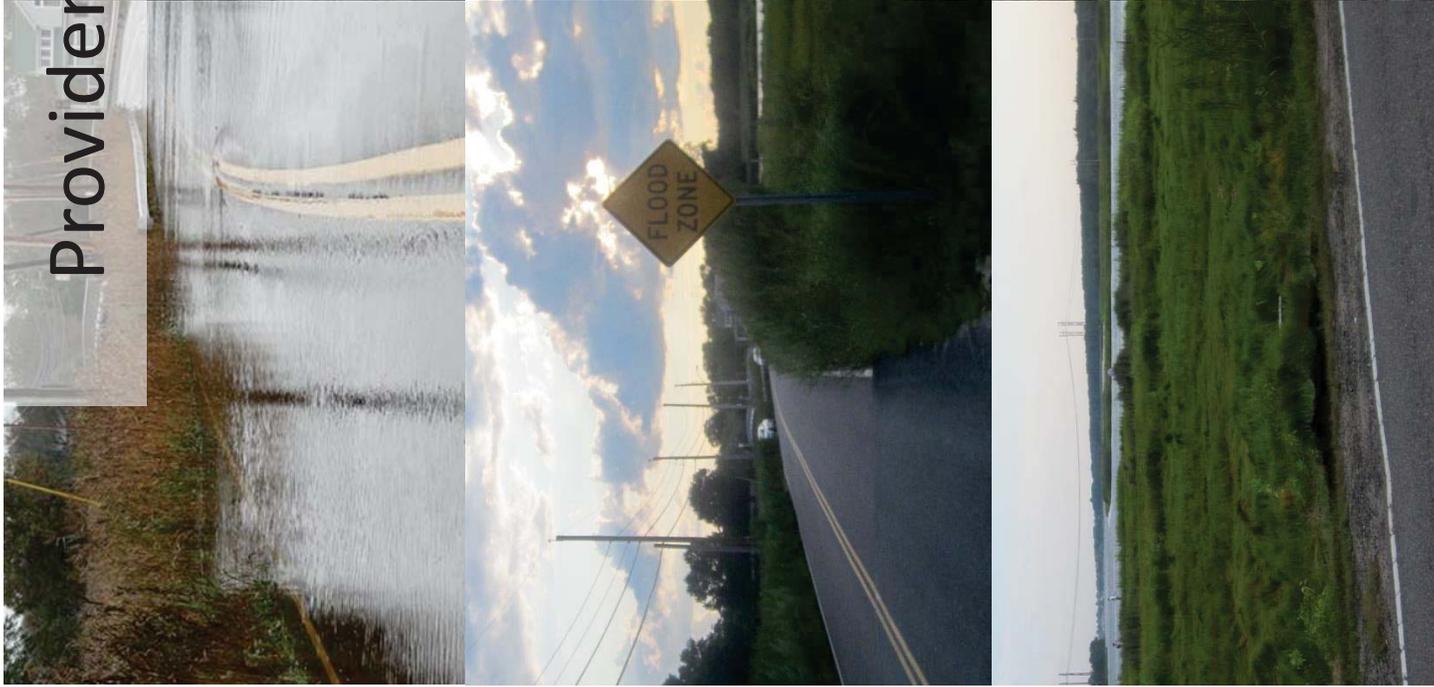
Example of areas where salt marsh could migrate inland



Palmer River 5' contour



Providence Road flooding, Swansea



Google

Palmer River, Swansea – Potential loss of land use and habitat, Bristol County Water Authority pipeline in marsh

Golf course located in former salt marsh, may become too wet to use. Could be protected in future.

Bristol County Water Authority pipeline runs above ground over the salt marsh, and is vulnerable to damage.

Freshwater bird habitat vulnerable to salt water inundation. The pond is protected by a spillway that is not far above sea level.



© 2012 Google

41°45'57.58" N 74°16'30.83" W elev 8 ft

Imagery Date: 4/2/2012

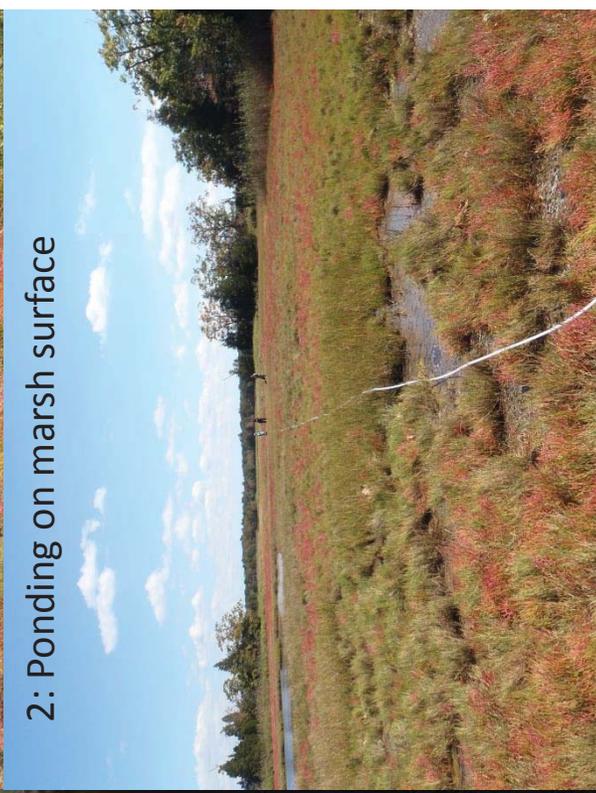
Salt marsh assessment on western Palmer River marsh



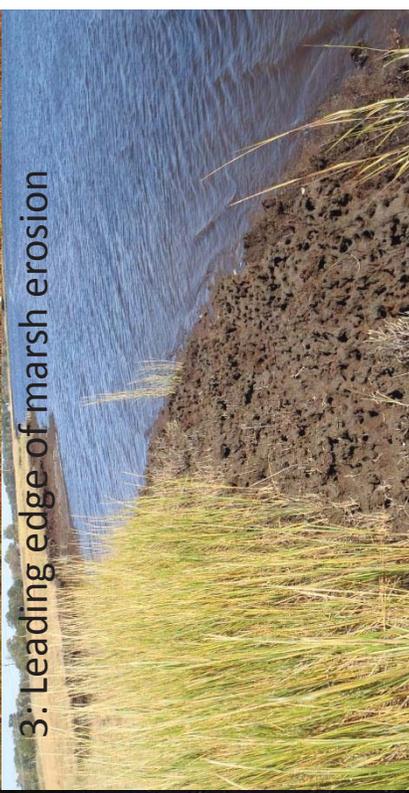
1: Pickleweed sign of vegetation change



2: Ponding on marsh surface



3: Leading edge of marsh erosion



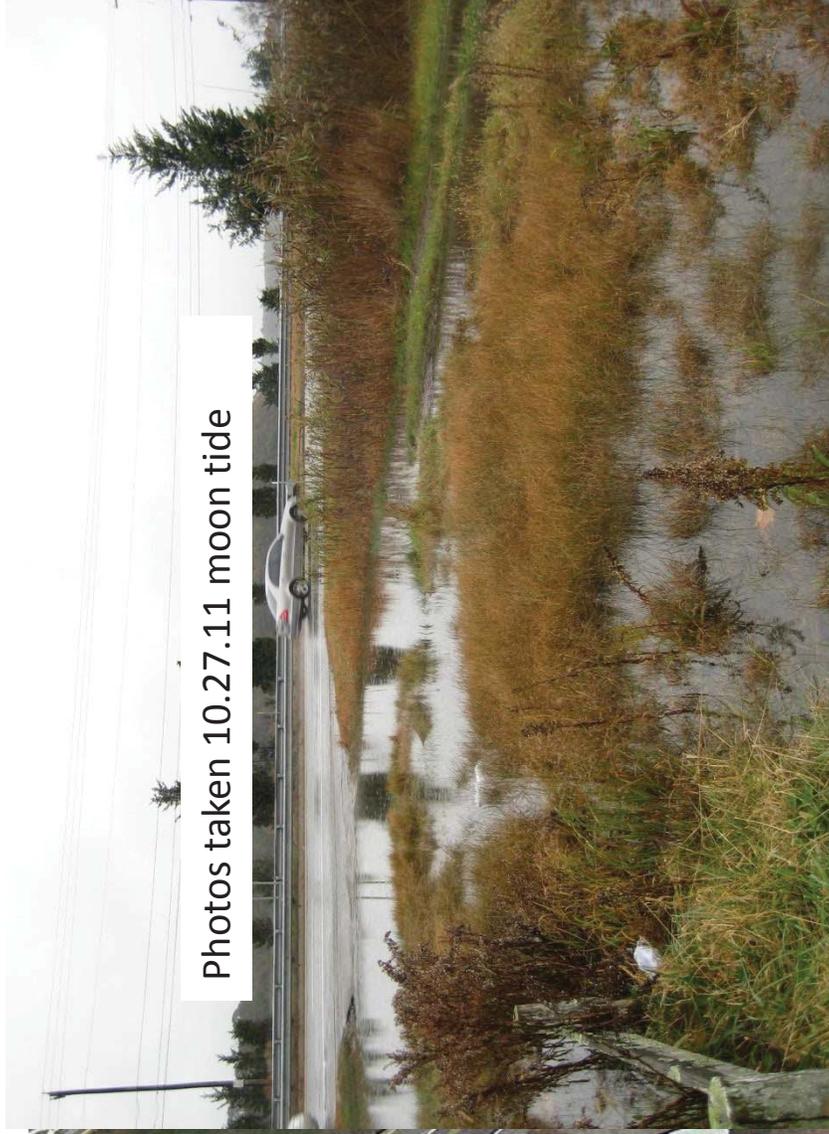


Google ear

© 2013 Google

308 ft





Photos taken 10.27.11 moon tide



Photos taken 10.27.11 moon tide

© 2013 Google

215 ft

Google ear



Google ear

Kyle Cir

Primrose Hill Rd

114

314 ft

© 2013



Short St stormwater infiltration



Appendix 7: STAPLEE Review

Table A7.1: Description of STAPLEE Criteria

Criteria	Explanation
Social	The public must support the overall implementation strategy and specific mitigation actions. Therefore actions need to be evaluated in terms of community acceptance to ensure compatibility with present and future local community needs and values.
Technical	It is important to determine whether the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Determine whether the alternative action is a whole or partial solution, or not a solution at all.
Administrative	Examine the anticipated staffing, funding, and maintenance requirements for the action to determine whether the jurisdiction has the personnel and administrative capabilities necessary to implement the action or whether outside help will be needed.
Political	As proposed mitigation objectives sometimes fail because of a lack of political acceptability, it is important to understand how the current local and State political leadership feels about issues related to the environment, economic development, safety and emergency management. This will provide valuable insight into the level of political support for mitigation activities and programs.
Legal	Without the appropriate legal authority, the action cannot lawfully be undertaken. Hence, determining whether the jurisdiction has the legal authority at the appropriate levels to implement the action or whether the jurisdiction must pass new laws or regulations, is critical. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. Identify the unit of government undertaking the mitigation action and include an analysis of the interrelationships between local, regional, State, and Federal Governments. Legal authority is likely to have a significant role later in the process when the State or community will have to determine how mitigation activities can be carried out, and to what extent mitigation policies and programs can be enforced.
Economic	Every local and State government experiences budget constraints. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles, at least in part, by outside sources, are more likely to be implemented than mitigation actions requiring general obligation bonds or other instruments that would incur long-term debt. "Big ticket" mitigation actions such as large-scale acquisition and relocation are often considered for implementation in a post-disaster scenario when additional Federal or State funding for mitigation may be available.
Environmental	Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities. Sustainable mitigation actions should not have adverse consequences to environmental assets, such as threatened and endangered species, wetlands, and other protected natural or cultural resources, and should comply with federal, state, and local environmental regulations.

Table A7.2: Review of Actions Applying STAPLEE Criteria

Actions Considered	EVALUATION SCORE (0=Low Relationship to 5=Strong Relationship)								Outcome	
	Social Support	Technical Feasibility	Administrative Capacity	Political Acceptability	Legal Authority	Economic Feasibility	Environmental Impact (Positive=5; Negative=0)	Total Points	Include/Don't Include?	Reference
Goal 1: Reduce current and future risk of natural hazards and sea level rise to the built environment.										
Complete community-wide sea level rise impact assessment	3	4	3	4	5	2	5	26	Yes	Action 1.A
Incentivize elevation or relocation of buildings threatened by sea level rise.	1	1	1	0	2	0	5	10	No	NA
Complete infrastructure projects in order to protect critical assets.	5	4	3	4	5	2	4	27	Yes	Action 1.B
Ban new construction within floodplain areas.	1	2	2	1	2	1	3	12	No	NA
Revise regulations to reduce future risk of natural hazards.	3	4	3	3	3	2	5	23	Yes	Action 1.C
Conduct community outreach to increase awareness about risk and potential opportunities to mitigate risk.	5	5	4	5	5	5	NA	29	Yes	Action 1.D
Require disclosure of potential sea level rise impacts in property sales.	0	3	1	0	2	1	2	9	No	NA
Publish design, site guidelines for elevation projects.	4	4	3	4	5	5	NA	25	Yes	Action 1.E
Adopt LID standards to reduce amount of impervious surfaces within new subdivisions and other private development projects.	3	4	3	4	5	4	4	27	Yes	Action 1.F
Improve stormwater facilities at public facilities.	4	4	3	4	5	4	4	28	Yes	Action 1.G
Evaluate Grades in Flood Zones at School and Municipal Buildings:	3	4	3	4	3	5	3	25	No	Combine with Action 1.B
Improve GIS capabilities, including enhancements to the Town's web-based mapping program, to help users identify flood risk throughout town.	4	4	3	5	5	5	3	29	Yes	Action 1.H
Goal 2: Preserve and enhance the capacity of the natural environment to improve Barrington's resilience against impacts of natural hazards.										
Prioritize and complete Coastal adaptation projects.	4	4	3	5	5	3	5	29	Yes	Action 2.A
Require dedication of land area threatened by sea level rise, flooding through subdivision review.	4	3	3	2	2	2	4	20	No	Combine with Action 2.E
Implement tree management program.	4	3	4	5	5	5	3	29	Yes	Action 2.B
Complete hydrology studies.	4	4	3	3	5	3	3	25	Yes	Action 2.C
Develop and complete projects identified in Walker Farm saltmarsh restoration plan.	3	3	3	3	5	2	4	23	Yes	Action 2.C
Protect vulnerable areas from development through acquisition, easements and other mechanisms.	4	4	3	5	4	3	4	27	Yes	Action 2.E

Table A7.2 (continued): Review of Actions Applying STAPLEE Criteria

Actions Considered	EVALUATION SCORE (0=Low Relation-								Outcome	
	Social Support	Technical Feasibility	Administrative Capacity	Political Acceptability	Legal Authority	Economic Feasibility	Environmental Impact (Positive=5; Negative=0)	Total Points	Include/Don't Include?	Reference
Goal 3: Reduce flood risk and the cost of flood insurance within Barrington.										
Complete steps to enroll in Community Rating System.	5	5	3	5	5	5	3	31	Yes	Action 3.A
Engage/provide training for Certified Flood Manager.	5	4	3	4	5	5	3	29	Yes	Action 3.B
Hire full-time floodplain manager.	3	4	3	1	5	1	3	20	No	See Action 3.B
Develop and enact tracking system to monitor HMP implementation progress, with updates on a semi-annual basis.	5	3	3	4	5	5	3	28	Yes	Action 3.C
Provide staff support for residents and businesses to secure outside funding sources to mitigate properties in areas at risk of flooding.	5	5	3	4	5	3	3	28	Yes	Action 3.D
Goal 4: Improve the community's awareness of threats to minimize risk to the public due to natural hazards.										
Initiate program such as "High Water Mark" initiative to increase public awareness of flooding risk and potential future high tide levels from sea level rise.	4	5	3	4	5	4	3	28	Yes	Action 4.A
Conduct extensive media campaign on risk of natural hazards in Barrington.	4	2	1	2	5	1	3	18	No	See Action 4.B
Conduct community outreach to increase awareness and improve preparedness for impacts of natural hazards.	5	5	4	5	5	5	3	32	Yes	Action 4.B
Develop process to inform vulnerable populations about procedures in place before and after a natural hazard event.	5	5	4	5	5	5	3	32	Yes	Action 4.C

Appendix 8: Local Plan Review Tool

The Hazard Mitigation Committee met in February 2017 to review the Hazard Mitigation Plan-2017 Update for completeness based on the FEMA Local Mitigation Plan Review Tool. The completed checklist is included in this appendix.

APPENDIX A: LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA’s evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan’s strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of the each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool*.

Jurisdiction: Town of Barrington, RI	Title of Plan: 2017 Barrington Hazard Mitigation Plan	Date of Plan:
Local Point of Contact: Philip Hervey	Address: Town of Barrington 283 County Road Barrington, RI 02806	
Title: Town Planner		
Agency: Planning Department		
Phone Number: (401) 247-1900 x347	E-Mail: phervey@barrington.ri.gov	

State Reviewer:	Title:	Date:

FEMA Reviewer:	Title:	Date:
Date Received in FEMA Region (insert #)		
Plan Not Approved		
Plan Approvable Pending Adoption		
Plan Approved		

**SECTION 1:
REGULATION CHECKLIST**

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been ‘Met’ or ‘Not Met.’ The ‘Required Revisions’ summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is ‘Not Met.’ Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST	Location in Plan		Met	Not Met
	(section and/or page number)			
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Pages 5-8	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Appendix 2	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Pages 6-8	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Section 2	X		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Page 64	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Pages 64-70	X		
<u>ELEMENT A: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Sections 4.1, 4.2 – pp. 13-32	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Section 4.2 – pp. 14-32	X		
B3. Is there a description of each identified hazard’s impact on the community as well as an overall summary of the community’s vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Section 4.2 – pp. 14-32; Section 4.5, pp. 39-44	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Section 4.5.2 – p. 41	X		
<u>ELEMENT B: REQUIRED REVISIONS</u>				
ELEMENT C. MITIGATION STRATEGY				
C1. Does the plan document each jurisdiction’s existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Section 5, pp. 47-51	X		
C2. Does the Plan address each jurisdiction’s participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 5.6.3, p. 52	X		
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Goal 1, p. 60 Goal 2, p. 62 Goal 3, p. 64	X		
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Action Plan – pp. 60-66	X		
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	pp. 58-66	X		
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	pp. 58-66 pp. 67-72	X		
<u>ELEMENT C: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 4.4.4.4, p. 37	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	Section 5.6.10, p. 56	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	See Table 5.1, p. 56	X		
<u>ELEMENT D: REQUIRED REVISIONS</u>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Appendix 1	X		
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Not applicable			
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				