ECOMONDO 2022
BLUE ECONOMY
Conference
*REGENERATION OF COASTAL AREAS AND PORTS AND ADAPTATION TO CLIMATE CHANGE*

# Spatial Planning and Permitting for Coastal Hazards

Grover Fugate, (Former) Executive Director of the Rhode Island Coastal Resources Management Council

Ecomondo, Rimini 8/11/2022

ECOMONDO THE GREEN TECHNOLOGY EXPO
MINISTERO DELLA TRANSIZIONE ECOLOGICA
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RegioneEmilia-Romagna
LEGAMBIENTE

# General Charge in the Federal Coastal Zone Management Act for Coastal Programs

Under the Federal Coastal Zone Management Act, one of the major goals for coastal management programs is to **ensure coastal development is done in a fashion to minimize the loss of life and property caused by improper development in flood-prone, storm surge, geological hazard, and erosion-prone areas and in areas likely to be affected by or vulnerable to sea level rise,** land subsidence, and **saltwater intrusion, and by the destruction of natural protective features such as beaches, dunes, wetlands, and barrier islands.**

# Rhode Island Coastal Resources Management Council is Unique.

1. They are a direct permitting agency which makes the same land use decisions as municipalities.
2. However, the staff is totally different, and they have expertise in areas that a municipality would never have. The staff consist of coastal and ocean engineers, coastal geologist, environmental scientist, and coastal policy specialist with a climate background. They also have access to cutting edge research, and work with, and through the Universities to routinely pull the latest science into their plans and programs.
3. They operate at the state level, so all municipalities get put on a level playing field in terms of the training and tools provided to them.

# The issues we were trying to address, to improve our resiliency going forward were:

-Land use decisions are made at the local government level property by property.
-This level of government has difficulty developing long range plans, due to short election cycles. In general, it also lacks the expertise and resources to address long range and short range coastal hazards.
-FEMA uses it's insurance based analysis to drive building standards in flood prone areas. This approach looks backwards and not forwards to anticipate climate hazards. Consequently, this program underestimates the risk, and as such, puts property owners at risk. A recent study from NC State found that by analyzing FEMA's flood maps and comparing them to actual damage from real events, shows that the majority of the damage reports, at 68.3%, were located outside of the agency's high-risk flood zones, while 16.2% were in unmapped locations.
-FEMA's maps are flawed in their assumptions and development. Also, these maps also do not account for sea level rise or erosion.
-Real estate buyers in the coastal zone assume that a CRMC permit means the coastal hazard risk has been addressed.
-Buyers are often not conversant in coastal risk and need a transparent way of measuring risk.
- As a result of all of this, the markets are not properly evaluating risk and pricing it appropriately.

# Three Threats the Plan will Address

- Sea Level Rise
- Storm effects
- Erosion

These forces interact in a synergistic fashion that adds to their destructive force.

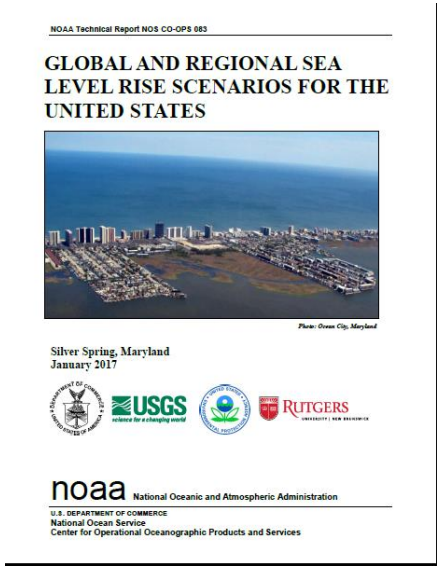
For example, one foot of sea level rise jumps the recurrence level, so that the once in one hundred year storm now has a return probability of one in fifty. Two feet, and that jumps once in 25 years, and 5 feet is like having a once 100 year storm once a day.

# New NOAA Estimate from Report Released January 2017

- Just released NOAA predicts a Global High Estimate for the Newport tide gage the 83% confidence interval of 9.6 feet. For the built environment we need to consider Extreme High Tide events that can add to 1.5 to 2 feet to the average high tide, this then would essentially be 12 feet by 2100.

From the report: “The growing evidence of accelerated ice loss from Antarctica and Greenland only strengthens an argument for ***considering worst-case scenarios in coastal risk management***.”

Extreme GMSL by 2200 projected to be 9.7M (31.8 feet). This SLR scenario will inundate most every coastal city worldwide.


NOAA Technical Report NOS CO-OPS 083

GLOBAL AND REGIONAL SEA LEVEL RISE SCENARIOS FOR THE UNITED STATES

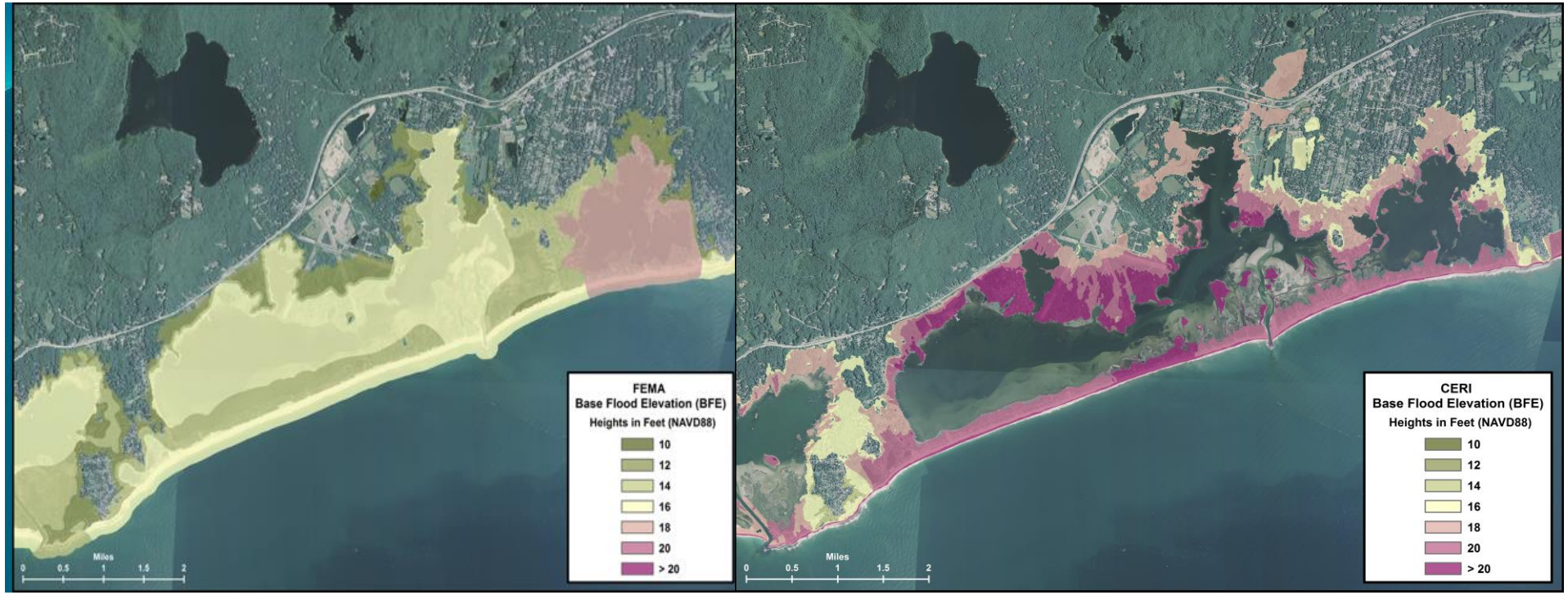
Silver Spring, Maryland
January 2017

noaa National Oceanic and Atmospheric Administration

U.S. DEPARTMENT OF COMMERCE
National Ocean Service
Center for Operational Oceanographic Products and Services

1991

Today


FEMA
Base Flood Elevation (BFE)
Heights in Feet (NAVD88)
10
12
14
16
18
20
> 20
Miles
0 0.5 1 1.5 2
CERI
Base Flood Elevation (BFE)
Heights in Feet (NAVD88)
10
12
14
16
18
20
> 20
Miles
0 0.5 1 1.5 2

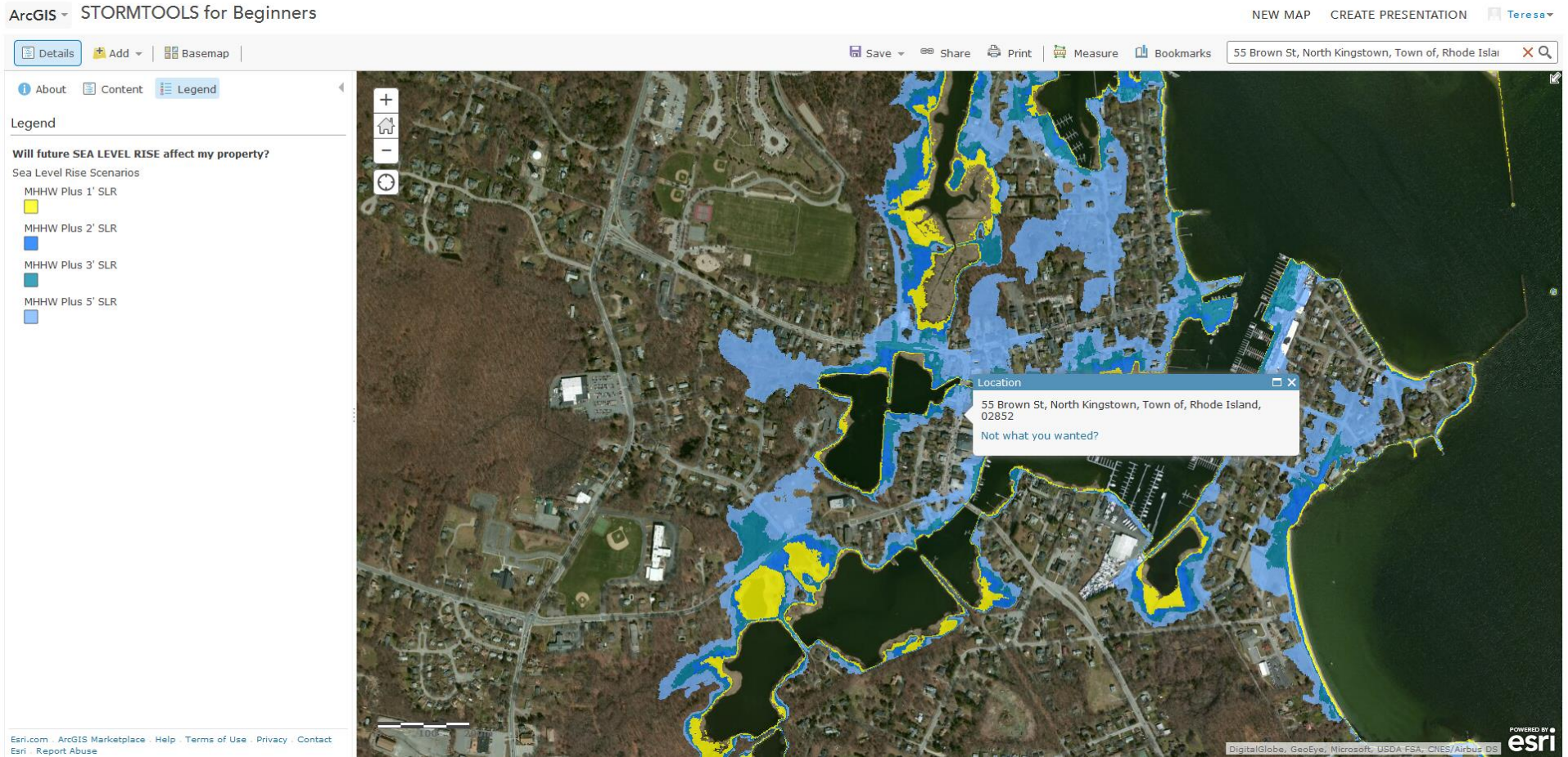
# “STORMTOOLS FOR BEGINNERS”

## Step 1: Enter an address

## Step 2: Click on the question you want to answer

***“Will future SEA LEVEL RISE affect my property (with 2 tides per day, every day)?”***

**(sea level rise scenario map)**



# “STORMTOOLS FOR BEGINNERS”

## Step 1: Enter an address

## Step 2: Click on the question you want to answer

***“Is my property vulnerable to STORM SURGE during a 100-year coastal storm (e.g. 1938 Hurricane)?”***

## (flood extent map)

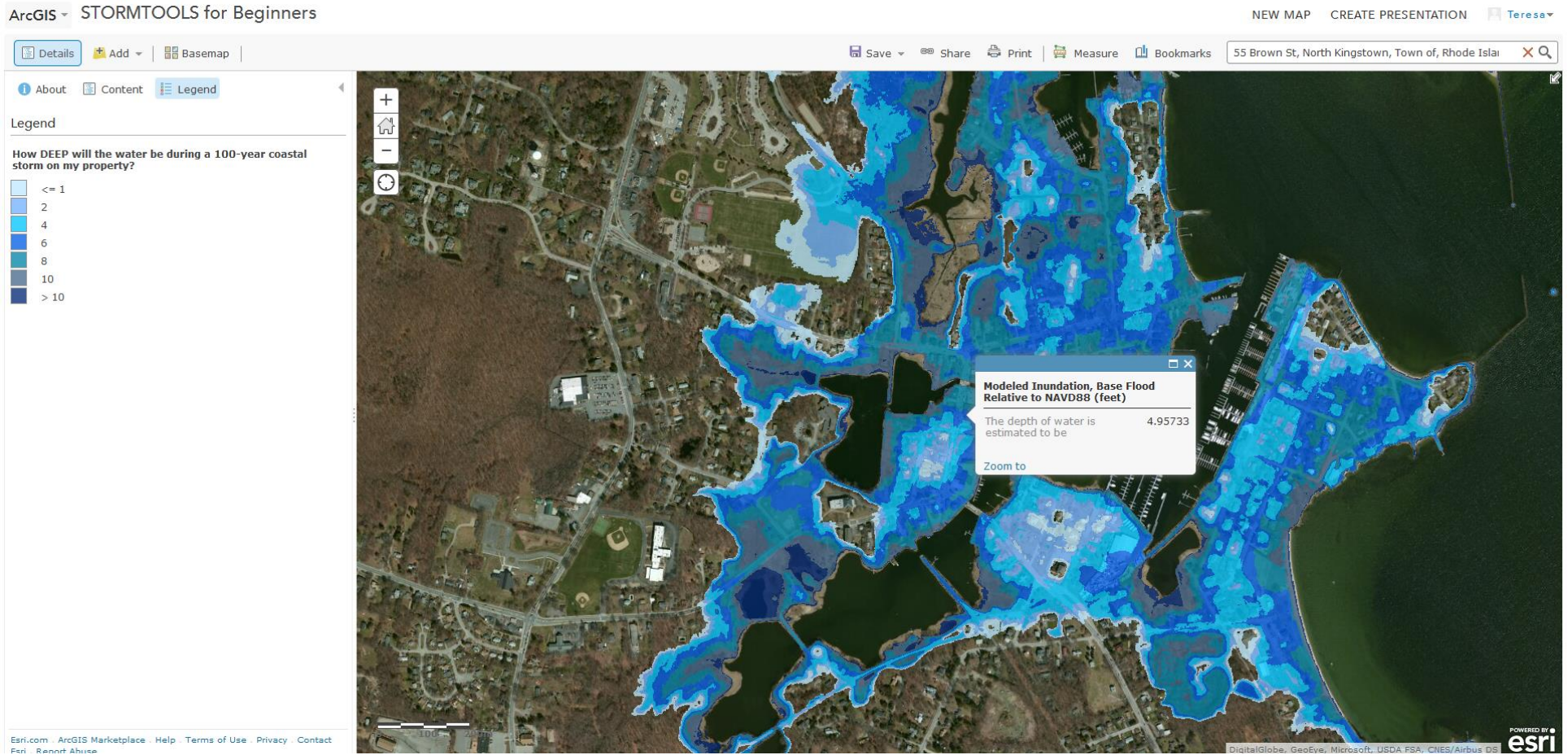
# “STORMTOOLS FOR BEGINNERS”

## Step 1: Enter an address

## Step 2: Click on the question you want to answer

***“How DEEP will the water be during a 100-year coastal storm on my property?”***

**(water depth map)**



# New Statewide analysis for every structure in the state SLR and Storm Scenarios

- **Sea Level Rise (feet)**
  - **1, 2, 3, 5, 7**

- **Storm Return Period (year)**
  - **10, 25, 100, 500**

- **Sea Level Rise & Storm Inundation**
  - **SLR1(10,25,100)**
  - **SLR2 (10,25,100)**
  - **SLR3 (10,25,100)**
  - **- SLR5 (10,25,100)**
  - **- SLR7 (10,25,100)**

# What do the combined data tell us ?
# Data has been developed town by town.

- **Number of exposed buildings**
- **Total buildings in town**
- **Total buildings exposed in a SLR 7/100-YR storm scenario (*maximum flood extent*)**
- **% of buildings exposed in town**
- **% of buildings exposed out of SLR7/100-YR storm**
- **Number of buildings inundated by: 0-2/0-5 ft, 2-4/5-10 ft, 4-6/10-15 ft, and >6/>15 ft of water**
- **Mean, min, and max elevation of water**

# CERI Building Blocks

- ***Water levels*** (100 yr.. or specific storm event) for flooding, with or without SLR, available from ***STORMTOOL***s. (http://www.beachsamp.org/resources/stormtools/)
- ***Wave estimates*** (100 yr..) for flood inundated areas, with and without SLR based on state of the art wave models.
- ***Shoreline change*** (erosion/accretion) estimates based on most recent 2016 RI CRMC shoreline change maps.
- ***Damage functions*** by structure or infrastructure type based on data from superstorm Sandy (2012) (US Army Corp of Engineers(ACOE)/FEMA)).
- ***Location/identification*** of individual structures and infrastructure from E911 and town and state data bases.


Town of Warren, RI
Waterfront
100-year storm | 0 feet sea level rise
0
20%
30%
40%
50%
60%
70%
80%
90%
100%
0–25% MODERATE
25%–50% HIGH
51%–75% SEVERE
76%–100% EXTREME
0-3 FT
3-7 FT
7-10 FT
10-13 FT
13-17 FT
>17 FT
Structure Risk Index
Data provided by RI STORMTOOLS Coastal Environmental Risk Index.
Water Depth at ground elevation
100-year storm + sea level rise inundation depth. Data provided by RI STORMTOOLS Coastal Environmental Risk Index.
Barrington River
N
THE UNIVERSITY OF RHODE ISLAND
COASTAL INSTITUTE
Sea Grant
COASTAL RESILIENCE CENTER
Barrington Yacht Club
Protector Boats
Blount Fine Foods
Warren Town Hall
Warren Handkerchief Factory
Warren DMV
N


Town of Warren, RI
Waterfront
100-year storm | +2 feet sea level rise
0
20%
30%
40%
50%
60%
70%
80%
90%
100%
0–25% MODERATE
25%–50% HIGH
50%–75% SEVERE
75%–100% EXTREME
Structure Risk Index
Data provided by RI STORMTOOLS Coastal Environmental Risk Index.
0-3 FT
3-7 FT
7-10 FT
10-13 FT
13-17 FT
>17 FT
Water Depth at ground elevation
100-year storm + sea level rise inundation depth. Data provided by RI STORMTOOLS Coastal Environmental Risk Index.
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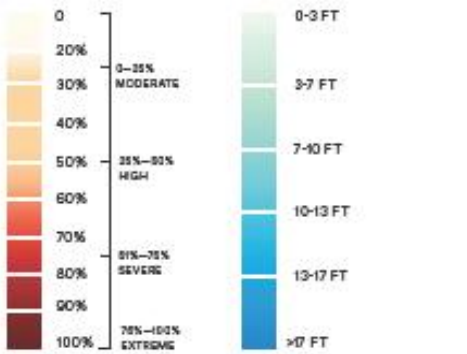
COASTAL RESILIENCE CENTER
Barrington Yacht Club
Protector Boats
Blount Fine Foods
Warren Town Hall
Warren Handkerchief Factory
Warren DMV
N

Town of Warren, RI

# Waterfront

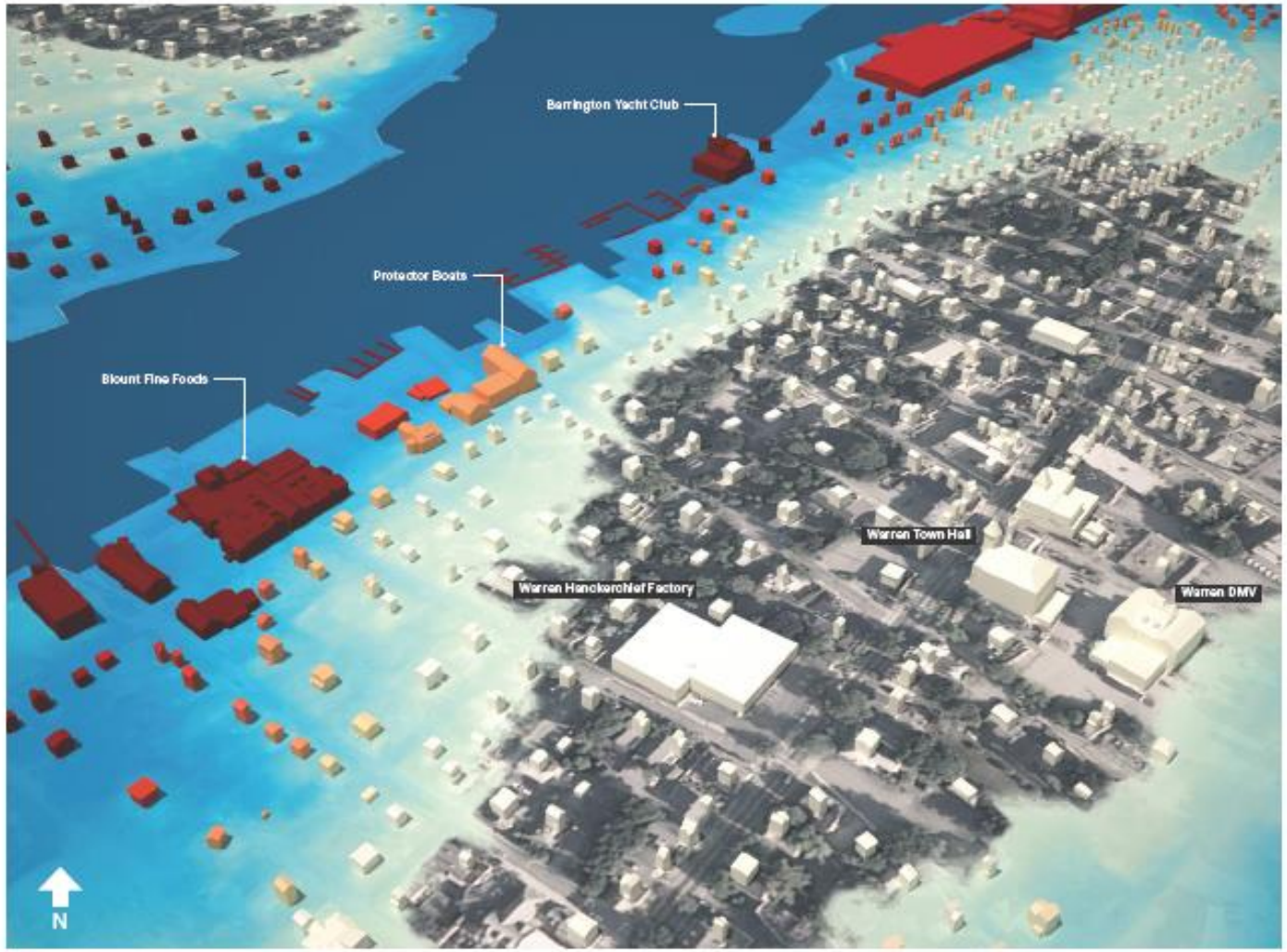
**100-year storm | +5 feet sea level rise**




Structure Risk Index
Data provided by RI STORMTOOLS Coastal Environmental Risk Index.

Water Depth at ground elevation
100-year storm + sea level rise inundation depth. Data provided by RI STORMTOOLS Coastal Environmental Risk Index.


THE UNIVERSITY OF RHODE ISLAND
COASTAL INSTITUTE
Sea Grant
COASTAL RESILIENCE CENTER



# Shoreline Change
# Special Area Management Plan (Beach SAMP)

## Volume 1

Executive Summary

1. Introduction
2. Coastal Hazards in RI
3. Assessing Coastal Risk
4. RI's Exposure to Coastal Hazards
5. RICRMC Application Guidance
6. State Agency & Municipal Considerations
7. Adaptation Strategies

## Volume 2

- Technical Reports of Research
- Compendium of Adaptation Techniques/Strategies

# CHAPTER 5

## RI CRMC Coastal Hazard Application Guidance

**Overview of Process**

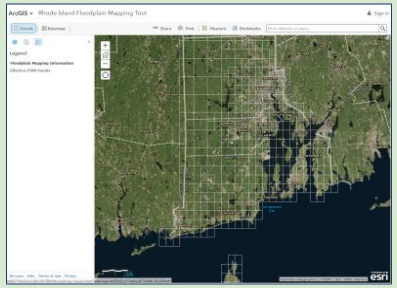
The steps presented below provide guidance for applicants to address Coastal Hazards for selected projects in the design and permitting process for the Rhode Island Coastal Resources Management Council (CRMC).

| | |
|---|---|
| STEP 1: PROJECT DESIGN LIFE | In this step, the applicant will choose an appropriate design life, or lifespan, for the project, and identify a projected sea level for the project site based on the selected design life. |
| STEP 2: SITE ASSESSMENT & BASE FLOOD ELEVATION | In this step the applicant will review specified maps and tools to assess the exposure and potential risk from coastal hazards at the project site. |
| STEP 3: LARGE PROJECTS | This step is for Large Projects and Subdivisions only. If not such a project, this step may be skipped. |
| STEP 4: DESIGN EVALUATION | The applicant will identify, document, and assess the feasibility of design techniques that could serve to avoid or minimize risk of losses. |
| STEP 5: SUBMIT AN APPLICATION | The applicant will submit the permit application and include the assessment from the previous steps in the application package to the CRMC. |

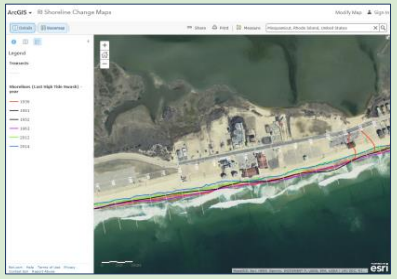
# Rhode Island's MAPPING TOOLBOX

## Past and Present

### 1. RIEMA Floodplain Mapping Tool

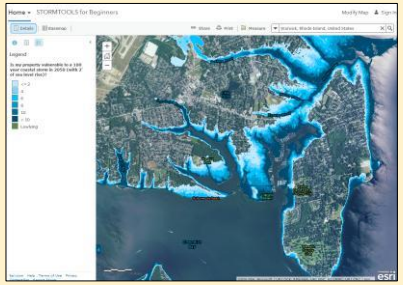


### 2. Coastal Erosion



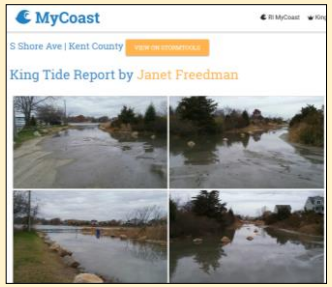
## Future

### 3. STORMTOOLS



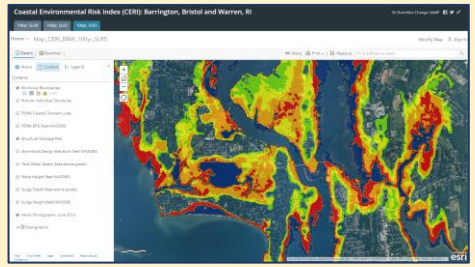
### 4. SLAMM


### 5. MyCoast

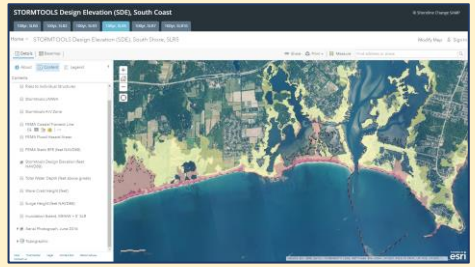



## Future

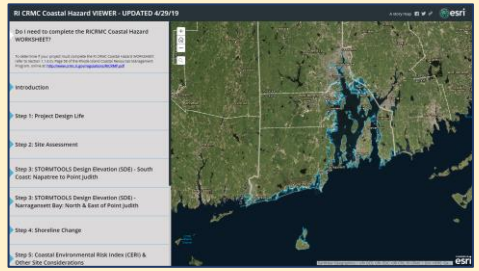
### 6. Coastal Environmental Risk Index (CERI)



### 7. STORMTOOLS Design Elevation



### 8. RICRMC Coastal Hazard Viewer



## RI CRMC COASTAL HAZARD APPLICATION WORKSHEET

APPLICANT NAME:

PROJECT SITE ADDRESS:

### STEP 1. PROJECT DESIGN LIFE

☐ A. [illegible] flood elevation (BFE) for the project location, available from FEMA, or the municipal building official. ____ ft

☐ B. Using the *CRMC Shoreline Change maps*, indicate the transect number closest to your site, and erosion rate listed for that transect. Transect #: ____

☐ C. How long do you want your project to last? Identify the expected design life for the project (CRMC recommends a **minimum of 30 years**) Erosion Rate: ____ ft/yr ____ years

☐ D. Add the number of years you identified in 1C to the current year. (For example, if you are completing this form in the year 2020, and you want your project to last 30 years, your design life year will be 2050.) Design Life Year: ____

☐ E. [illegible] the sea level rise (SLR) projection that matches or comes closest to project design life [illegible]

| Year | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | 2080 | 2090 | 2100 |
|---|---|---|---|---|---|---|---|---|---|
| SLR | 1.05 | 1.67 | 2.33 | 3.25 | 4.20 | 5.35 | 6.69 | 8.14 | 9.61 |
| | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

*Source: [illegible] Projections (Feb. 2017). NOAA High Curve, 83% Confidence Interval. Newport, RI Tide [illegible] are expressed in feet relative to [illegible]*

**NOTE:** The STORMTOOLS sea level rise scenarios depict how high the water will be above the average height of the daily high tide over the 19-year period between 1983 and 2001. There have been between 4 and 5 inches of sea level rise in Rhode Island since then. The higher modeled water level accounts for the uncertainties in ice sheet and ocean dynamics.

### STEP 2. SITE ASSESSMENT

☐ A. Open *RICRMC Coastal Hazard Mapping Tool*. Following the tutorial along the left side of the screen, enter the project site address and turn on the sea level layer closest to the number you circled in 1E.

☐ B. **ENTER** the STORMTOOLS SLR map layer closest to the SLR value you checked in Step 1E above. If the value falls between the available STORMTOOLS SLR map layers, round off to the closest of these sea level rise (SLR) numbers: 1ft, 2ft, 3ft, 5ft, 7ft, 10ft, or 12ft ____ ft

☐ C. Does the STORMTOOLS SLR map layer you circled above expose your project site to future tidal inundation? **CHECK YES or NO** ○ YES ○ NO

☐ D. List any **roads or access routes** that are potentially inundated from SLR and storms. To do this, ZOOM OUT from your project location, change BASEMAP on the viewer to "street view" – see Step 2A.

_____

### STEP 3. STORMTOOLS DESIGN ELEVATION (SDE)

☐ A. Based on the project location, CHECK the SDE Viewer for your site, and open the corresponding tab in Mapping Tool:
○ South Coast SDE Viewer: Napatree to Pt. Judith ○ Narragansett Bay SDE Viewer: North and East of Pt. Judith

☐ B. Follow the tutorial included along the left panels of the viewer to enter the address of your project site. Select the tab across the top that corresponds to the sea level rise projection you identified in STEP 1E.

☐ C. Click on the map at project site to identify **STORMTOOLS Design Elevation (SDE)** from the pop up box. **Enter the SDE value:** ____ ft

***Please be advised that CRMC staff may also review the implications of sea level rise in combination with nuisance storm flooding and discuss these potential project concerns with the applicant. Nuisance flooding impacts may be viewed in STORMTOOLS here.*



## RI CRMC COASTAL HAZARD APPLICATION WORKSHEET

### STEP 4. SHORELINE CHANGE

☐ A. Setbacks are required per RI Coastal Resources Management Program (RICRMP), Section 1.1.9. Indicate the annual shoreline change rate value from STEP 1B, and the design life selected in STEP 1C above. Enter values in 4C below.

☐ B. **CHECK** below the Projected Erosion Rate that corresponds to the design life you identified above.

| Year | 2050 | 2060 | 2070 | 2080 | 2090 | 2100 |
|---|---|---|---|---|---|---|
| Projected Future Erosion Multiplier | 1.34 | 1.45 | 1.57 | 1.70 | 1.84 | 2.00 |
| | ○ | ○ | ○ | ○ | ○ | ○ |

*Source: Projected Shoreline Change Rate multipliers. (Oakley et al., 2016)*

☐ C. **COMPLETE EROSION SETBACK CALCULATION:**

| Historic shoreline change rate, STEP 1B | | Design Life, STEP 1C | | Projected Future Erosion Multiplier, STEP 4B | | Erosion Setback (ft) 1B x 1C x 4B |
|---|---|---|---|---|---|---|
| | X | | X | | = | |

***NOTE: A minimum setback of 50-feet is required**, but a greater setback may be necessary and/or desirable based on this analysis.*

### STEP 5. CERI & OTHER SITE CONSIDERATIONS

☐ A. If you live in a community where a Coastal Environmental Risk Index (CERI) has been completed (Barrington, Bristol, Charlestown, Narragansett, South Kingstown, Warren, Warwick, Westerly), CHECK the level of projected damage to your location, as indicated on the map that corresponds to the design life identified in STEP 1.

| CERI Level: | Moderate | High | Severe | Extreme | Inundated by 2100 | Not applicable |
|---|---|---|---|---|---|---|
| | ○ | ○ | ○ | ○ | ○ | ○ |

☐ B. Consider and discuss with your design consultant other forces or factors that might impact the development, such as coastal habitats, shoreline features, public access, wastewater, storm water, depth to water table/groundwater dynamics, saltwater intrusion, or other issues not listed above. In addition, pressure from rising sea levels will result in rising subsurface groundwater levels ultimately effecting wells and septic systems.

### STEP 6. LARGE PROJECTS

**This step is for Large Projects and Subdivisions only, six (6) or more units, as defined by RI CRMP Section 1.1.6.I(1)(f). This step may be skipped for other projects.**

☐ A. Use the Sea Level Affecting Marshes Model (SLAMM) Maps to assess potential impacts to large projects and subdivisions from salt marsh migration resulting from projected sea level rise. CRMC SLAMM maps can be accessed here. ○ YES ○ NO
The CRMC recommends using the 5-foot SLR projection within SLAMM to assess future potential project impacts on migrating marshes. Does the SLAMM map that corresponds to the design life you identified in STEP 1 expose your project site to future salt marsh migration? **CHECK YES or NO**

### STEP 7: DESIGN EVALUATION

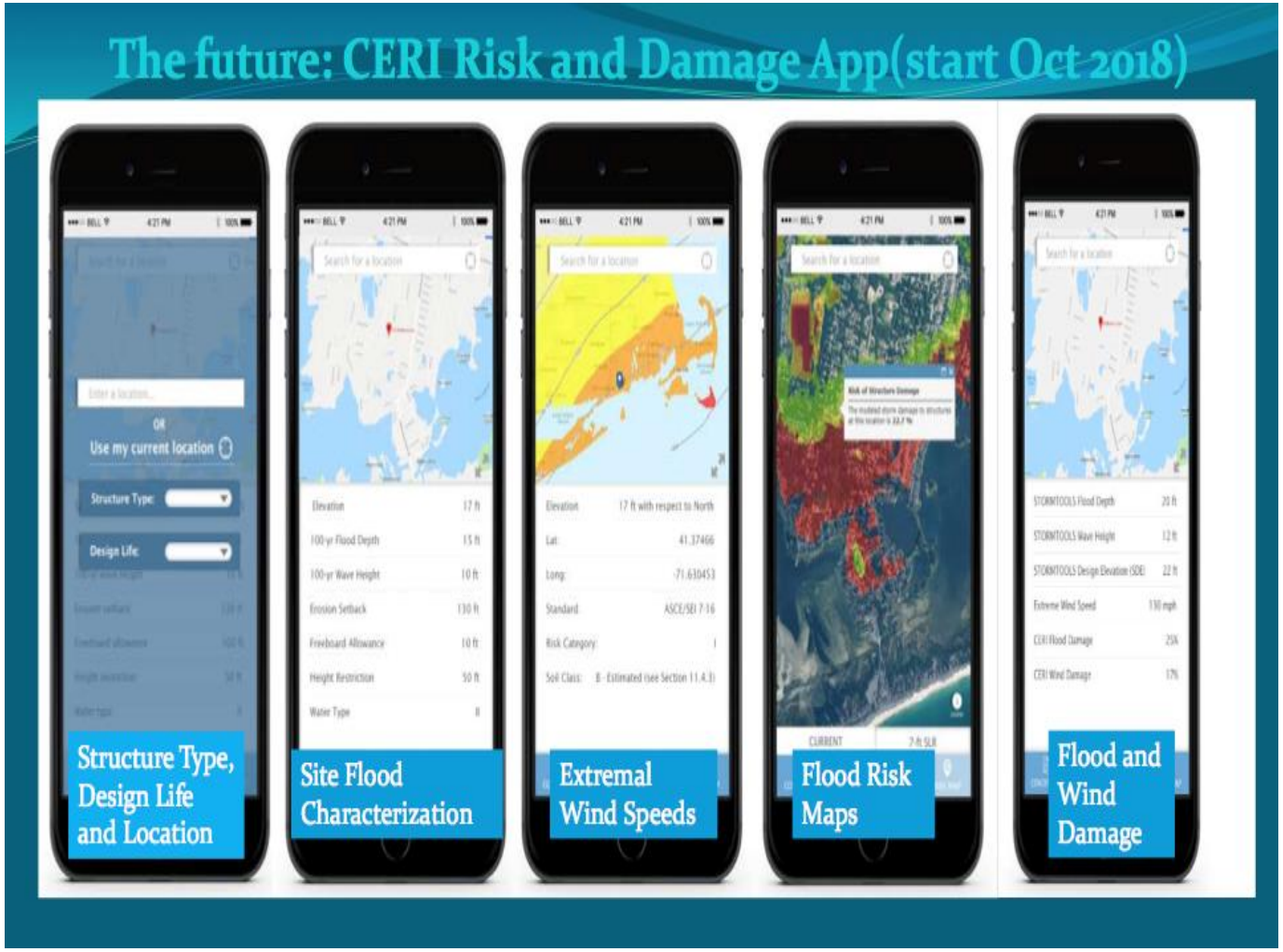
☐ A. Using Chapter 7 of the RI Shoreline Change SAMP as a guide, investigate mitigation options for the exposure identified above and include that in the final application.

**This fully completed Coastal Hazard Application Guidance worksheet must accompany the application. If you are a design or engineering professional, please print and sign here that you have discussed the findings of this worksheet with the Owner.**

DESIGN/ENGINEER SIGNATURE:_____ DATE:_____

OWNER'S SIGNATURE:_____ DATE:_____

*Please refer to the RI Shoreline Change Special Area Management Plan, Chapter 5 for background.*


The future: CERI Risk and Damage App(start Oct 2018)
Structure Type, Design Life and Location
Site Flood Characterization
Extremal Wind Speeds
Flood Risk Maps
Flood and Wind Damage

# Actual Permit Language inserted in Permit.

The permit is registered in the land evidence records and serves as a notice to future purchasers regarding the coastal hazard risk in this property.

This project required a coastal hazards analysis as per the Rhode Island Coastal Resources Management Council's regulations. The Council recommends residential applications meet a minimum of a 30 year design life..

Please be advised this project with a stated FFE of 17.23':

- does meet the anticipated rate of Sea Level Rise (SLR) (for 30 years/3' SLR)
- does meet applicable the accelerated erosion rate setback
- does not meet the recommended StormTools Design Elevation (SDE) for three feet (3')of SLR.
- does not meet the StormTools Design Elevation (SDE) recommended for the submitted/CHA design life of 50 years/5' of SLR.

# THANKS FOR YOUR ATTENTION

Grover Fugate

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groverfugate@gmail.com
http://www.beachsamp.org/beachsamp-document/