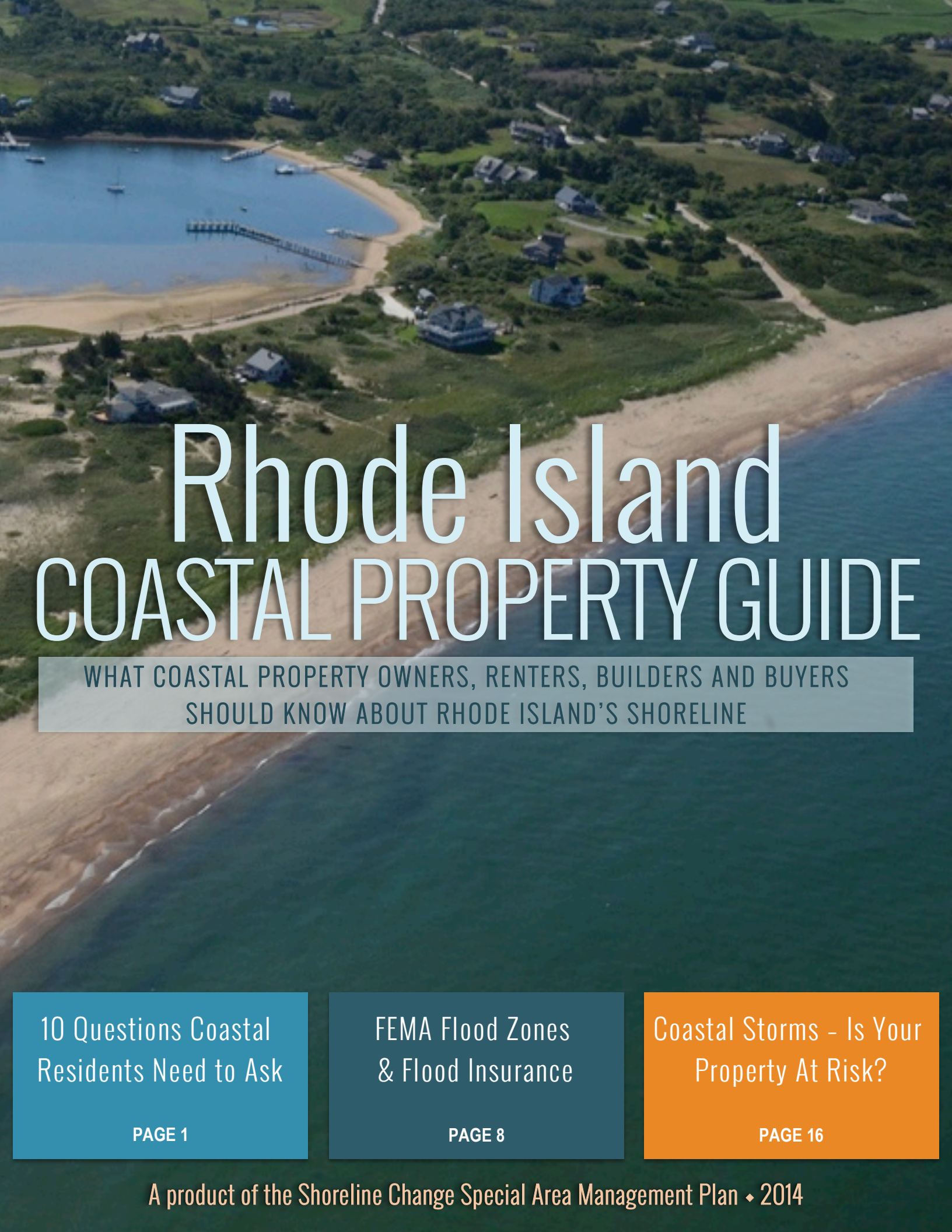

Rhode Island COASTAL PROPERTY GUIDE

WHAT COASTAL PROPERTY OWNERS, RENTERS, BUILDERS AND BUYERS SHOULD KNOW ABOUT RHODE ISLAND'S SHORELINE

10 Questions Coastal Residents Need to Ask

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FEMA Flood Zones & Flood Insurance

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Coastal Storms - Is Your Property At Risk?

PAGE 16

A product of the Shoreline Change Special Area Management Plan ◆ 2014

Rhode Island Coastal Property Guide 2014

The University of Rhode Island Coastal Resources Center/Rhode Island Sea Grant compiled this guidance document for the Rhode Island Coastal Resources Council as a product of the Shoreline Change Special Area Management Plan, or Beach SAMP.

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Rhode Island Coastal Property Guide

2014

CRMC Coastal Resources Management Council

Coastal Resources Center

Sea Grant Rhode Island

The University of Rhode Island Graduate School of Oceanography

Rhode Island's coast is a vital part of the state's identity, and draws residents and visitors alike. However, with the beauty of the waterfront come hazards that threaten human activity and development along the coast. Here's what you need to know about living or building along the water.

10 Questions Coastal Residents Should Ask About Coastal Property

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Introduction

The Ocean State, with over 400 miles of coastline, is known for its beaches, bluffs, and scenic waterfronts. The water is a big a part of Rhode Island as the land, attracting long- and short-term visitors, and offering opportunities for recreation, industry, and simple enjoyment. As a result, the coastline is populated by businesses, important infrastructure, and many residences – and it's these structures that are at risk when it comes to coastal hazards.

Being within a stone's throw of the beach is a dream for many, but the realities of coastal living can be harsh. Coastal buildings may be more vulnerable to severe storms, erosion, and coastal flooding. Additionally, there are special policies and regulations that govern shoreline activities in order to preserve natural habitats, ensure public safety, and protect resources. As such, coastal residents and property owners face unique challenges and considerations.

THE OCEAN ISN'T ALWAYS THE BEST NEIGHBOR – With climate change causing increased storminess, proximity to the water also means frequent exposure to coastal hazards, like storm events and associated flooding. In addition, long-term changes like sea-level rise will continue to influence the coastal landscape so that today's property lines may be inundated during future high tides.

THE COASTAL ZONE – The coastal zone in Rhode Island has special policies, regulations, and requirements that differ from inland areas. The Rhode Island Coastal Resources Management Council[1], or the CRMC, is the managing agency for the state's extensive shoreline, and has produced regulations[2] to govern building, permitting, and policy in coastal areas.

THE BOTTOM LINE – If you're currently a coastal property owner, considering buying coastal real estate, or if you live, work, or even play along Rhode Island's shoreline, you should be aware of the conditions that shape the coastal zone and the policies that protect it.

Coastal property owners should be aware of the hazards that impact the shoreline, including sea-level rise, erosion, storm events, and flooding.

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[1] R.I. CRMC: www.crmc.ri.gov/
[2] R.I. CRMC Regulations (R.I. Coastal Resources Management Program): www.crmc.ri.gov/regulations/RICRMP.pdf

1. What kinds of coastal features are on or near the property, and what kinds of setbacks or regulations apply?

In addition to municipal zoning conditions, properties in coastal areas are subject to coastal zone management classifications that may carry building and permitting ramifications. These classifications are based on both the water the property abuts and characteristics of the shoreline on or near the property.

Coastal or shoreline features such as coastal barriers, dunes, and wetlands have specific regulations and protections under the CRMC. These regulations include structural setbacks, buffers, and rules pertaining to construction and renovating or remodeling older structures. Depending on the property's proximity to coastal features, there may be implications for new construction, home improvements, and structural alterations.

CRMC Shoreline Feature Classifications

Areas of Historic/Archaeological Significance	Rocky Shores
Beaches and Dunes	Manmade Shorelines
Coastal Wetlands	Developed Barriers
Headlands, Bluffs and Cliffs	Moderately Developed Barriers
Tidal Waters	Undeveloped Barriers

Examples of shoreline features in Rhode Island (clockwise from top left): coastal beach, coastal dunes, shoreline protection structures along a manmade shoreline, and coastal wetlands.

For freshwater wetlands, the R.I. Department of Environmental Management has jurisdiction – to determine whose jurisdiction the property is under, you can check the *CRMC/RIDEM Wetland Jurisdiction Maps*[3]. For more information about freshwater wetlands management, please see the *DEM's Wetlands FAQ*[4].

Why it matters: A CRMC permit is required for any construction or alteration activity on a shoreline feature or within 200 feet of a shoreline feature. Additionally, setbacks are required for all new structures along the shore. The minimum setback from coastal features is 50 feet, but in areas with erosion, setbacks are determined using the rates of change found on the shoreline change maps (see below).

Distances for setbacks are 30 times the calculated average annual erosion rate for less than four dwelling units, and 60 times the average annual rate for commercial, industrial, or more than four units. Note: Setbacks and buffers are always measured from the most inland edge of the shoreline feature. If there is a coastal buffer zone[5], an additional 25-foot setback is measured from the inland edge of the buffer zone.

For example, if the erosion rate is 2.5 feet per year, and you are planning to build a single-family home, the setback from the inland edge of the coastal feature would be 75 feet (2.5 feet x 30 = 75 feet).

Setbacks that are larger than these requirements will provide the property with a greater level of protection against the impacts of coastal erosion and other hazards.

To identify the shoreline features and find out more: The CRMC's Guide to Coastal Shoreline Features[6] will help you begin to identify the shoreline features on the property. Additionally, you can consult with CRMC staff for shoreline feature verification and applicable setback requirements. For more information about setbacks and shoreline features, please see Sections 140 and 210 of the CRMC regulations.[7]

The CRMC's shoreline change maps[8] depict past coastal erosion, and include the calculated rates of change used to determine setbacks. When siting for coastal construction, the CRMC recommends that property owners exceed the minimum setback requirements in order to better protect the structure, as shoreline change is an ongoing process influenced by coastal storms.

Using the CRMC Shoreline Change Maps

The CRMC Shoreline Change Maps (see example on the following page) were created using aerial photography and are intended to show past erosion and the shoreline rates of change that are applied to pertinent sections of the Council's regulatory programs to address issues including setbacks of activities from coastal features.

The colored lines along the coast represent past and more recent placements of the shoreline – the blue line represents the shoreline in 2004, while the red line demonstrates where the shoreline was in 1939. The white numbers show *total change* in feet and meters in shoreline location between 1939 and 2004. Yellow numbers show a *rate of change* in feet or meters in shoreline location between past and present.

Please note: Coastal erosion does not occur slowly over time at a constant rate, but is instead the result of abrupt changes due to storms. For that reason, the rates provided within the Shoreline Change Maps should be used with caution.

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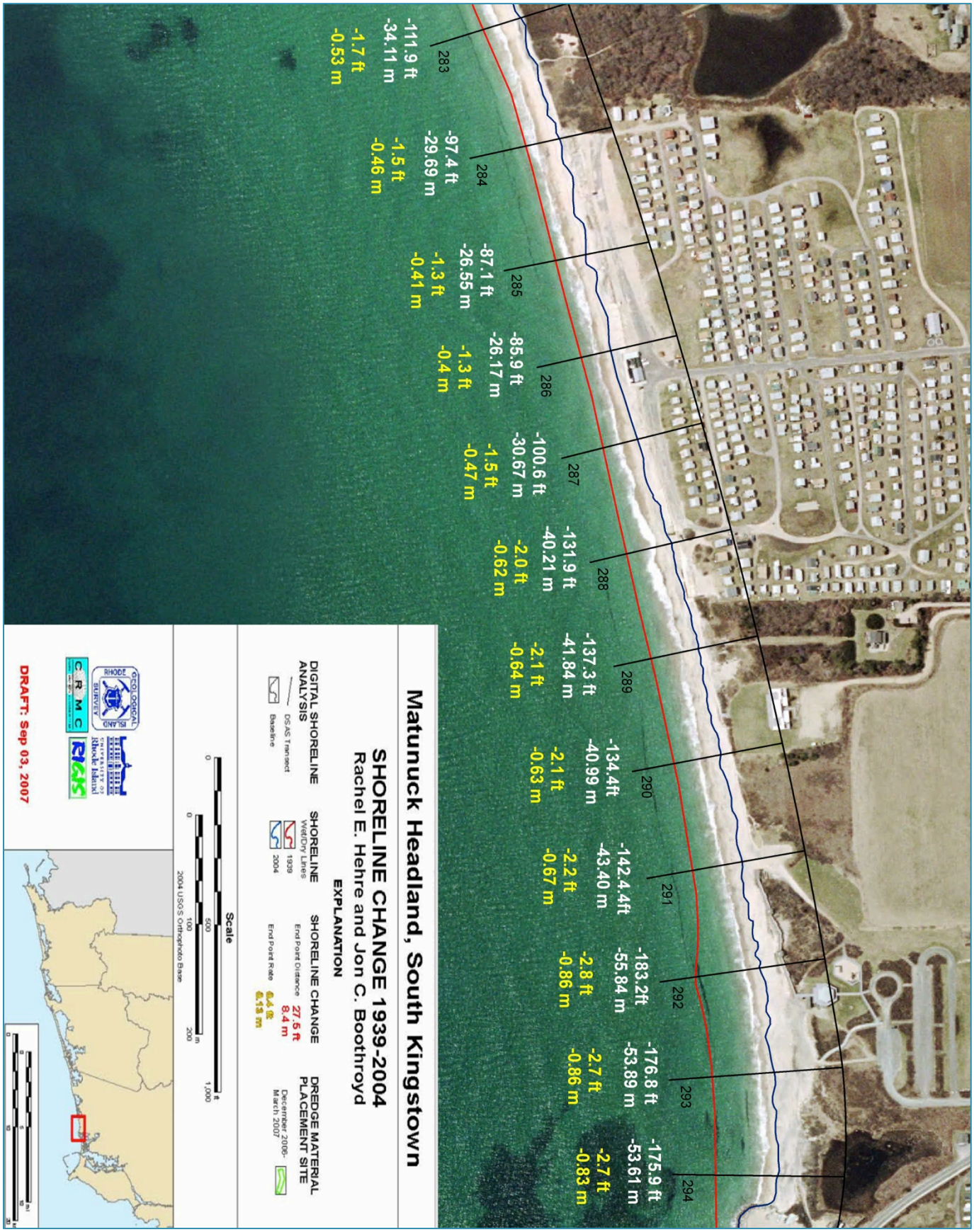
[3] Wetland Jurisdiction Maps: www.dem.ri.gov/maps/wetjuris.htm
[4] R.I. DEM Wetlands FAQ: www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/realtor.pdf
[5] Coastal Buffer Zone: a land area adjacent to a coastal feature that is vegetated with native shoreline species and acts as a natural transition zone between the coast and adjacent upland development.
[6] Coastal Shoreline Features: www.crmc.ri.gov/guidesreports/CRMC_Coastal_Shoreline_Features.pdf
[7] R.I. CRMC Regulations: www.crmc.ri.gov/regulations/RICRMP.pdf
[8] R.I. CRMC Shoreline Change Maps: www.crmc.ri.gov/maps/maps_shorechange.html


Matunuck Headland, South Kingstown
SHORELINE CHANGE 1939-2004
Rachel E. Hehre and Jon C. Boothroyd
EXPLANATION
DIGITAL SHORELINE ANALYSIS
DSAS Transect
Baseline
SHORELINE
Wet/Dry Lines
1939
2004
SHORELINE CHANGE
End Point Distance
27.5 ft
8.4 m
End Point Rate
0.4 ft
0.13 m
DREDGE MATERIAL PLACEMENT SITE
December 2006-March 2007
Scale
0
500
1,000
ft
0
100
200
m
2004 USGS Orthophoto Base
DRAFT: Sep 03, 2007
283
-111.9 ft
-34.11 m
-1.7 ft
-0.53 m
284
-97.4 ft
-29.69 m
-1.5 ft
-0.46 m
285
-87.1 ft
-26.55 m
-1.3 ft
-0.41 m
286
-85.9 ft
-26.17 m
-1.3 ft
-0.4 m
287
-100.6 ft
-30.67 m
-1.5 ft
-0.47 m
288
-131.9 ft
-40.21 m
-2.0 ft
-0.62 m
289
-137.3 ft
-41.84 m
-2.1 ft
-0.64 m
290
-134.4ft
-40.99 m
-2.1 ft
-0.63 m
291
-142.4.4ft
-43.40 m
-2.2 ft
-0.67 m
292
-183.2ft
-55.84 m
-2.8 ft
-0.86 m
293
-176.8 ft
-53.89 m
-2.7 ft
-0.86 m
294
-175.9 ft
-53.61 m
-2.7 ft
-0.83 m

2. Are there restrictions on the property due to the adjacent CRMC water classification?

All coastal waters in Rhode Island are categorized into six water types according to the characteristics of the adjacent shoreline, water use, and density of use. Conservation, recreation, transportation, and industrial activities all occur along the shore, and influence the shoreline policies and regulations based on water types. The six water type classifications, as designated by the CRMC, are:

CRMC Water Type Classifications

Type 1: Conservation Areas	Areas of natural habitat or scenic value of unique or unusual significance, or areas that have been deemed unsuitable for structures due to their exposure to severe wave action, flooding, and erosion.
Type 2: Low Intensity Use	Areas with high scenic value that support low-intensity recreational and residential uses.
Type 3: High Intensity Boating	Intensely utilized water where recreational boating activities dominate and where the adjacent shorelines are developed as marinas, boatyards, and associated water-enhanced and water-dependent businesses.
Type 4: Multipurpose Waters	Large expanses of open water in Narragansett Bay and Rhode Island and Block Island sounds that support a variety of commercial and recreational activities with adjacent shorelines that may be used to support water-dependent commercial, industrial, and/or high-intensity recreational activities.
Type 5: Recreational and Commercial Harbors	Areas adjacent to waterfront areas that support a variety of tourist, recreational, and commercial activities.
Type 6: Industrial Waterfronts and Commercial Navigation Channels	Areas that are used to accommodate commercial and industrial water-dependent and water-enhanced activities.

Why it matters: Though all areas along classified waters are subject to coastal zone management, properties located along certain water types may have more strict regulations for development. Some of the activities or structures that are regulated in the coastal area include:

- *Filling, removal, and grading along the shoreline*
- *Construction of residential or recreational structures, including docks*
- *Construction of public infrastructure*
- *Individual sewage disposal systems*
- *Installation of shoreline protection structures*
- *Beach nourishment (replenishment)*
- *Prohibition of new construction on undeveloped barriers*

Identify the adjacent water type and find out more: For each coastal municipality, maps of water types and other shoreline classifications are available online[9]. Information about restricted activities, prohibited activities, and permitting processes can be found in the CRMC regulations[10].

Some coastal areas are governed by CRMC Special Area Management Plans, and as such, have area-specific regulations. To determine if the property is included under a Special Area Management Plan, visit the CRMC SAMP page[11].

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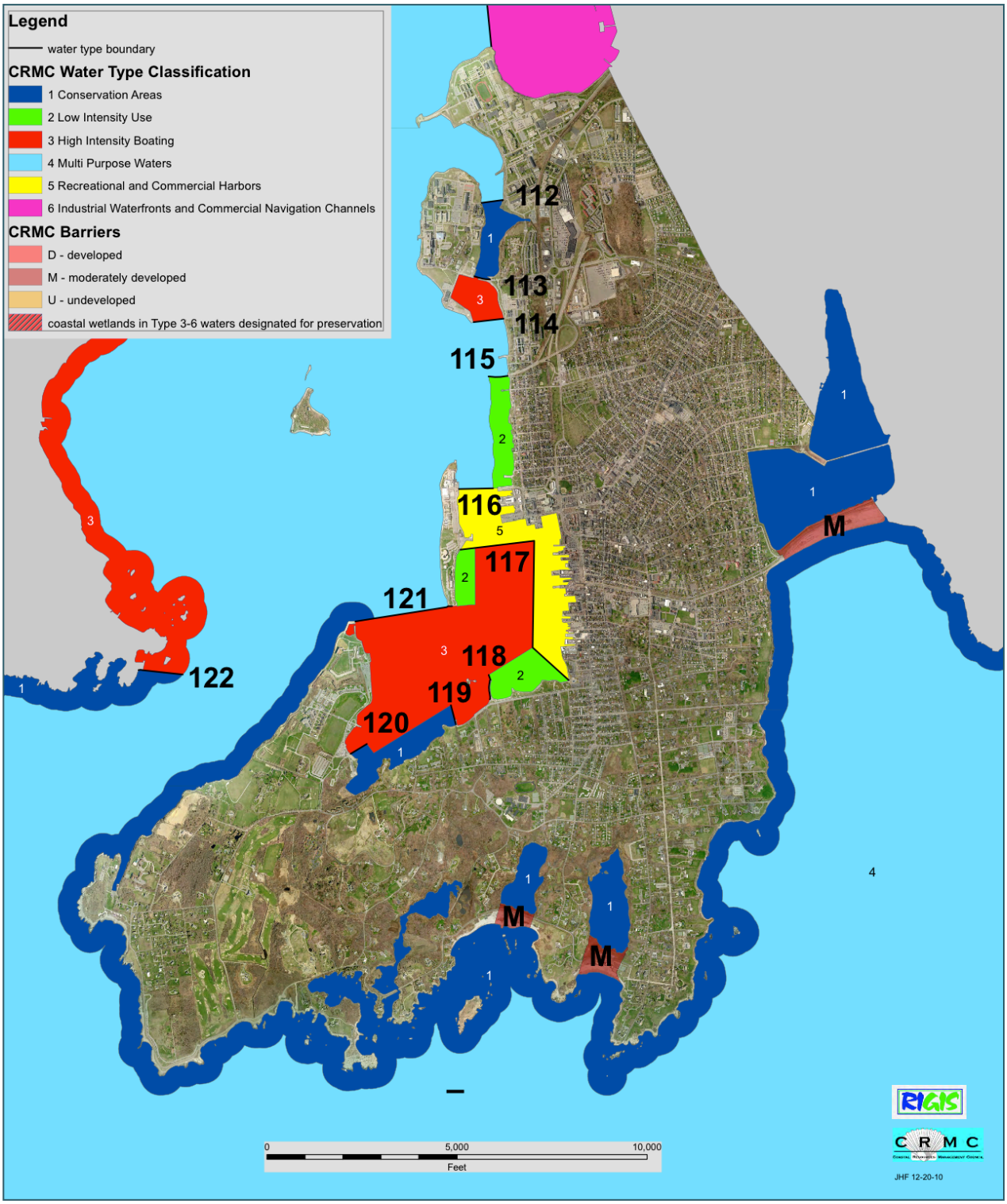
[9] R.I. CRMC Water Use Maps: www.crmc.ri.gov/maps/maps_wateruse.html
[10] R.I. CRMC Regulations: www.crmc.ri.gov/regulations/RICRMP.pdf
[11] R.I. CRMC SAMPs: www.crmc.ri.gov/samps.html



The CRMC Water Use map for the City of Newport, Rhode Island. The water use maps show the six different water types, or classifications, as determined by CRMC along Rhode Island's coast. Maps for all of the coastal municipalities are at www.crmc.ri.gov/maps/maps_wateruse.html.

3. Is the property in a flood zone according to FEMA maps?

With the increased frequency and severity of storms and ongoing sea-level rise, coastal properties are often at higher risk for damage caused by flooding events. As such, proximity to the coast can have a number of impacts on a coastal property, from additional flood insurance premiums to special building requirements.

As part of the National Flood Insurance Program[12], the Federal Emergency Management Agency, or FEMA, has mapped risk zones for flood-prone areas, and these maps inform flood insurance rates as well as municipal and state regulations. The most recent Flood Insurance Rate Maps, or FIRMs, can be found at the FEMA Map Service Center[13].

FEMA Flood Zones

The FEMA flood zones are defined by the likelihood of flooding events caused by storms, specifically, the probability of a certain flood's occurrence in any given year. The varying flood zones represent areas inundated by flooding events of differing magnitudes, and are the basis of the FEMA flood maps.

The **base flood** has about a 1% chance of being met or exceeded during any given year. Often referred to as the 100-year flood, this flooding event is anticipated to impact Special Flood Hazard Area zones A and V.

A **0.2% annual chance flood** occurs when a storm of a magnitude so great that only 2 out 1,000 (or 1 out of 500) floods will be of equal or greater size or intensity. This flood event is sometimes referred to as 500-year storm event, and is represented by the 0.2% zone.

Why it matters: If a structure is in a high-risk flood hazard zone (or a Special Flood Hazard Area) as determined by FEMA, a buyer must obtain flood insurance in order to get a mortgage. For owners of existing structures within flood zones, taking out a line of credit, obtaining a reverse mortgage, or acquiring any federally-attached loan will require the borrower to purchase flood insurance. For property owners looking to build, any structure built in a SFHA will require flood insurance if a mortgage is needed, and new construction will have to meet the latest building codes.[14]

To find out if the property is in a flood zone: Consult the Flood Insurance Rate Maps (FIRMs) for the municipality. These are located at the city or town hall, but can also be found online at the FEMA Map Service Center. Additionally, FIRM information is available on the R.I. Emergency Management Agency (RIEMA) flood mapping page[15], and through the RIEMA Floodplain Mapping tool. The RIEMA Floodplain Mapping tool is intended to be used for reference only, and will direct the user to the official FIRMs. The tool comes with a helpful tutorial[16] that explains the maps, the different flood zones, and how to get more information about a specific property.

If the property is not currently in a flood zone, be sure to check the 0.2% risk area (or 500-year flood zone)[17] to see if the property may be in the flood zone in the future. With rising sea levels, the 0.2% risk area may offer a more accurate look at the future floodplain. Additionally, many lenders assess flood-risk for the life of the loan, and with increasing sea-level rise and shoreline change, the long-term impacts on the property may come into play.

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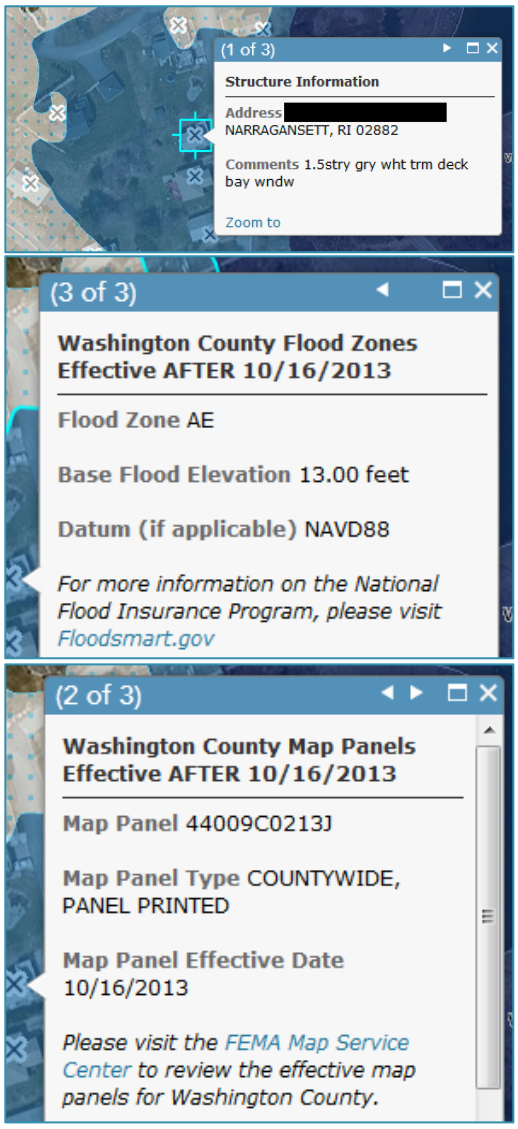
[12] National Flood Insurance Program: www.fema.gov/national-flood-insurance-program
[13] FEMA Map Service Center: msc.fema.gov/
[14] For information about structural resiliency in relation to flooding, please see question 10.
[15] RIEMA Floodplain mapping: www.riema.ri.gov/prevention/floods/flood_mapping.php
[16] RIEMA Map Tool Tutorial: www.riema.ri.gov/prevention/floods/MapToolTutorial.pdf
[17] FEMA Flood Zones: www.fema.gov/floodplain-management/flood-zones

Consulting the Maps

- **Base flood** – the flood having a 1% chance of being equaled in any given year, also known as the "100-year-flood" – this is used as a national standard
- **Base flood elevation (BFE)** – the computed elevation for which floodwater is anticipated to rise during base flood
- **Elevation certificate (EC)** – a FEMA document filled out by a professional which verifies the elevation of the lowest floor of a building (necessary for obtaining insurance and other information)
- **FIRM** – Flood Insurance Rate Map
- **Flood insurance premiums** – the relationship between the BFE and a structure's elevation determines the flood insurance premium
- **Floodplain** – the area inundated by the base flood
- **Flood Zones** – 0.2 Percent Annual Chance Flood Zone, A-zone, AE-zone, AH-zone, AO-zone, VE-zone (see the flood zone descriptions on the next page)
- **Lowest floor** – the lowest enclosed area of the structure, including the basement
- **Map panel** – corresponds to FIRMs, refers to specific sections of the map
- **NFIP** – National Flood Insurance Program
- **SFHA** – Special Flood Hazard Area



Using the RIEMA Floodplain Mapping Tool

Please note that the RIEMA Floodplain Mapping tool is intended to be used for reference only, and will direct the user to the official FIRMs. The RIEMA mapping tool is based on the FEMA flood insurance maps, and displays all of the FEMA flood zones. See the explanation of the flood zones, from the RIEMA Map Tool Tutorial below.

After an address is entered, the mapping tool provides the FIRM Map panel for the property, and, if the structure is within the SFHA, the flood zone classification, and the BFE (right).

ZONE	DESCRIPTION
0.2%	Areas of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. Are also used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
A	Areas with 1% annual chance of flooding and 26% chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas; no depths or BFEs are shown within these zones.
AE	The base floodplain where base flood elevations are provided.
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas, and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. These areas have a 26% chance of flooding over the life of a 30-year mortgage. Average flood depths derived from detailed analyses are shown within these zones.
VE	Coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30-year mortgage. BFEs derived from detailed analyses are shown at selected intervals within these zones.

4. If I am in a flood zone, do I have to obtain flood insurance? How can I find out what my flood insurance premiums will be?

Homeowner's insurance does not cover damage caused by coastal flooding – flood insurance in the coastal zone must be purchased separately. As part of the National Flood Insurance Program (NFIP)[18], the federal government offers flood insurance to homeowners everywhere, including those within the coastal floodplain.

Why it matters: If a structure is in a high-risk flood hazard zone as determined by FEMA, a buyer must obtain flood insurance in order to get a mortgage. For existing structures or buildings within flood zones, an owner taking out a line of credit, obtaining a reverse mortgage, or acquiring any federally-attached loan will need to purchase flood insurance. Property owners intending to build in a flood zone will be required to purchase flood insurance if they are obtaining a mortgage. Additionally, all new construction must meet the most recent building codes.

If a property is only partially in a flood zone, structures that are not within the flood zone do not require flood insurance.

To determine if your property is within a flood zone, and to obtain information about structures on the property, visit the FEMA Map Service Center[19] or the RIEMA floodplain mapping page[20].

Image from the RIEMA Floodplain Mapping Tool. The structure on the left would not have a mandatory flood insurance requirement, while the structure to the right is entirely within the AE Zone and would require a borrower to purchase flood insurance.

Getting a Flood Insurance Estimate

In order to get a flood insurance estimate, an owner must obtain an elevation certificate[21] for any post-FIRM structure (a building constructed or substantially improved after the adoption of the first flood insurance rate maps). An elevation certificate is an official FEMA document filled out by an authorized land surveyor, engineer, or architect verifying the elevation of the lowest floor[22] of the structure. Elevation certificates are used to determine the

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[18] National Flood Insurance Program: www.fema.gov/national-flood-insurance-program
[19] FEMA Map Service Center: msc.fema.gov/
[20] RIEMA Floodplain mapping: www.riema.ri.gov/prevention/floods/flood_mapping.php
[21] FEMA NFIP Elevation Certificate and Instructions: www.fema.gov/media-library-data/20130726-1437-20490-0725/f_053_elevcertif_30nov12_fillable.pdf
[22] The *lowest floor* of a structure is the lowest floor of the lowest enclosed area of a structure, including the structure's basement. Areas that are not fully enclosed or are flood-resistant (frequently areas used for storage, parking, or access) are not considered the lowest floor.

appropriate flood insurance premium rate for the building, and also attest to a community's compliance with floodplain management ordinances.

Once the elevation certificate is verified, an insurance company can provide estimates for future flood insurance premium rates. Due to recent changes in the NFIP, relying on a property seller's premiums and other insurance information to estimate potential premium is not recommended.

Reducing Flood Insurance Premiums: Elevating Your Structure

Rhode Island State Building Code (see www.ribcc.ri.gov/) mandates that new and substantially improved one and two family residential buildings in coastal A and V zones be elevated at least one foot above the base flood elevation. For structures in Coastal A zones, the lowest floor of the dwelling must be one foot above the BFE. For structures in Coastal V zones, the lowest horizontal structural member must be one foot above the BFE.

Increasing the freeboard (the space between the BFE and the lowest enclosed floor or horizontal structural member) by more than the required foot will help reduce flood insurance premiums, and may aid in protecting the structure from flood-related damage. Elevating above the mandatory requirement may also prevent increased flood insurance premiums in the future, should the floodplain shift due to shoreline change and sea-level rise.

For more information about elevating structures, increasing structural resiliency, and flood-proofing buildings, please see Question 10: *Can I make the existing building more resilient? How do I build a new resilient structure?*

Flood Insurance Claims & Past Damage

FEMA flood insurance claim information is not accessible to the public. However, FEMA provides statistics on claims by state and municipality. The loss statistics for Rhode Island are located in FEMA's NFIP statistics report[23].

If you are purchasing a property with existing buildings, ask the seller or real estate licensee about the property's history of flood damage – it is the seller's responsibility to disclose any known defects to prospective buyers[24]. You can also contact the municipality's building official to get information on any permits that were required or issued to the previous owners documenting any repairs or renovations to the building.

NFIP Community Rating System

The Community Rating System (CRS)[25] is a voluntary program through which communities can earn discounts off premiums for flood insurance policy holders by exceeding NFIP floodplain management requirements. If you are purchasing flood insurance, visit the RIEMA Floodplain Management page[26] to see if your community participates in the program. It is the responsibility of the property owner to notify his or her insurance agent of a community's participation in the program.

Find out more: For more information about the floodplain, flood insurance, and the Community Rating System, visit the RIEMA's Flood Insurance page[27], consult the Floodplain Management in Rhode Island: 2007 Quick Guide[28], or contact your local NFIP Coordinator[29]. For additional insurance information, please see the R.I. Department of Business Regulation Insurance Division's Consumer Alert HURRICANE PREPARATION: Act Now to Make Filing a Claim Easier After the Storm[30].

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[23] R.I. NFIP Statistics: bsa.nfipstat.fema.gov/reports/1040.htm#44
[24] R.I. Real Estate Sales Disclosures: webserver.rilin.state.ri.us/Statutes/TITLE5/5-20.8/INDEX.HTM
[25] FEMA Community Rating System: www.fema.gov/national-flood-insurance-program-community-rating-system
[26] RIEMA Floodplain Management: www.riema.ri.gov/prevention/floods/
[27] RIEMA Flood Insurance Information: www.riema.ri.gov/prevention/floods/flood_insurance.php
[28] Floodplain Management Guide: www.riema.ri.gov/prevention/floods/floods_documents/RIQG_DesktopPrint.pdf
[29] Local NFIP Coordinators: www.riema.ri.gov/prevention/floods/localNFIP.php
[30] R.I. Department of Business Regulation Insurance Division - Consumer Alert Hurricane Preparation: www.dbr.state.ri.us/documents/divisions/insurance/consumers/ConsumerAlert2014-5.pdf

5. How will erosion and sea-level rise impact the property and surrounding area?

EROSION is the process by which wave action, wind, and storm surges remove sediment from beaches, dunes, bluffs, and headlands. Once removed from the shore, the sediment can be carried away into the coastal lagoons, deposited on the back of coastal barriers, or swept offshore; often, the sediment won't return to the shoreline.

Extensive erosion in Matunuck, R.I. Tropical Storm Sandy caused severe erosion along the southern Rhode Island coast in 2012.

Although shorelines go through natural periods of change, there has been a net loss of sediment over the past few decades in Rhode Island and many municipalities have faced, or are currently facing erosion issues on both public and private beaches. Notably, the most eroded portions of state's coastline have lost over 250 feet of beach in just 50 years.

SEA-LEVEL RISE: Since 1930, sea-level rise in Rhode Island has increased an average of 1 inch per decade. However, the rate of sea-level rise has quickened and sea level along Rhode Island's coast has risen 6 inches over the last 40 years. Accelerated sea-level rise is projected to continue into the next century.

What can we expect in the future?

Coastal erosion is primarily influenced by storm events along the shore. In the future, both sea levels and storm intensity are expected to increase as a result of climate change. Therefore, coastal erosion will likely increase, especially along areas of the Rhode Island coastline most exposed to wave action.

The CRMC projects that Rhode Island sea levels will rise between 3 and 5 feet by 2100 (Section 145 of the CRMC Regulations, www.crmc.ri.gov/regulations/RICRMP.pdf). Accelerated sea-level rise creates concern for coastal towns and cities with vulnerable infrastructure such as roads, utility lines, water supplies, sewage treatment facilities, and public property along the shore. In addition, private coastal property will be subjected to increased flooding or permanent inundation.

CRMC recommends that coastal municipalities recognize and plan for sea-level rise, as does the state. By 2016, under the 2012 Comprehensive Planning Act, Rhode Island municipalities will have to address natural hazards, including sea-level rise, where applicable, within their municipal comprehension plans.

Why it matters: Shoreline change not only impacts beaches and nearby structures, but also affects vital coastal infrastructure, like the roads leading to shoreline properties. For shorefront real estate, it is important to consider how erosion and sea-level rise currently influence the shoreline, and how long-term changes may affect the specific property in the future, and over the course of the design-life of a coastal structure. When assessing the impacts of erosion and sea-level rise on a property, be sure to look at how sewer lines, water lines, and access to a property may be compromised over the long-term.

Find out more: The CRMC has created a series of shoreline change maps[31] that depict past coastal erosion. These maps can help you gauge how much erosion a property may experience in the future. To get an idea of how sea-level rise will impact the state, your community, and your property, use the Rhode Island Inundation Surfaces interactive map[32].

Is the property in an area that has experienced significant erosion?

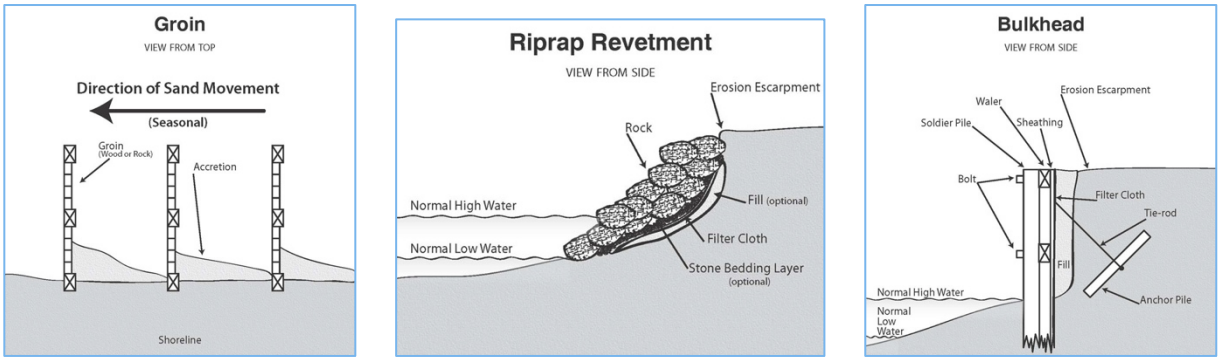
You can use the CRMC Shoreline Change Maps to find out. The maps demonstrate past erosion along Rhode Island's shoreline, and provide rates of erosional change along the coast. For information about how erosion rates influence coastal setbacks, see Question 1: *What kinds of coastal features are on or near the property, and what kinds of setbacks or regulations apply?*

Please note: Coastal erosion does not occur slowly and steadily over time at a constant rate, but is instead the result of abrupt changes due to storms. For that reason, the rates provided on the CRMC Shoreline Change Maps should be used with caution.

[31] R.I. CRMC Shoreline Change Maps: www.crmc.ri.gov/maps/maps_shorechange.html
[32] R.I. Inundation Surfaces (SLR viewer): www.arcgis.com/home/webmap/viewer.html?webmap=6b97585af3ee4b51af62a10953cd7dc0

6. Can I install structures along the shore to protect the property and buildings from erosion or flooding?

Examples of shoreline protection structures. Source: N.C. Division of Coastal Management[33]



Shoreline protection structures are manmade formations like revetments or seawalls designed to protect landforms or structures along the coast. Often, these structures are installed with the intention of preventing shoreline erosion, but shoreline protection structures frequently contribute to increased erosion farther down the coast.

In Rhode Island, the CRMC regulates the installation and maintenance of shoreline protection structures, and differentiates between existing structures and new structures, as well as hardened or natural structures.

Seawalls, groins, jetties, breakwaters, bulkheads, and revetments are examples of hardened shoreline protection structures, meaning they do not utilize natural or "green" infrastructure to protect the shorefront from erosion. Instead, these structures are composed of concrete, quarry stone, wood, or even the remnants of buildings destroyed by extreme coastal weather.

Shoreline protection structures in Rhode Island: a seawall, a riprap revetment, and a bulkhead.

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[33] dcm2.enr.state.nc.us/estuarineshoreline/options.html

Why it matters: Frequently, hardened structures cause increased erosion in areas farther down the coast by retaining erodible sediment behind the structure and sometimes interrupting alongshore transport of sediment to those properties. This means that if an adjacent property owner has a seawall or revetment, the neighboring property's beachfront may be impacted in the future.

If there is an existing shoreline protection structure on the property, be advised that many existing older walls and revetments were not designed to withstand the wave forces and storm surges that are produced by storm events. Many of the revetments on properties in Rhode Island were installed prior to state regulations pertaining to shoreline structures and were built haphazardly or too close to the structures they are intended to protect, which can exacerbate damage to homes during storms. Even a properly designed shoreline protection structure may not protect the property under all circumstances.

CRMC Guidelines on Shoreline Protection Structures

Maintaining structures: Any alteration or maintenance to an existing shoreline protection structure requires a CRMC permit. Engineers on CRMC's staff will review the proposed structure to ensure that it is designed correctly for its location.

New structures: Structural shoreline protection facilities are prohibited when they are implemented to regain property lost through past erosion by storms. In Type 1 waters, and along undeveloped, moderately developed, and developed barriers, CRMC does not permit new shoreline protection structures. Existing structures may be maintained (but not enlarged or enhanced) with a CRMC permit.

Non-structural methods for controlling erosion such as planting vegetation or beach nourishment are encouraged by the CRMC. New, hardened shoreline protection structures are only permitted when the property owner has exhausted other, non-hardened methods of shoreline protection.

Find out more: For more information about shoreline protection structures, their installation, and maintenance, refer to Section 300.7 of the CRMC regulations.[34]

[34] R.I. CRMC Regulations: www.crmc.ri.gov/regulations/RICRMP.pdf

7. How will coastal storms and flooding affect the property and structures? Will I be allowed to rebuild in the event of a flood or storm that partially or completely destroys the building?

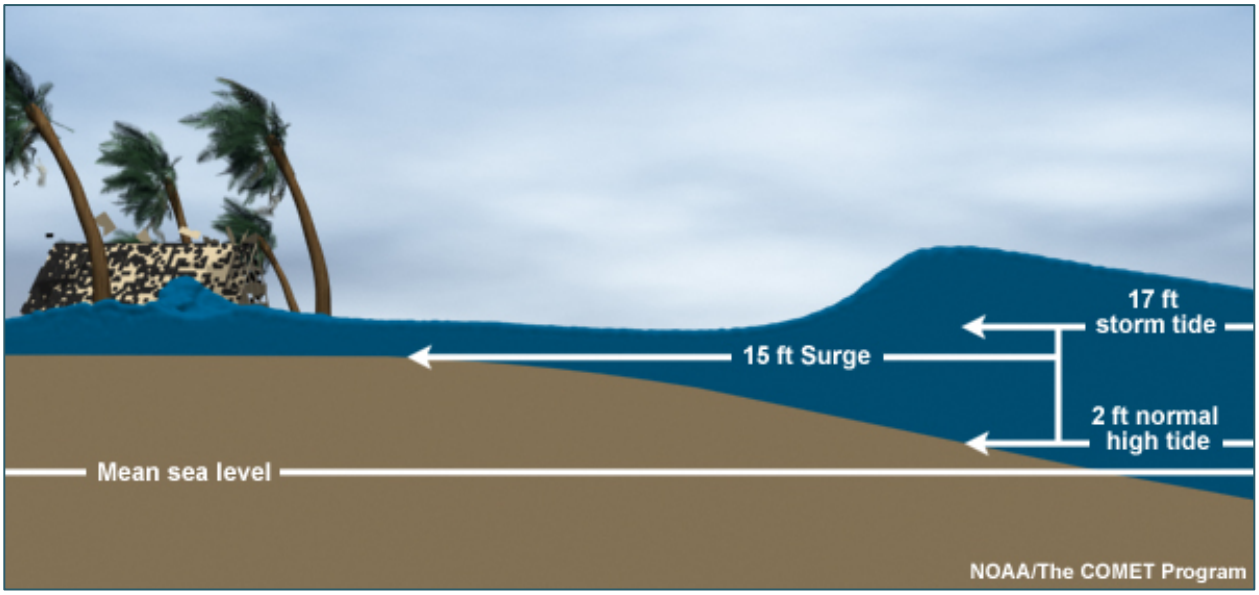
In Rhode Island, tidal flooding, high winds, coastal flood events, hurricanes and other storms can impact property and activity along the shoreline. Severe weather and associated inundation can cause extensive and expensive damage to coastal properties, and, in extreme cases, may debilitate entire communities.

Storms & Flooding

Storms are a year-round concern for coastal residents, as tropical storms and hurricanes occur in late summer and early fall while extratropical storms, including nor'easters, occur in mid- to late-fall, winter, and early to mid-spring.

Storms cause coastal erosion and other shoreline changes due to high winds, increased ocean water height, and wave action along the coast. Several factors contribute to a storm's magnitude and destructive power, including wind speed, wind direction, wave action, and the status of the tide at the time of the storm's passing.

The **storm surge**, which is an elevation of water beyond the typical tidal range that occurs during storms, can result in flooding when storm winds push the elevated ocean water toward the coastline. The storm surge combined with the normal tidal elevation is the **storm tide**, or the observed level of the ocean during a storm event. The storm surge can cause extensive damage to coastal property and is a serious hazard during coastal storms and hurricanes.



During a storm event like a hurricane, a storm surge forms on top of normal tide levels. The resulting storm tide can cause extensive coastal inundation if winds push the ocean water toward the shoreline. Image source: www.nhc.noaa.gov/surge/

As a result of climate change, future storm events may produce stronger wave action, larger storm surges, and extreme precipitation, resulting in greater flood impacts and increased coastal erosion. Moreover, climate change is anticipated to cause increased frequency and intensity of storms.

Review the Rhode Island Hurricane Inundation Maps[35] to see how flooding caused by coastal storms and hurricanes may impact the property and the nearby area. Even if the property isn't in a flood zone, flooding in the surrounding area may damage critical infrastructure or make evacuation routes inaccessible.

[35] U.S. Army Corps of Engineers Hurricane Inundation Maps: www.riema.ri.gov/preparedness/evacuation/hurricane_inundation.php

Rhode Island's Big One – The 1938 Hurricane

Similarly to the way in which flood zones are defined by likelihood of a flood event's occurrence, storms are categorized by magnitude and probability of occurrence during a given time period. A '100-year storm event' has about a 1 in 100 probability of occurring during any given year. The Hurricane of 1938 meets the storm surge and wave height criteria for a 100-year storm, and as such is the "storm of record" for Rhode Island.

The 1938 Hurricane was devastating for Rhode Island as a whole, and was especially destructive for coastal communities along the south shore of the state. The hurricane was particularly impactful because forecasters expected the storm to move away from the New England coast, and coastal residents were not adequately warned about the impending disaster.

Corn Neck Road on Block Island, R.I. (left) was partially destroyed during Sandy, while many private properties were damaged along the south coast of R.I. (right). Though Sandy caused destruction due to high winds and flooding, the storm was not a worst-case scenario for R.I. Below: Destruction in Oakland Beach, Warwick, R.I., following the 1938 Hurricane.

THE 1938 HURRICANE AND HURRICANE SANDY[36] – The 1938 event was a Category 3 Hurricane that coincided with a high tide, and passed just to the west of Rhode Island, causing the region to experience wind speeds of the hurricane's highest velocity. In contrast, Hurricane Sandy did not hit the state directly, and was technically a Post-tropical Cyclone when it impacted Rhode Island.

	1938 Hurricane	Hurricane Sandy (2012)
Winds	Sustained winds of 91 mph with gusts of 121 mph (Block Island, RI) Sustained winds of 100 mph with gusts of 125 mph (Providence, RI)	Sustained winds of 64.4 mph, gusts of 80 - 86 mph (Southern R.I. coast) Sustained winds of 41.4 mph (Providence, RI)
Storm Surge	Newport storm surge height: 11.6 feet above mean sea level, 9.5 feet higher than normal high tide Providence storm surge height: 15.25 feet above mean sea level, ~13.5 feet higher than normal high tide	South coast storm surge height: 4.4 feet above normal high tide Providence storm surge height: 9.4 feet above mean sea level, 4.6 feet above normal high tide
Deaths	262 direct deaths in Rhode Island	No direct deaths in Rhode Island
Damages	Beach communities along south coast devastated, over 2,000 homes destroyed or damaged, extensive flooding along coast Estimated cost of damages (in R.I.): $100 million (1938 USD); $1.6 billion (2013 USD)	Wind, storm surge and flooding caused damage to public and private property, 624 homes destroyed or damaged in Washington County Estimated cost of damages (in R.I.): as yet undetermined

While Sandy caused significant damages in Rhode Island, the 1938 Hurricane eclipses the 2012 event in wind speed, height of storm surge, and overall strength. Furthermore, coastal development has reclaimed much of the land area impacted by the '38 storm, so even more property, assets, and infrastructure will be at risk should a 100-year-storm hit Rhode Island directly.

Hazard Preparedness & Hurricane Evacuation

A storm of the magnitude experienced in 1938 has about a 1 in 100 probability of occurring in a given year, meaning that there is a 30% chance that a coastal structure will be impacted by at least one major storm event over the course of a 30-year mortgage. However, there is always a risk that a significant storm or flooding event will occur, and coastal residents especially should be prepared for a large-scale event.

HAVE A DISASTER PLAN – The R.I. Emergency Management Agency recommends that all Rhode Island residents prepare for disasters by reviewing evacuation zones and routes, instating evacuation plans, and having disaster supply kits (RIEMA Evacuation Information[37]). Additionally, coastal residents should view the Rhode Island Hurricane Inundation Maps[38] and the Rhode Island Hurricane Evacuation Maps[39] in order to anticipate storm-surge related evacuations.

For information about planning for hurricanes and other hazards, consult your municipality's hazard mitigation plan, the CRMC Hurricane Preparedness Guide[40], Storm Smart Rhode Island[41], and the 2014 R.I. Hazard Mitigation Plan[42].

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[36] *'The Great New England Hurricane of 1938', NOAA National Weather Service (www.erh.noaa.gov/box/hurricane/hurricane1938.shtml), 'Hurricane of '38 wrought unparalleled destruction, death on unprepared R.I.', Providence Journal (www.providencejournal.com/breaking-news/content/20130920-hurricane-of-38-wrought-unparalleled-destruction-death-on-unprepared-r.i..ece), 'Examining The Impacts of Hurricane Sandy on Rhode Island: A serious wake-up call' David R. Vallee (www.slideshare.net/riseagrant/examining-the-impacts-of-hurricane-sandy-on-rhode-island-a-serious-wakeup-call), and 'Tropical Cyclone Report - Hurricane Sandy', NOAA National Weather Service (www.nhc.noaa.gov/data/tcr/AL182012_Sandy.pdf).*

[37] RIEMA Evacuation Information: www.riema.ri.gov/preparedness/evacuation/

[38] U.S. Army Corps of Engineers Hurricane Inundation Maps: www.riema.ri.gov/preparedness/evacuation/hurricane_inundation.php

[39] R.I. Hurricane Evacuation Maps: www.riema.ri.gov/preparedness/evacuation/hurricane_evac.php#EvacMaps

[40] CRMC Hurricane Preparedness Guide: www.crmc.ri.gov/coastalstorms/Hurricane_Prepare_RI.pdf

[41] StormSmart Rhode Island: ri.stormsmart.org/

[42] 2014 R.I. Hazard Mitigation Plan: www.riema.ri.gov/prevention/mitigation/RI%20HMP_2014_FINAL.pdf

KNOW YOUR RISK – Consult the flood zone maps, inundation maps, and wind zone map[43] for Rhode Island to understand the property's susceptibility to coastal storms. If there are existing buildings on the property, structures should be assessed by an inspector or engineer to discover how well they will withstand storm events. For more information about how a structure was built, and whether it has undergone any repairs in the aftermath of storms, owners or potential buyers can contact the municipality's building official to view permitting records.

MINIMIZE YOUR RISK – Where possible, owners should retrofit or build structures to increase structural resiliency in the face of wind and flood loads. Elevating structures and setting structures back from the coast are recommended practices for minimizing risk. Remember: no method is 100% fail-safe when it comes to protecting coastal property from storm-related damage, but certain measure can lower the structure's vulnerability to storms.

DURING THE STORM – In the event of severe coastal storms or a hurricane, heed the warnings of local or state officials, and evacuate the area if necessary. Personal safety should be the primary concern of residents during hazardous conditions.

AFTER THE STORM – Coastal structures can sustain damage from high winds, flooding, and storm-carried debris during a storm event. While homeowner's insurance may cover wind damage, only flood insurance will cover damage caused by flooding. Review your policies to understand what damage will be covered, and to what extent. For more information about insurance and claims, see HURRICANE PREPARATION: Act Now to Make Filing a Claim Easier After the Storm[44].

Will I be allowed to rebuild in the event of a flood or storm that partially or completely destroys the building?

Repairs and renovations to structures in flood-prone areas are subject to special regulations under the National Flood Insurance Program that require owners to bring structures into compliance with the latest codes for construction in the floodplain. In the event that a structure within the floodplain sustains *substantial damage*, or renovations qualify as *substantial improvements*, that structure must now meet the most recent requirements for new construction in the floodplain.

> *Substantial damage* means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50% of the market value of the structure before the damage occurred.
>
> *Substantial improvement* means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50% of the market value of the structure before the "start of construction" of the improvement. This term includes structures that have incurred "substantial damage," regardless of the actual repair work performed.
>
> *-NFIP Substantial Improvement/Substantial Damage: Requirements and Definitions (FEMA)*

Similarly, all structures that are undergoing substantial improvement within CRMC's jurisdiction must be brought into compliance with the all CRMC regulations, in addition to requiring standard CRMC permits.

For more information, please see FEMA's *NFIP Substantial Improvement/Substantial Damage: Requirements and Definitions* (http://www.fema.gov/media-library-data/20130726-1733-25045-8643/p758_ch3_r2.pdf).

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[43] R.I. Wind Zone Map – see page 21 of this document: sos.ri.gov/documents/archives/regdocs/released/pdf/BCSC/5976.pdf

[44] R.I. Department of Business Regulation Insurance Division - Consumer Alert Hurricane Preparation: www.dbr.state.ri.us/documents/divisions/insurance/consumers/ConsumerAlert2014-5.pdf

8. How do I determine if the buildings on the property meet the current design and construction standards for the flood zone?

Many homes along the coast were built before the institution of the National Flood Insurance Program (NFIP), and therefore prior to a community's first floodplain management code, ordinance, or standard. Since the adoption of the earliest flood insurance rate maps (FIRMs) in the mid-1970s, provisions designed to increase the flood-resistance of coastal structures have been strengthened within international, federal, and state building codes to meet the requirements of the NFIP.

In addition to the setbacks discussed in relation to coastal features and buffer zones (see Question 1: *What kinds of coastal features are on or near the property, and what kinds of setbacks or regulations apply?*), buildings in the coastal zone are required to meet certain standards in regards to design, construction, and siting. For example, in accordance with the NFIP, Rhode Island State Building Code[45] requires that new and substantially improved structures in flood-prone areas be elevated at least one foot above the base flood elevation (BFE) for the area[46], and that all building components below BFE be constructed with flood-resistant materials.

Why it matters: If there is an older building on a coastal property, the structure may be more prone to damage from coastal hazards as a result of being built to less stringent codes.

To begin to assess the property, consult the list of questions on the following page. For a more detailed assessment, owners should engage an engineer or other building professional to evaluate the property to determine structural vulnerabilities.

Additionally, owners and potential buyers of coastal buildings can contact the municipality's building official to get information on any permits that were required or issued to the previous owners documenting any repairs or renovations. These records can indicate how the structures were built, if they were ever updated, and measures were taken to increase structural resiliency.

Find out more: For more information about building standards in the floodplain, please see Section 300.3, Part G - *Guidelines for Construction in Flood Hazard Zones* in the CRMC regulations, and the resources listed in Question 10 of this document, *Can I make the existing building more resilient? How do I build a new resilient structure?* For information about flood-resistant building features, refer to the Floodplain Management in Rhode Island: 2007 Quick Guide[47].

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[45] Rhode Island State Building Code documents: sos.ri.gov/library/buildingcodes/

[46] To determine if a property is within a flood zone visit the RIEMA floodplain mapping page at www.riema.ri.gov/prevention/floods/flood_mapping.php. There, you can find the base flood elevation (BFE) for the area if it is available.

[47] Floodplain Management Guide www.riema.ri.gov/prevention/floods/floods_documents/RIQG_DesktopPrint.pdf

Assessing an existing building for risk- initial questions to ask, and what to look for:

If you own or are planning to buy a coastal structure that was built prior to the municipality's adoption and enforcement of floodplain ordinances, the structure may be more vulnerable to coastal hazards than newer structures. To begin a preliminary assessment of the property and structure, consult permitting documents at the Building Official's office or utilize the resources and maps cited in this document and obtain the answers to the following questions.

For a more complete analysis of risk and susceptibilities to coastal hazards, engage an engineer or other building professional to evaluate the property and structure.

- Does the structure meet CRMC's current setback requirements for the area? If not, in the event that the structure requires substantial repairs or renovations, the structure will have to be relocated to meet CRMC siting regulations.
- Is the structure in a flood zone according to FEMA FIRMs? If so, what is the BFE for the area?
- Is the lowest floor (the lowest floor of the lowest enclosed area, including the basement) of the building above the base flood elevation, or BFE, for the area? If not, the lowest level may flood in a storm event.
- If the structure is elevated, assess the quality of the piles and foundation. Are the pilings deep enough and adequately braced? Does the foundation allow the unobstructed flow of floodwaters?
- Is the structure on a concrete slab, and if so, how does its elevation compare to the BFE? Is the foundation vulnerable to erosion or flooding?
- Is the structure located on or near an eroding coastal feature? For example, if the structure is on a bluff, though it may be out of the floodplain, coastal erosion could undermine the bluff resulting in eventual collapse.
- Are the materials used in the foundation vulnerable to water-damage? Current provisions call for structural elements below the BFE to be constructed out of flood-resistant materials.
- Have storm resistance measures been included in the design and construction of the building? Resistance measures may include flood vents below the BFE, hurricane clips, hurricane shutters, other protective measures for windows, and sealing the roof to prevent leaks during storm events.
- Are the structure's mechanical and utility equipment housed above the BFE? Is the equipment on the water-ward (more vulnerable) or the landward (less vulnerable) side of the building?
- If present, are breakaway walls and similar structures unobstructed? Are any elements tethered to breakaway walls? If breakaway walls are obstructed or have tethered elements, they will not function properly in a flood event, and may cause more damage.
- Are external elements such as the fuel tank sufficiently tied down or protected?
- Are there nearby elements or objects that could become storm-driven debris? Debris may damage a structure or property during flooding or high winds.
- What are the nearby grade elevations, and how do they compare to the property's elevations? Understanding neighboring topography may help you identify which areas of the property are more susceptible to flooding.
- Is the structure close to other coastal buildings? If so, are these buildings elevated or at ground-level? If nearby structures are swept from their foundations during storm events, the bulky debris can cause significant damage to event the most well constructed coastal building.

9. What kinds of septic systems are permitted in the coastal zone? Can I repair or replace a damaged septic system?

In addition to assessing buildings on the property for potential vulnerabilities to coastal hazards, it's important to be aware of the property's septic system status. If the property is not connected to the municipality's sewer system and has an *onsite wastewater treatment system*, the system may be susceptible to damage from storms, flooding, or erosion. In some instances, the system may need to be repaired, replaced, or upgraded in order to meet CRMC standards.

CRMC Definition: Onsite Wastewater Treatment Systems (OWTS)

An onsite wastewater treatment system means any system of piping, tanks, dispersal areas, alternative toilets, or other facilities designed to function as a unit to convey, store, treat or disperse wastewater by means other than discharge into a public sewer system.

CRMC Regulation: OWTS

The construction, repair or alteration of all OWTS and components shall conform to the standards set forth in the most recent Rules Establishing Minimum Standards relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems promulgated by the Rhode Island Department of Environmental Management (http://www.dem.ri.gov/pubs/regs/regs/water/owts09.pdf).

Exposed septic system: Erosion can uncover and damage septic systems during severe coastal storms.

Why it matters: Within the coastal zone, the CRMC requires that any septic system within fifty feet of the shoreline be a zero-discharge system. Additionally, if the property has a cesspool within 200 feet of the shoreline, it must be replaced with a new septic system or the property must be connected to the municipal sewer lines in accordance with the DEM cesspool phase-out. A cesspool is any buried chamber that receives sewage from a building for disposal into the ground. For more information, please visit the DEM page on cesspool phase-out[48].

Below, purple shading indicates where the DEM's cesspool phase-out program is in effect. See the DEM's Environmental Resource Map[49] to see other municipalities.

In the event that a septic system in the coastal zone needs to be repaired or replaced following a storm, the homeowner must first obtain a permit from DEM and then submit that permit and relevant plans to the CRMC for approval (for repairs in erosion areas, please see OWTS Guidance for Repairs in Critical Erosion Areas).

Find out more: For more information about septic system management in the coastal zone, please see Section 300.6 of the CRMC regulations[50], CRMC's OWTS page[51], and the DEM's *Rules Establishing Minimum Standards relating to Location, Design, Construction and Maintenance of Onsite Wastewater Treatment Systems*[52].

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[48] R.I. DEM Cesspool Phase-out: www.dem.ri.gov/programs/benviron/water/permits/isds/cessfaze.htm
[49] R.I. DEM Environmental Resource Map: www.dem.ri.gov/maps/
[50] R.I. CRMC Regulations: www.crmc.ri.gov/regulations/RICRMP.pdf
[51] R.I. CRMC OWTS page: www.crmc.ri.gov/owt.html
[52] R.I. DEM OWTS Rules: www.dem.ri.gov/pubs/regs/regs/water/owts09.pdf

10. Can I make the existing building more resilient? How do I build a new resilient structure?

Retrofitting & Repairing an Existing Building

If the existing building is especially vulnerable to coastal hazards or does not meet the most recent standards for building in the coastal zone (Question 8: *How do I determine if the buildings on the property meet the current design and construction standards for the flood zone?*), it may be possible to retrofit the structure to increase resiliency. If a structure requires repairs following a coastal storm or flood event, it is recommended that owners incorporate resilience measures in the renovation process.

- **Elevating** – raising the structure so that it is above the base flood elevation (BFE) for the area. State building code requires new and substantially improved construction in the flood plain to be raised one foot above BFE, but increasing the freeboard (the space between the BFE and the lowest floor of the structure) will help reduce risk.
- **Retrofitting or reinforcing** – using methods such as hurricane shutters, flood vents, flood-resistant materials or other techniques to protect the structure.
- **Retreat or relocation** – moving the structure back from the shoreline. CRMC regulations require certain setbacks based on erosion rates and coastal features – exceeding these setbacks may reduce risk and prolong the life of the structure.
- **Repairing previously damaged structures** – if structures have been damaged due to coastal hazards, repairing them quickly will prevent increased vulnerability in the face of the next coastal weather event.
- **Replacing or repairing the structure's roof** – a large portion of storm-related damage is associated with roof failures. Replacing an older roof with a sealed, structurally sound roof could reduce potential storm-related damage by half.

RECOMMENDATION FOR BUYERS: If you intend to update or otherwise alter an existing structure, develop a plan to renovate or retrofit before buying. Weigh costs of improvements against flood insurance premiums, risk, and vulnerability. Buyers can obtain elevation certificates based on a proposed project in order to get flood insurance estimates for the renovated structure.

Elevated homes in Westerly, R.I. The green house (center) has been elevated to 5 feet above the base flood elevation.

Retrofitting Resource: IBHS FORTIFIED Program

The Insurance Institute for Business & Home Safety (IBHS) has created the FORTIFIED Program to help home- and business-owners to retrofit existing structures or design new construction for resilience. The program "helps any homeowner in a coastal area strengthen their home against the devastating power of tropical storms and hurricanes" (FORTIFIED Home *Hurricane Designation Pocket Guide*). Although the program has not yet been instituted in Rhode Island, resources at the IBHS FORTIFIED Program website (www.disastersafety.org/fortified-main/fortified-home/) provide valuable information about retrofitting existing structures and constructing resilient new buildings.

The CRMC recommends that property owners in the coastal zone retrofit or build structures to FORTIFIED Home Hurricane Designation Silver standard. The Silver standard requirements include:

- Sealed roof deck
- High wind rated roof mounted vents
- Gable wall vents protected against water intrusion
- All door, window, and skylight openings protected with qualified impact-protection systems
- Any attached structures connected by strapped beams or columns to prevent uplift

For more information about the FORTIFIED Home Hurricane Standards, consult the *Technical Requirements Summary for* the Bronze, Silver, and Gold standards (http://www.disastersafety.org/wp-content/uploads/FORTIFIED-Home-Technical-Standards-Hurricane-New-Construction_IBHS.pdf).

New Construction in the Coastal Zone

In addition to adhering to local building codes, new development in the coastal zone must meet specific criteria in regards to flood resistant and load-bearing construction as per the CRMC and the NFIP. The loads that need to be considered for coastal construction are wind loads, flood loads, breaking wave loads, and debris-impact loads.

Flood-provisions in the state's building code address elevation regulations, siting practices, the use of flood-resistant materials, and other design requirements for residential and commercial buildings in flood-prone areas. For information about Rhode Island's current building codes and standards, please visit the state's Building Code Commission website[53].

Best Practices for New Construction

These recommendations are derived from the FEMA Coastal Construction Manual. Strong, resilient structures will not only better withstand extreme weather, they may also help lower flood insurance premiums.

- Before purchasing the property, or beginning to build, consider the siting conditions. Is the area densely populated by older structures? Is the proposed structure close to an eroding coast? Are there older, failing shoreline protection structures nearby? All of these conditions contribute to the vulnerability of a coastal structure.
- Exceed minimum regulations, such as setbacks, and elevation requirements.
- The design of coastal buildings must consider coastal hazards and forces over the long-term.
- Designs should aim to either resist or avoid hazards, forces, and loads. For example, buildings should resist wind loads and avoid flood loads by elevating.
- Keep in mind that the FEMA flood maps do not factor in sea-level rise and ongoing erosion.
- Structural connections throughout the building should be strong, braced when possible, and resistant to corrosion.
- Make sure all enclosures (any space below the lowest floor that is enclosed by walls or partitions) are utilized properly. Breakaway walls and similar facades will not function adequately if they are blocked.

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[53] R.I. Building Code Commission: www.ribcc.ri.gov/

Find out more: For more information about building in the SFHA, please see Section 300.3, Part G - *Guidelines for Construction in Flood Hazard Zones* in the R.I. CRMC regulations.

For additional information about retrofitting, rebuilding, and constructing in the coastal zone, please consult the following resources:

- CRMC Rebuilding after the Hurricane[54]
- FEMA Coastal Construction Manual[55]
- FEMA Building Code Resources[56]
  - 2012 *International Building Code* – Flood Resistant Provisions[57]
  - Highlights of ASCE 24-05 Flood Resistant Design and Construction (2010)[58]
- FEMA Homeowner's Guide to Retrofitting[59]
  - Chapter Five: Elevating Your Home[60]
- FEMA Wind Retrofit Guide for Residential Buildings[61]
- Floodplain Management in Rhode Island: 2007 Quick Guide[62]
- International Code Council: Hurricane Safety[63]
- IBHS FORTIFIED Program[64]
  - FORTIFIED Home 2012 Hurricane Standards[65]
  - Is your roof FORTIFIED?[66]
- R.I. Flood Awareness & Climate Change Task Force - Rebuilding After a Storm[67]

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[54] CRMC – Rebuilding after the Hurricane: www.crmc.ri.gov/coastalstorms/CRMC_RebuildAfterHurricane.pdf
[55] FEMA Coastal Construction Manual: www.fema.gov/media-library-data/20130726-1510-20490-2899/fema55_voli_combined.pdf
[56] FEMA Building Code Resources: www.fema.gov/building-code-resources
[57] 2012 IBC Flood Resistant Provisions: www.fema.gov/media-library-data/20130726-1816-25045-8053/2012_i_code_floodprovisions.pdf
[58] Highlights of ASCE 24-05 Flood Resistant Design and Construction (2010): www.fema.gov/media-library-data/20130726-1643-20490-4974/asce24_highlights_dec2010.pdf
[59] FEMA Homeowner's Guide to Retrofitting: www.fema.gov/media-library-data/20130726-1441-20490-4268/fema_p312_a.pdf
[60] FEMA Elevating Your Home: www.fema.gov/pdf/rebuild/mat/sec5.pdf
[61] FEMA Wind Retrofit Guide for Residential Buildings: www.fema.gov/media-library-data/20130726-1753-25045-2304/508versioncombined_804.pdf
[62] Floodplain Management Quick Guide: www.riema.ri.gov/prevention/floods/floods_documents/RIQG_DesktopPrint.pdf
[63] ICC Hurricane Safety: www.iccsafe.org/safety/Pages/hurricane.aspx
[64] IBHS FORTIFIED Program: www.disastersafety.org/fortified-main/fortified-home/
[65] FORTIFIED Hurricane Standards: www.disastersafety.org/wp-content/uploads/fortified-home-hurricane-standards.pdf
[66] FORTIFIED Roof Information: www.disastersafety.org/wp-content/uploads/FORTIFIED-re-roofing-hurricane_IBHS.pdf
[67] R.I. FACCTF – Rebuilding After a Storm: www.crmc.ri.gov/coastalstorms/PostStormRebuild.pdf

Coastal Property Topics & Terms

Building codes: The State of Rhode Island currently adheres to the latest edition of the *International Building Code*, which includes provisions for construction in flood zones. Building to the latest standards is required for both new construction and when a structure undergoes repairs or renovations that constitute more than 50% of the structure's previous market value.

Coastal features: From barriers to bluffs, the shoreline is comprised of an array of naturally occurring elements. The presence of specific features on a coastal property determines certain setbacks and regulations.

Coastal hazards: A few of the hazards or processes that occur along Rhode Island's coast include storms and severe weather, storm-driven erosion, tidal flooding, and accelerated sea-level rise. These hazards may threaten coastal property or activities in the coastal zone now or in the future.

Coastal Resources Management Council (CRMC): The CRMC is the managing agency for Rhode Island's shoreline, and has jurisdiction within 200 feet of any coastal feature. Coastal property owners must obtain permits from the CRMC for various activities within this zone.

CRMC regulations: CRMC regulations and policy govern activity in the coastal zone based on area classifications and activities. *Coastal features* inform construction setbacks and buffers, while an area's *water type* determines the size of buffer zones, whether or not property owners can install shoreline protection, and what activities may occur within tidal waters.

CRMC water types: All waters along Rhode Island's coast are classified according to the CRMC. The six water types are determined by how the area is used, density of use, and presence of conservation considerations.

Federal Emergency Management Agency (FEMA) floodplain mapping: As part of the National Flood Insurance Program (NFIP), FEMA maps all risk zones, including the coastal floodplain. The resulting maps, Flood Insurance Rate Maps (FIRMs), trigger developmental/building code revisions and may illustrate whether or not a property owner has to purchase flood insurance for a structure.

FEMA Flood Hazard Zones: Flood zones are areas identified by FIRMs as being prone to flooding during storm events of given strengths.

Increasing structural resilience: The practice of building or retrofitting properties so as to increase structural integrity in the face of coastal hazards, including storms and associated winds and flooding (sometimes referred to as "flood-proofing"). In some instances, resilience cannot be achieved, and other options, including relocation, must be considered.

Renovating or repairing an existing building: Any addition to an existing structure within CRMC's jurisdiction or in a flood zone is required to meet current building standards. If the cost of renovations or repairs to an existing structure equals or exceed 50% of the structure's market value, the entire building must be updated to meet current standards, setbacks, and other CRMC regulations.

Septic systems (onsite wastewater treatment systems): If a coastal property is not connected to the municipality's sewage system and relies on a septic system, property owners must adhere to certain regulations when constructing, repairing, or altering their septic systems in the coastal zone. The CRMC and the R.I. Department of Environmental Management jointly regulate the installation and maintenance of septic systems in the coastal zone.

Shoreline protection structures: Shoreline protection structures are manmade formations such as revetments or seawalls designed to protect landforms or structures along the coast. The CRMC regulates the installation and maintenance of shoreline protection structures in Rhode Island.

Resources & Links

2012 IBC Flood Resistant Provisions:
www.fema.gov/media-library-data/20130726-1816-25045-8053/2012_i_code_floodprovisions.pdf

2014 R.I. Hazard Mitigation Plan:
www.riema.ri.gov/prevention/mitigation/RI%20HMP_2014_FINAL.pdf

FEMA Building Code Resources:
www.fema.gov/building-code-resources

FEMA Coastal Construction Manual:
www.fema.gov/media-library-data/20130726-1510-20490-2899/fema55_voli_combined.pdf

FEMA Community Rating System:
www.fema.gov/national-flood-insurance-program-community-rating-system

FEMA Elevating Your Home:
www.fema.gov/pdf/rebuild/mat/sec5.pdf

FEMA Flood Zones:
www.fema.gov/floodplain-management/flood-zones

FEMA Homeowner's Guide to Retrofitting:
www.fema.gov/media-library-data/20130726-1441-20490-4268/fema_p312_a.pdf

FEMA Map Service Center:
msc.fema.gov/

FEMA NFIP Elevation Certificate and Instructions:
www.fema.gov/media-library-data/20130726-1437-20490-0725/f_053_elevcertif_30nov12_fillable.pdf

FEMA Wind Retrofit Guide for Residential Buildings:
www.fema.gov/media-library-data/20130726-1753-25045-2304/508versioncombined_804.pdf

Floodplain Management Quick Guide:
www.riema.ri.gov/prevention/floods/floods_documents/RIQG_DesktopPrint.pdf

Floodsmart.gov Glossary of Terms:
www.floodsmart.gov/floodsmart/pages/glossary_A-I.jsp

Floodsmart.gov:
www.floodsmart.gov/floodsmart/

Highlights of ASCE 24-05 Flood Resistant Design and Construction (2010):
www.fema.gov/media-library-data/20130726-1643-20490-4974/asce24_highlights_dec2010.pdf

IBHS FORTIFIED Program:
www.disastersafety.org/fortified-main/fortified-home/

IBHS FORTIFIED Hurricane Standards:
www.disastersafety.org/wp-content/uploads/fortified-home-hurricane-standards.pdf

IBHS FORTIFIED Roof Information:
www.disastersafety.org/wp-content/uploads/FORTIFIED-re-roofing-hurricane_IBHS.pdf

ICC Hurricane Safety:
www.iccsafe.org/safety/Pages/hurricane.aspx

N.C. Division of Coastal Management, shoreline protection structures:
dcm2.enr.state.nc.us/estuarineshoreline/options.html

National Flood Insurance Program (NFIP):
www.fema.gov/national-flood-insurance-program

Local NFIP Coordinators:
www.riema.ri.gov/prevention/floods/localNFIP.php

R.I. Building Code Commission:
www.ribcc.ri.gov/

R.I. Coastal Resources Management Council (CRMC):
www.crmc.ri.gov/

R.I. CRMC – Rebuilding after the Hurricane:
www.crmc.ri.gov/coastalstorms/CRMC_RebuildAfterHurricane.pdf

R.I. CRMC Coastal Barrier Resource System (CBRS) Maps:
www.crmc.ri.gov/maps/RI_CBRS_Maps.pdf

R.I. CRMC Coastal Shoreline Features:
www.crmc.ri.gov/guidesreports/CRMC_Coastal_Shoreline_Features.pdf

R.I. CRMC Hurricane Preparedness Guide:
www.crmc.ri.gov/coastalstorms/Hurricane_Prepare_RI.pdf

R.I. CRMC On-site Wastewater Treatment System (OWTS) page:
www.crmc.ri.gov/owt.html

R.I. CRMC Regulations (R.I. Coastal Resources Management Program):
www.crmc.ri.gov/regulations/RICRMP.pdf

R.I. CRMC Special Area Management Plans:
www.crmc.ri.gov/samps.html

R.I. CRMC Shoreline Change Maps:
www.crmc.ri.gov/maps/maps_shorechange.html

R.I. CRMC Water Use Maps:
www.crmc.ri.gov/maps/maps_wateruse.html

R.I. DEM Cesspool Phase-out:
www.dem.ri.gov/programs/benviron/water/permits/isds/cessfaze.htm

R.I. DEM Environmental Resource Map:
www.dem.ri.gov/maps/

R.I. DEM OWTS Rules:
www.dem.ri.gov/pubs/regs/regs/water/owts09.pdf

R.I. DEM Wetland Jurisdiction Maps:
www.dem.ri.gov/maps/wetjuris.htm

R.I. DEM Wetlands FAQ:
www.dem.ri.gov/programs/benviron/water/wetlands/pdfs/realtor.pdf

R.I. Department of Business Regulation Insurance Division - Consumer Alert Hurricane Preparation:
www.dbr.state.ri.us/documents/divisions/insurance/consumers/ConsumerAlert2014-5.pdf

R.I. Flood Awareness and Climate Change Taskforce (R.I. FACCT): Rebuilding After A Storm – November 2009:
www.crmc.ri.gov/coastalstorms/PostStormRebuild.pdf

R.I. Hurricane Evacuation Maps:
www.riema.ri.gov/preparedness/evacuation/hurricane_evac.php#EvacMaps

R.I. Inundation Surfaces (Sea Level Rise viewer):
www.arcgis.com/home/webmap/viewer.html?webmap=6b97585af3ee4b51af62a10953cd7dc0

R.I. National Flood Insurance Program Statistics:
bsa.nfipstat.fema.gov/reports/1040.htm#44

R.I. Real Estate Sales Disclosures:
webserver.rilin.state.ri.us/Statutes/TITLE5/5-20.8/INDEX.HTM

Rhode Island State Building Code documents:
sos.ri.gov/library/buildingcodes/

RIEMA Evacuation Information:
www.riema.ri.gov/preparedness/evacuation/

RIEMA Flood Insurance FAQ:
www.riema.ri.gov/prevention/floods/faq.php

RIEMA Flood Insurance Information:
www.riema.ri.gov/prevention/floods/flood_insurance.php

RIEMA Floodplain Management:
www.riema.ri.gov/prevention/floods/

RIEMA Floodplain Mapping:
www.riema.ri.gov/prevention/floods/flood_mapping.php

RIEMA Map Tool Tutorial:
www.riema.ri.gov/prevention/floods/MapToolTutorial.pdf

StormSmart Rhode Island:
ri.stormsmart.org/

U.S. Army Corps of Engineers Hurricane Inundation Maps:
www.riema.ri.gov/preparedness/evacuation/hurricane_inundation.php

www.beachsamp.org/coastalpropertyguide

CRMC
Coastal Resources Management Council

Coastal Resources Center

Sea Grant
Rhode Island

The University of Rhode Island
Graduate School of Oceanography