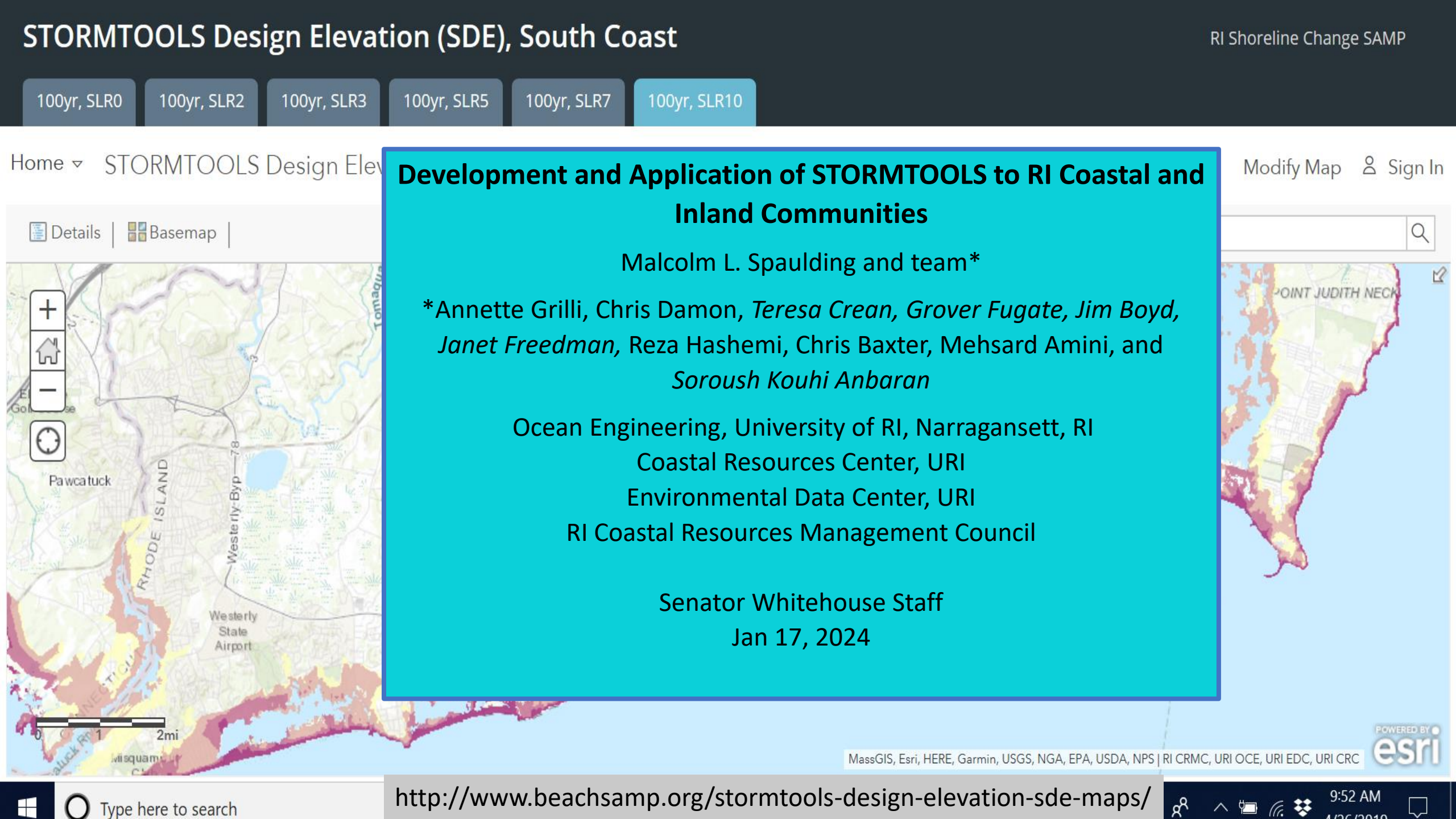

STORMTOOLS Design Elevation (SDE), South Coast
RI Shoreline Change SAMP
100yr, SLR0
100yr, SLR2
100yr, SLR3
100yr, SLR5
100yr, SLR7
100yr, SLR10
Home
STORMTOOLS Design Elev
Modify Map
Sign In
Details
Basemap
Pawcatuck
RHODE ISLAND
Westerly Byp
78
Westerly State Airport
POINT JUDITH NECK
0
1
2mi
MassGIS, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS | RI CRMC, URI OCE, URI EDC, URI CRC
POWERED BY esri
Development and Application of STORMTOOLS to RI Coastal and Inland Communities
Malcolm L. Spaulding and team*
*Annette Grilli, Chris Damon, Teresa Crean, Grover Fugate, Jim Boyd, Janet Freedman, Reza Hashemi, Chris Baxter, Mehsard Amini, and Soroush Kouhi Anbaran
Ocean Engineering, University of RI, Narragansett, RI
Coastal Resources Center, URI
Environmental Data Center, URI
RI Coastal Resources Management Council
Senator Whitehouse Staff
Jan 17, 2024
http://www.beachsamp.org/stormtools-design-elevation-sde-maps/
Type here to search
9:52 AM

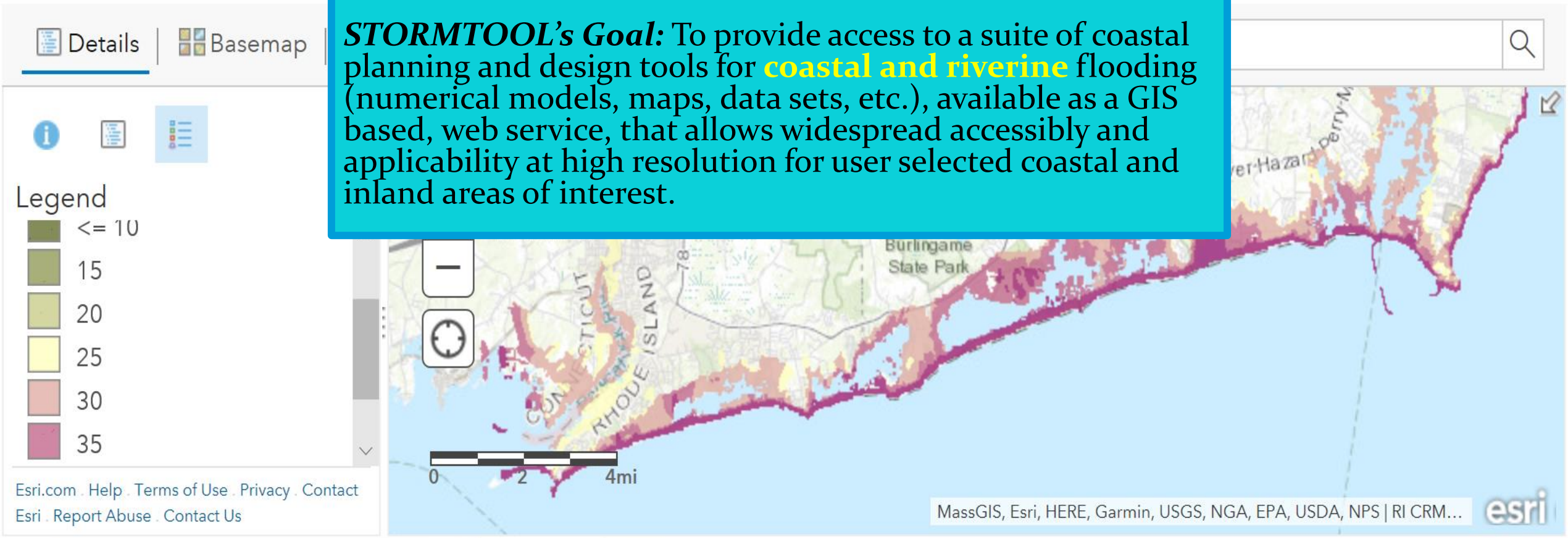
STORMTOOLS Design Elevation (SDE) Review, South Coast

RI Shoreline Change SAMP

100yr, SLR0 | 100yr, SLR2 | 100yr, SLR5 | 100yr, SLR7 | 100yr, SLR10

Home ▾ STORMTOOLS Design Elevation (SDE) Review, South Shore, SLR10 Modify Map Sign In

STORMTOOL's Goal: To provide access to a suite of coastal planning and design tools for **coastal and riverine** flooding (numerical models, maps, data sets, etc.), available as a GIS based, web service, that allows widespread accessibly and applicability at high resolution for user selected coastal and inland areas of interest.



Type here to search
4:08 PM
10/21/2018

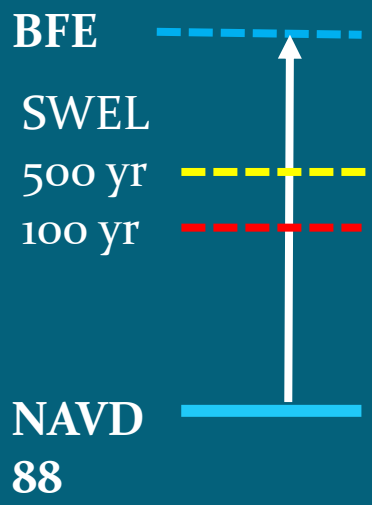
Overarching Goals

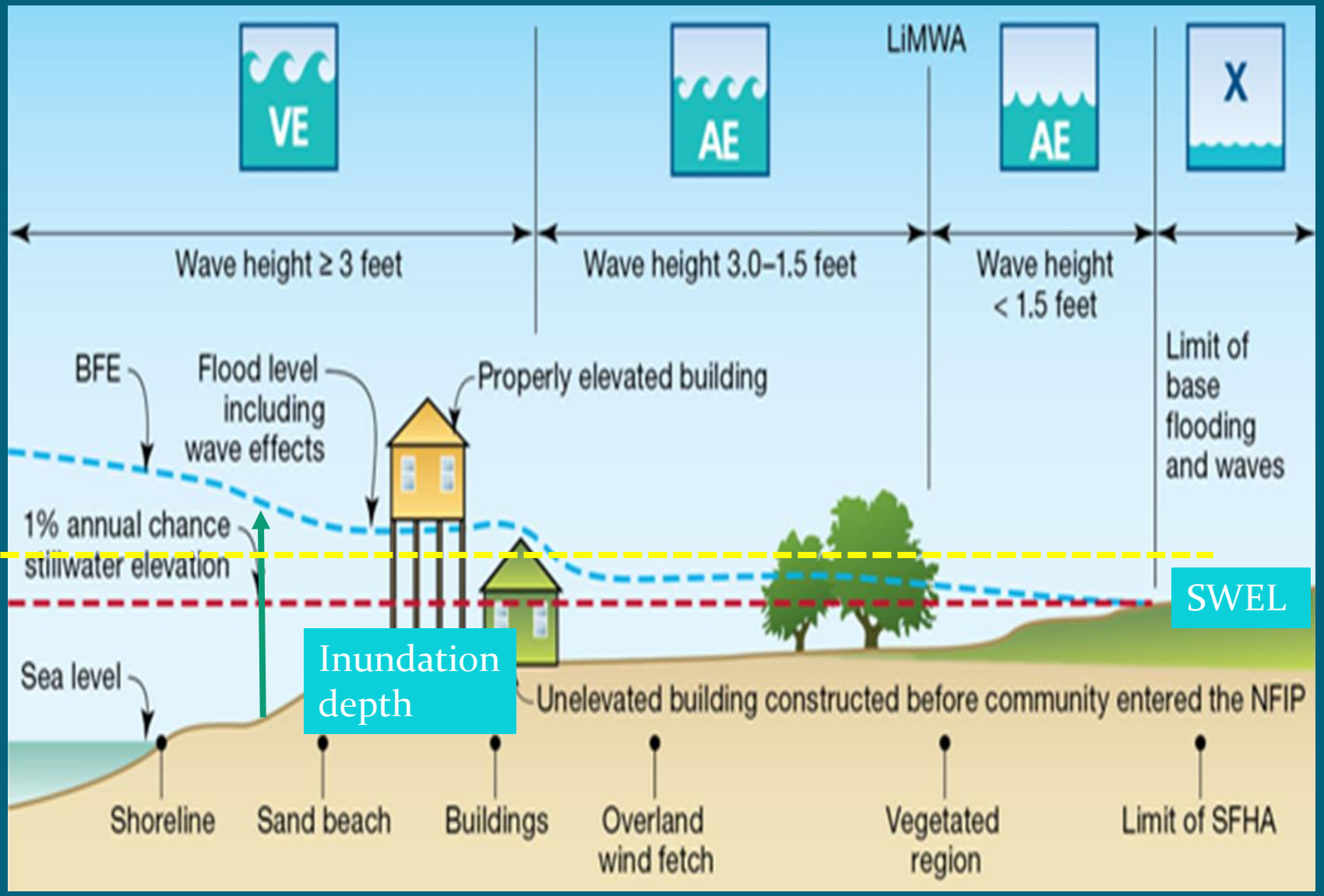
- Seamless **STORMTOOLS** flooding (BFE)/storm wind, and CERI maps for coastal and inland waters of state of RI, that explicitly consider the effects of climate change (sea level rise and increased precipitation).
- Maps embedded in permitting system for state agencies (RI CRMC, RI DEM, RI DOT, RI Building Commission, etc.) and land use planning for communities.
- Tools publicly available, simple to use, understand, routinely upgraded and maintained.

FEMA flood zones associated water levels and waves

BFE: referenced to NAVD88

Depth of inundation, referenced to grade elevation





FEMA FIRMS 100 and 500 yr events, do not consider sea level rise or change in precipitation.

STORMTOOLS Development(2014- present)

- 2014 Initiated in response to RI CRMC challenge to FEMA FIRMS, Washington County, RI.
- 2015 STORMTOOLS vision initiated, integrated tools to assist in flood management.
- 2014-2015 Flood maps (Base Flood Elevation, BFE) developed for Washington County (RI).
- 2015-2017 Flooding maps extended to Pawtucket River watershed, Scituate Reservoir, simulation of 2010 flood event.
- 2016 - 2017 Coastal Environmental Risk Index(CERI) developed and applied to Charlestown, Warwick, Barrington, Bristol, Warren, and southern RI shoreline.
- 2017 - 2020 CERI app, STORMTOOLS Design Elevation(SDE) maps generated, CERI and SDE extended to Mt Hope Bay and Taunton River
- 2020 STORMTOOLS GIS Hub introduced: Beginners, Advanced, SDE, CERI, et al.

STORMTOOLS Development(2014- present)

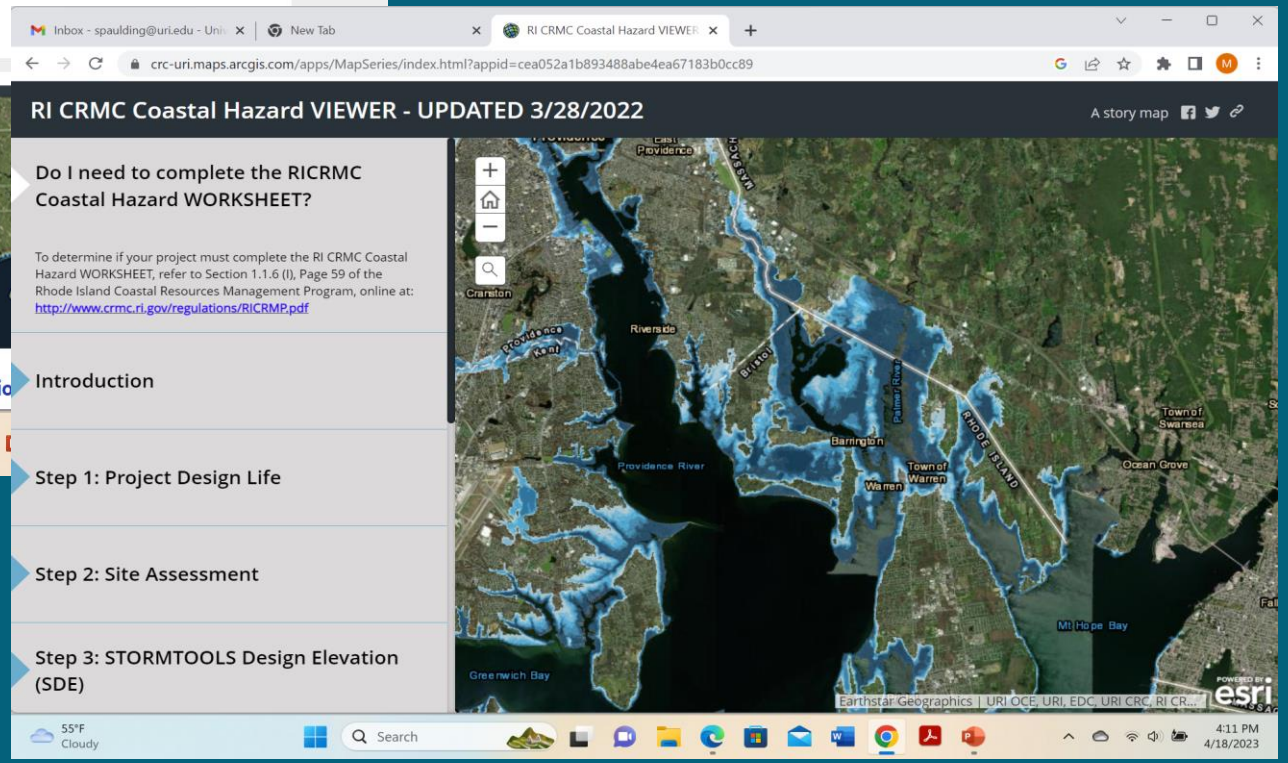
- 2018 RI CRMC Coastal Hazard App Permitting System developed and implemented.
- 2023 – 2026 Inland STORMTOOLS, enhanced rainfall rates (kickoff Jan 18, 2024, in progress).

Proposals Pending FEMA BRIC 2023

- 2024-2027 Extension of STORMTOOLs to include compound flooding and wind damage in Bristol and Newport Counties.
- 2024-2026 Update SDE maps to 500 yr flooding level with sea level rise in compliance to updated ASCE 7-22 flood design standards.

RI CRMC COASTAL HAZARD APPLICATION





http://www.crmc.ri.gov/coastalhazardapp.html

Town of Warren, RI

Waste Treatment

100–year storm | 0 feet sea level rise

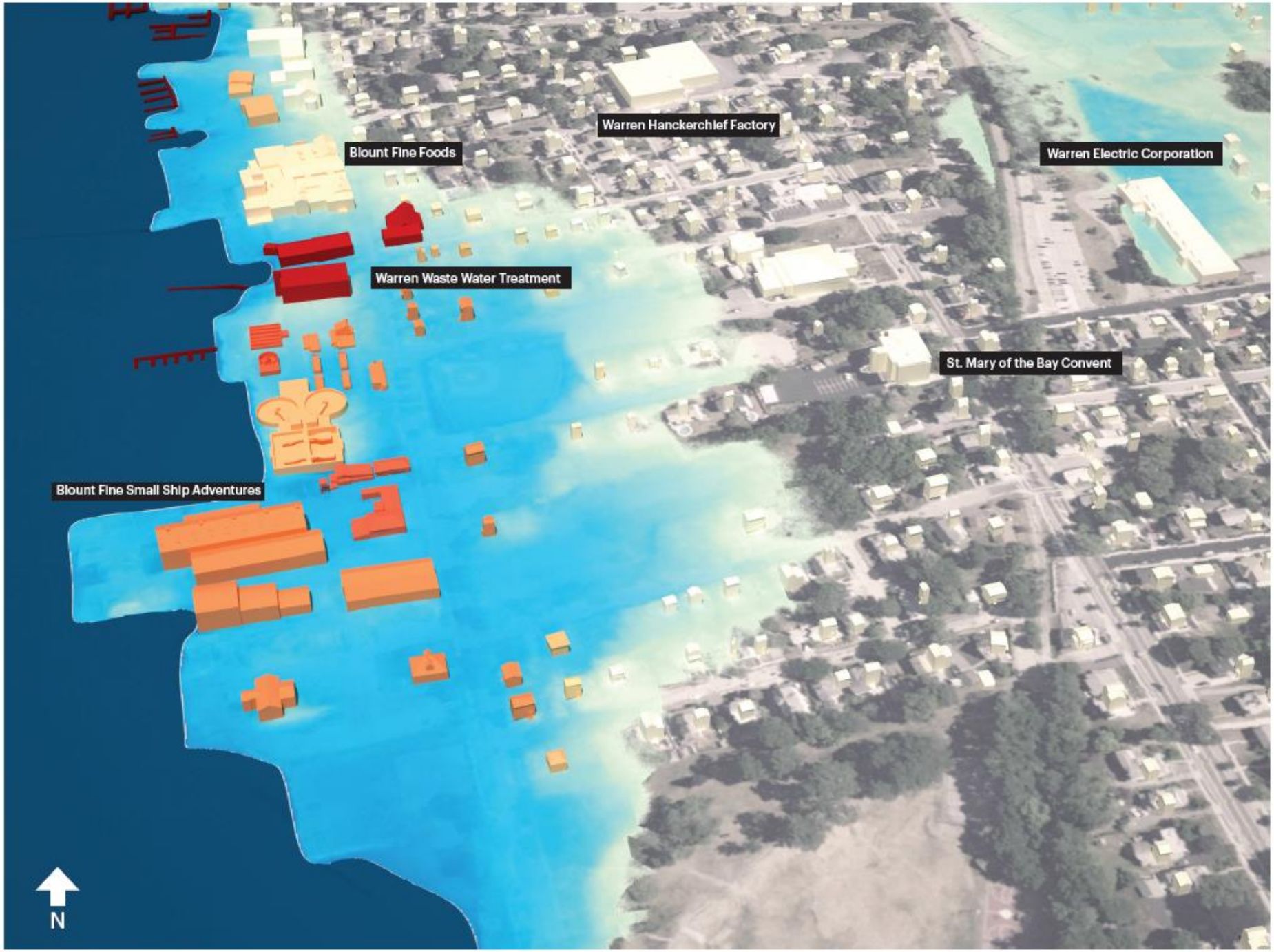
0	
20%	
30%	0–25% MODERATE
40%	
50%	25%–50% HIGH
60%	
70%	
80%	51%–75% SEVERE
90%	
100%	76%–100% EXTREME

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.





THE UNIVERSITY OF RHODE ISLAND DEPARTMENT OF MARINE AFFAIRS
COASTAL INSTITUTE
Sea Grant Rhode Island
CRMC COASTAL RESOURCES MANAGEMENT COUNCIL

Town of Warren, RI

Waste Treatment

100-year storm | +2 feet sea level rise

0
20%
30%
40%
50%
60%
70%
80%
90%
100%

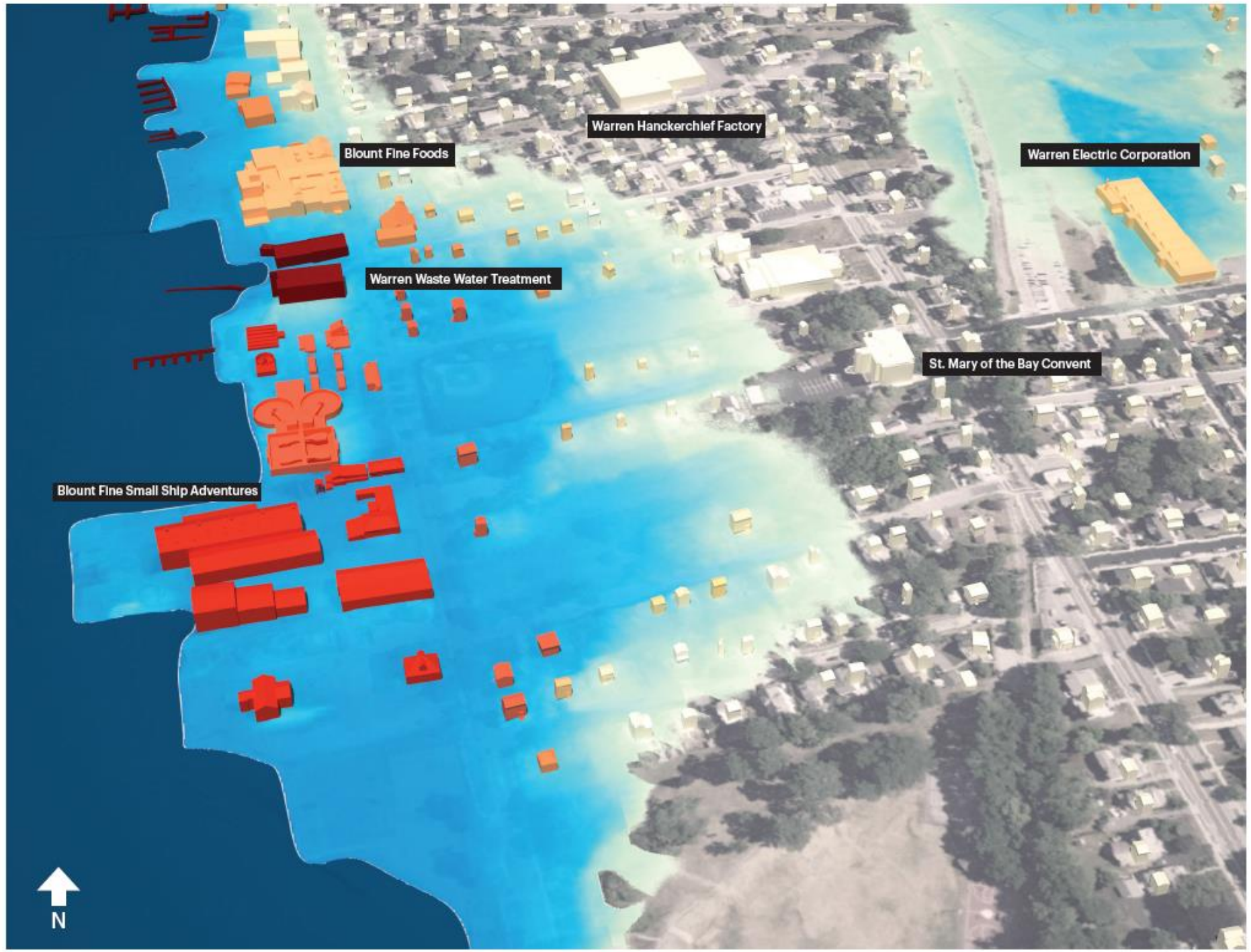
0–25% MODERATE
25%–50% HIGH
51%–75% SEVERE
76%–100% EXTREME

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.





THE UNIVERSITY OF RHODE ISLAND DEPARTMENT OF MARINE AFFAIRS
COASTAL INSTITUTE
Sea Grant Rhode Island
CRMC COASTAL RESOURCES MANAGEMENT COUNCIL

Town of Warren, RI

Waste Treatment

100-year storm | +5 feet sea level rise

0
20%
30%
40%
50%
60%
70%
80%
90%
100%

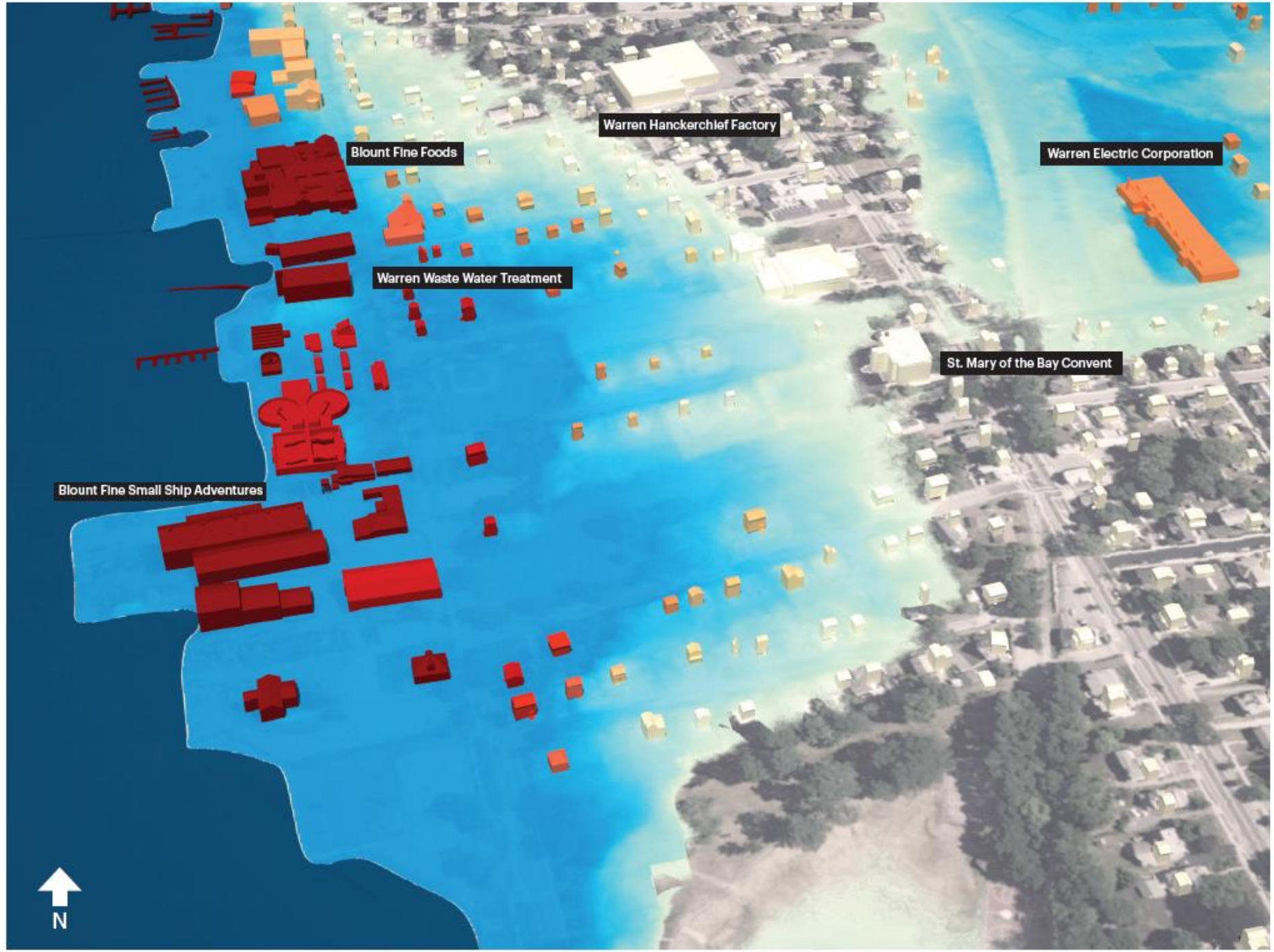
0–25% MODERATE
25%–50% HIGH
51%–75% SEVERE
76%–100% EXTREME

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.

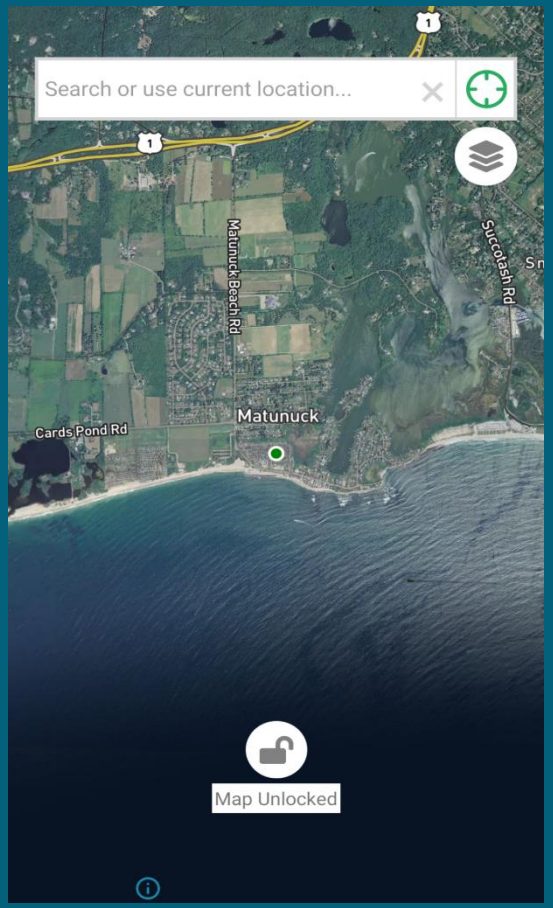


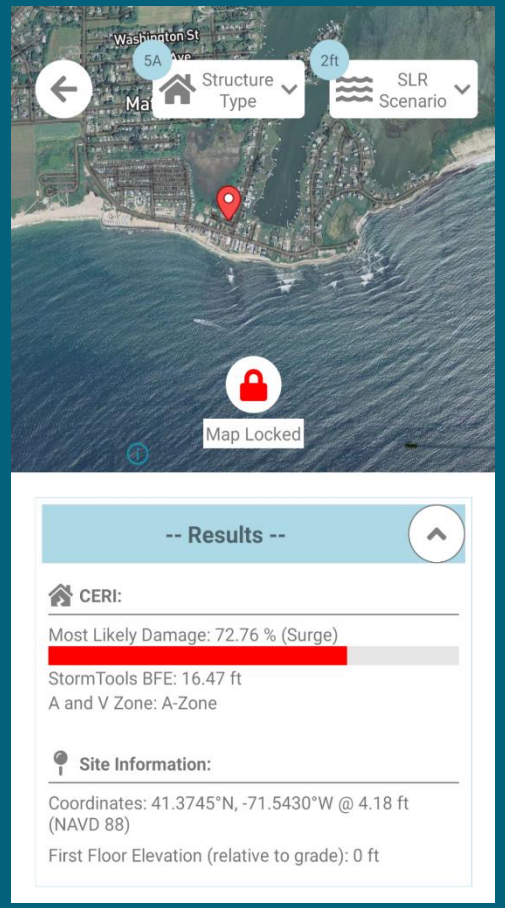


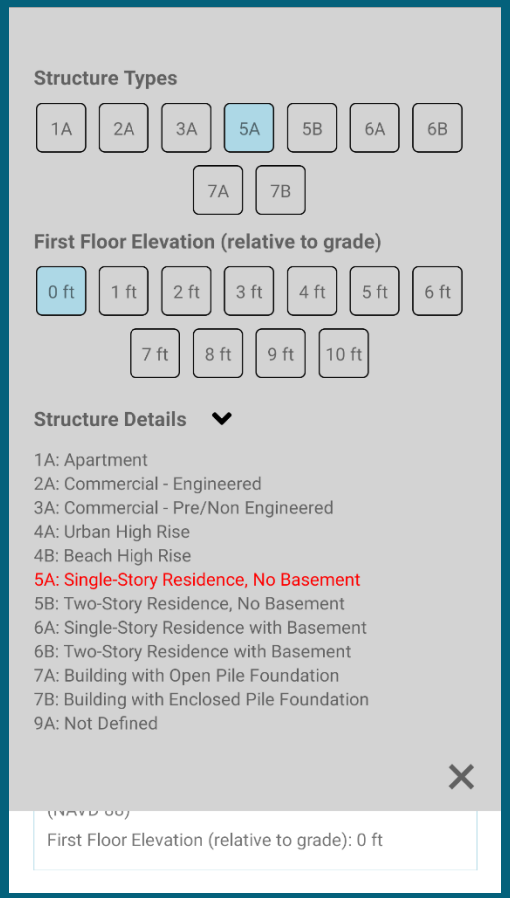
THE UNIVERSITY OF RHODE ISLAND DEPARTMENT OF MARINE AFFAIRS
COASTAL INSTITUTE
Sea Grant Rhode Island
CRMC Coastal Resources Management Council

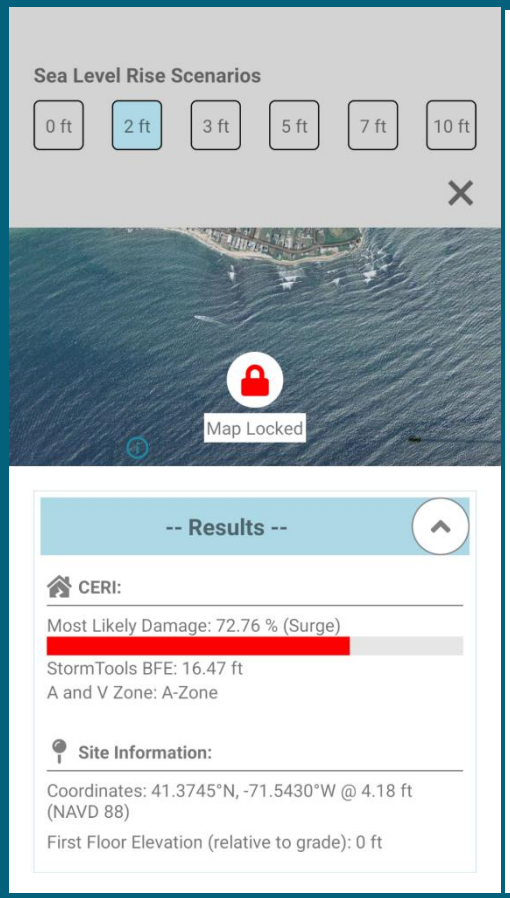
STORMTOOLS CERI Risk and Damage App

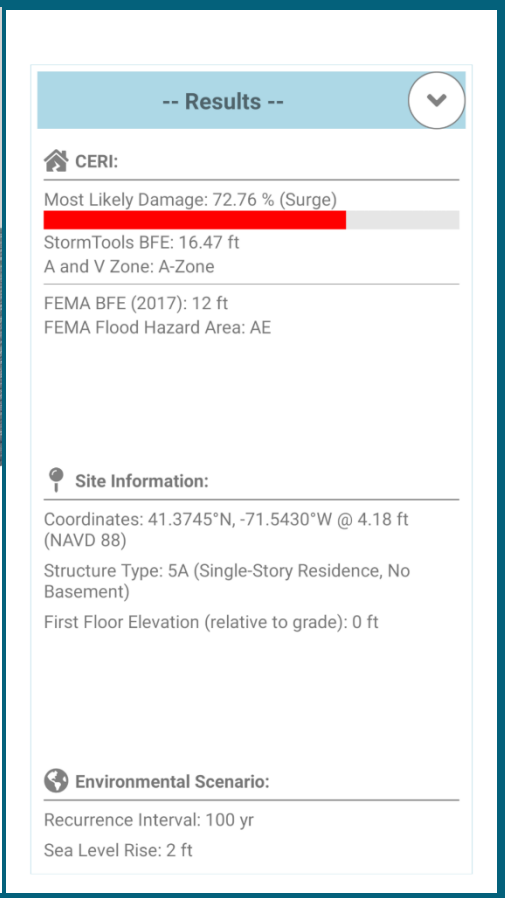
Goal: Develop an App that will provide access to coastal flood risk and associated damages for a user selected structure in RI.

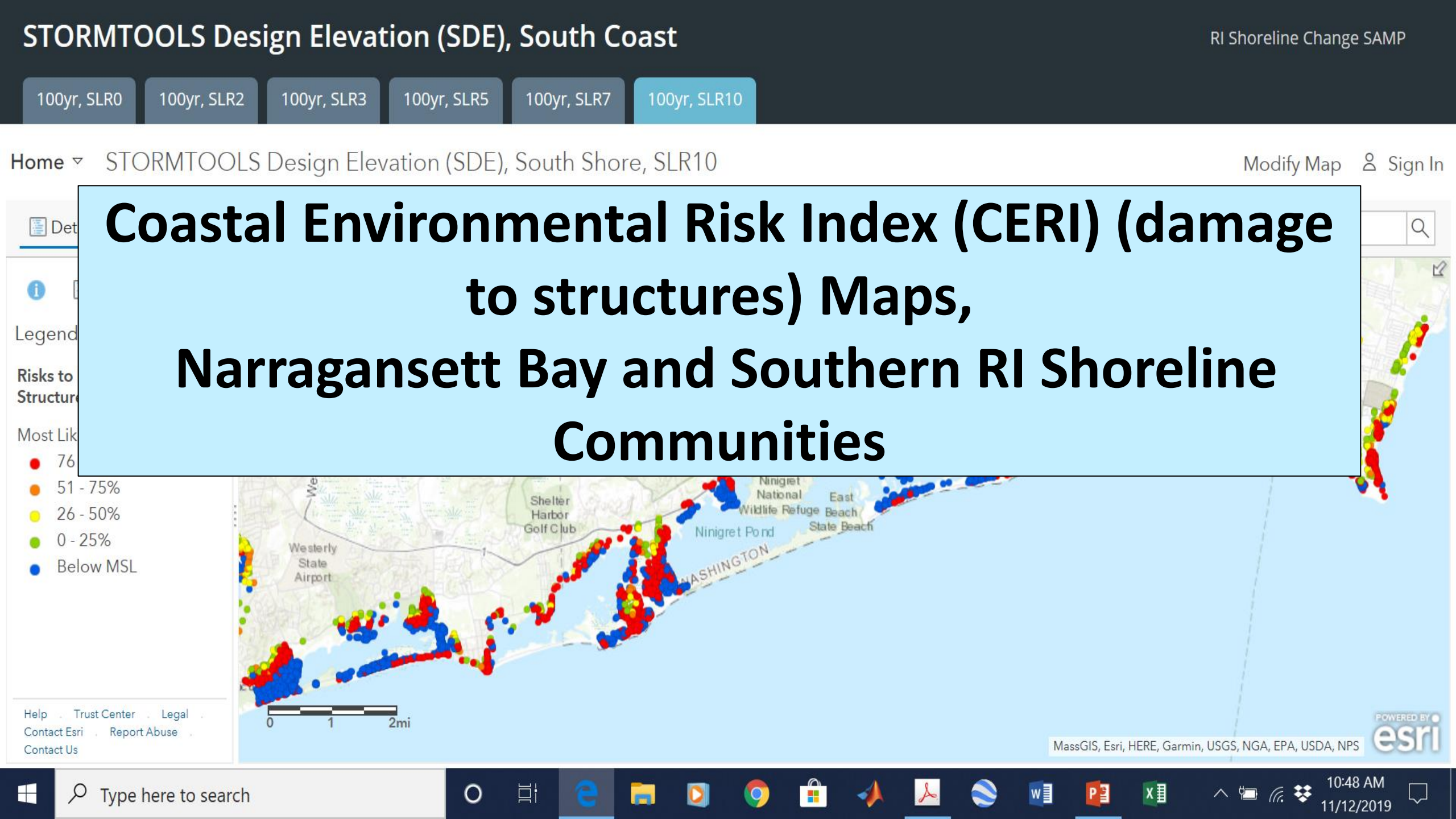












Coastal Environmental Risk Index (CERI) (damage to structures) Maps, Narragansett Bay and Southern RI Shoreline Communities

STORMTOOLS Design Elevation (SDE), South Coast

RI Shoreline Change SAMP

100yr, SLR0 | 100yr, SLR2 | 100yr, SLR3 | 100yr, SLR5 | 100yr, SLR7 | 100yr, SLR10

Home ▾ STORMTOOLS Design Elevation (SDE), South Shore, SLR3

Modify Map | Sign In

Details | Basemap | Share | Print ▾ | Measure | Find address or place

Contents

- [x] Risks to Individual Structures

  Most Likely
  - 76 - 100%
  - 51 - 75%
  - 26 - 50%
  - 0 - 25%
  - Below MSL

- [ ] Stormtools LIMWA
- [ ] Stormtools A/V Zone
- [ ] FEMA Coastal Transect Line



Help . Trust Center . Legal . Contact Esri . Report Abuse . Contact Us

Type here to search

1:44 PM
4/28/2019

STORMTOOLS Design Elevation (SDE), South Coast

RI Shoreline Change SAMP

100yr, SLR0 | 100yr, SLR2 | 100yr, SLR3 | 100yr, SLR5 | 100yr, SLR7 | 100yr, SLR10

Home ▾ STORMTOOLS Design Elevation (SDE), South Shore, SLR3

Modify Map | Sign In

Details | Basemap | Share | Print ▾ | Measure | Find address or place

Contents

- [x] Risks to Individual Structures
  - Most Likely
    - 76 - 100%
    - 51 - 75%
    - 26 - 50%
    - 0 - 25%
    - Below MSL
- [ ] Stormtools LIMWA
- [ ] Stormtools A/V Zone
- [ ] FEMA Coastal Transect Line

Help . Trust Center . Legal . Contact Esri . Report Abuse . Contact Us

Projected Structural Damage, 100yr SLR3

Input Parameters
E-911 Use Code: **CL**
NACCS Type: **3**
FFE: **10.4ft**

Modeled Damage
Minimum: **32.9%**
Most Likely: **42.0%**
Maximum: **63.2%**

Zoom to

0 150 300ft

Projected Structural Damage, 100yr SLR3

Input Parameters
E-911 Use Code: **C1**
NACCS Type: **3**
FFE: **6.1ft**

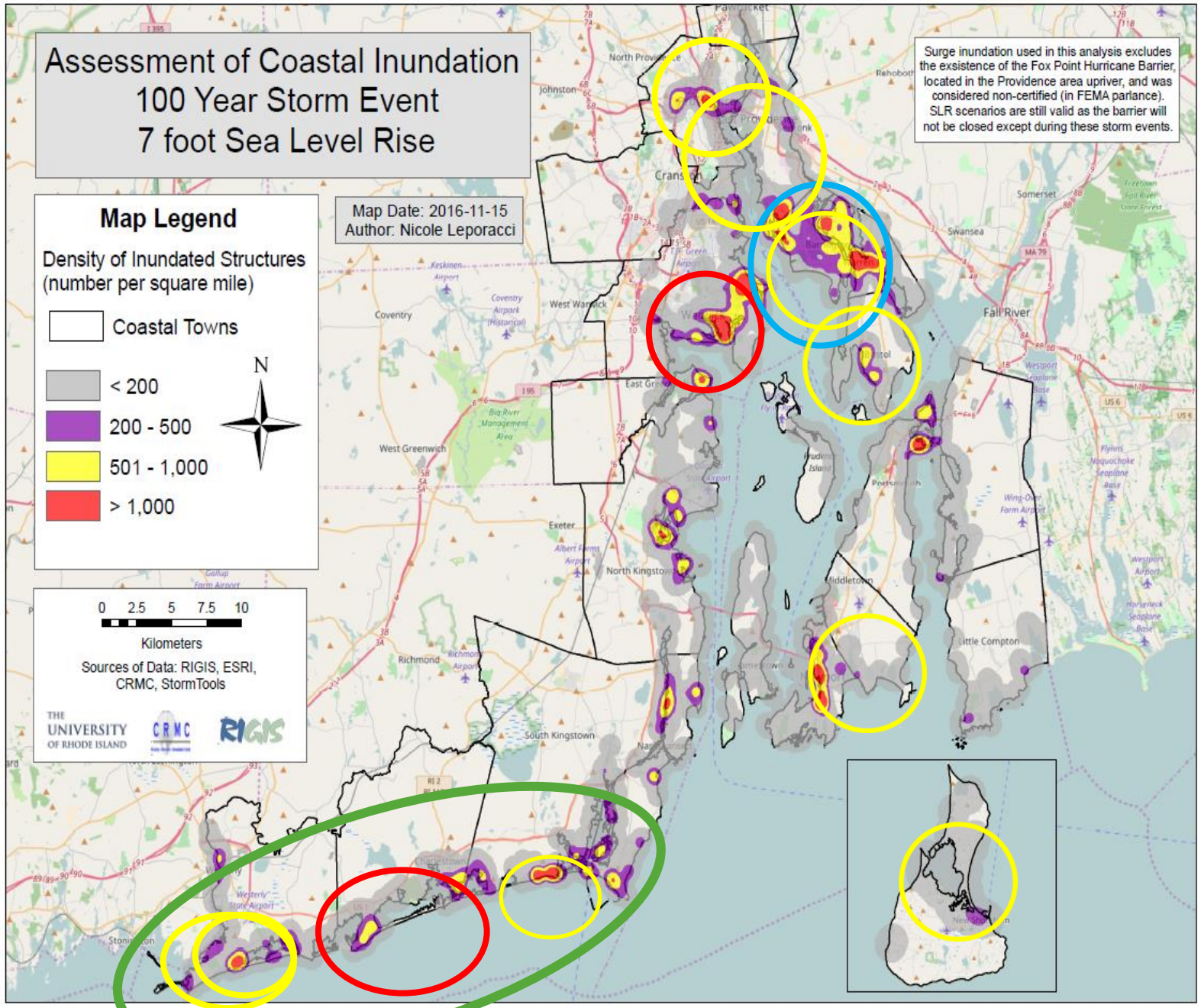
Modeled Damage
Minimum: **39.9%**
Most Likely: **58.9%**
Maximum: **85.8%**

Zoom to

0 150 300ft

USDA FSA

POWERED BY esri



HUD Funded, Warwick and Charlestown, RI, Completed, May 2017

HUD Funded, Barrington, Bristol, and Warren, RI, May 2019

NOAA PSM
Southern RI shoreline, completed June 2019

OCE Senior Design Class
Matunuck, RI, May 2016; Misquamicut, RI, May 2017; Fox Pt Hurricane Barrier, Providence, RI
May 2018; WWTF & AST, May 2019; Warren River, May 2021; Infrastructure across state, May 2024

Summary of Expenditures: STORMTOOLS (2014- present)

System Development and Distribution (2014- present)

- RI CRMC; State of RI; Hurricane Sandy
  CDBG Disaster Recovery, HUD; $2 m
  NOAA Office of Coastal Management(OCM),
  Projects of Special Merit(PSM) & FEMA BRIC 2022

System maintenance (2019- present)

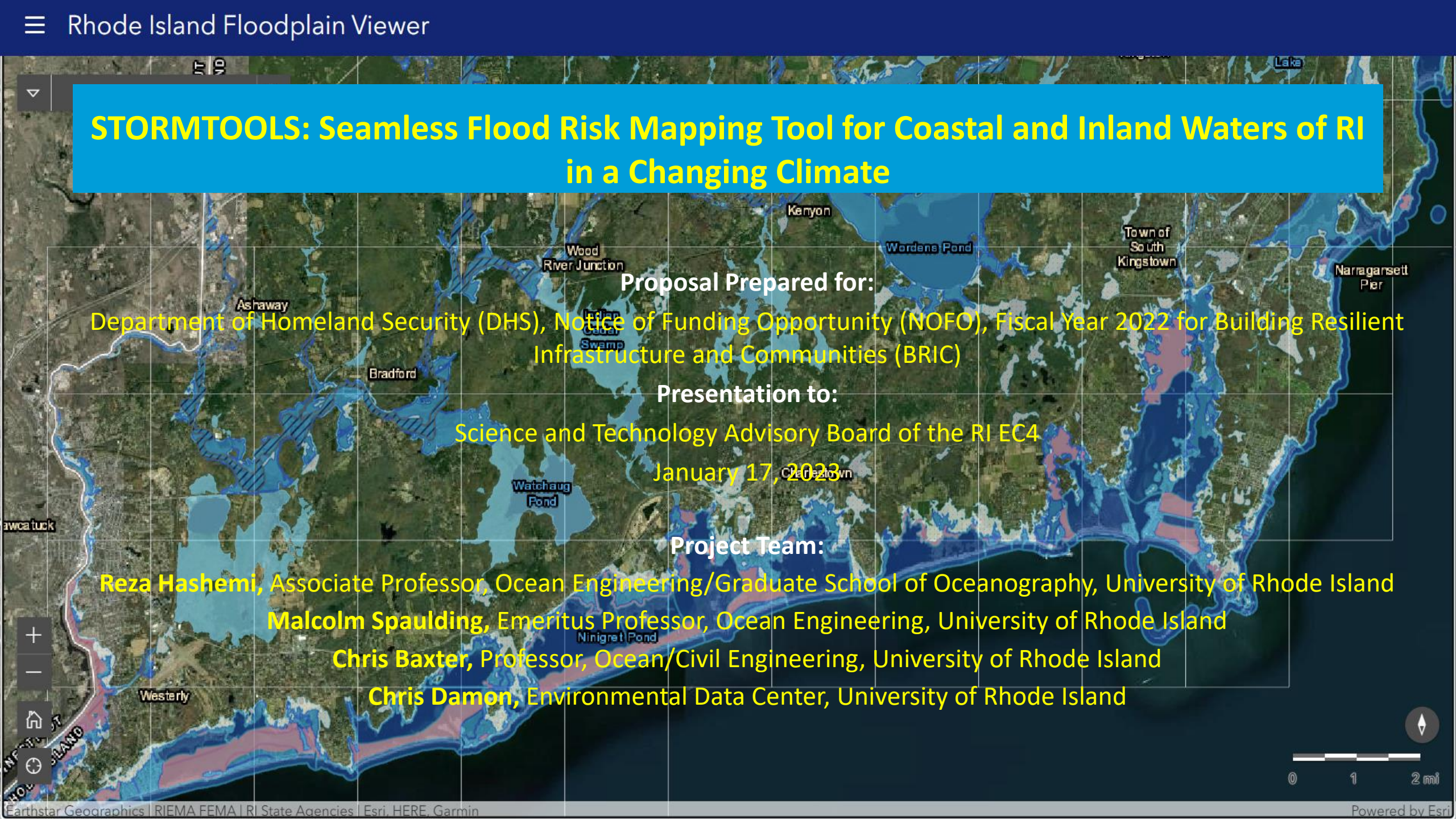
- RI CRMC $160,000
  (~$30,000 per yr)

Proposals Pending (2023- 2027)

- FEMA BRIC 2023 $650,000

STORMTOOLS Initiatives (2014 - present)

- Maps of flooding from sea level rise (0 to 12 ft); 25 and 50 yr storms; nuisance flooding maps (1 ,2, 3, 5 and 10 yrs), flooding from historical storms (1938, Carol- 1954, Bob- 1991, and Sandy- 2012). STORMTOOLS Beginners and Advanced.
- Development and application of STORMTOOLS Design Elevation Maps (SDEs) (BFE- Base Flood Elevation) for Narragansett Bay and southern RI shoreline (embedded in RI CRMC Coastal Hazard Permitting System).
- Development and application of STORMTOOLS Coastal Environmental Risk Index (CERI) to various communities in the state (Narragansett Bay: Barrington, Bristol, Warren, and Warwick, and southern RI shoreline), estimate flood damage to structures.
- STORMTOOLS GIS Hub, central GIS access to all STORMTOOLS products.
- E911 Exposure Assessment, Number and type of structures at risk by community.
- CERI Risk and Damage App (RI coastal areas, including Block Island)
- Senior Capstone Design Projects in Ocean Engineering (https://storymaps.arcgis.com/stories/03880b4e67c740bba740f29730c5dc4c)



STORMTOOLS: Seamless Flood Risk Mapping Tool for Coastal and Inland Waters of RI in a Changing Climate

Proposal Prepared for:

Department of Homeland Security (DHS), Notice of Funding Opportunity (NOFO), Fiscal Year 2022 for Building Resilient Infrastructure and Communities (BRIC)

Presentation to:

Science and Technology Advisory Board of the RI EC4

January 17, 2023

Project Team:

Reza Hashemi, Associate Professor, Ocean Engineering/Graduate School of Oceanography, University of Rhode Island

Malcolm Spaulding, Emeritus Professor, Ocean Engineering, University of Rhode Island

Chris Baxter, Professor, Ocean/Civil Engineering, University of Rhode Island

Chris Damon, Environmental Data Center, University of Rhode Island

Extension STORMTOOLS to Pawtuxet River Watershed



Narragansett Bay Estuary Program

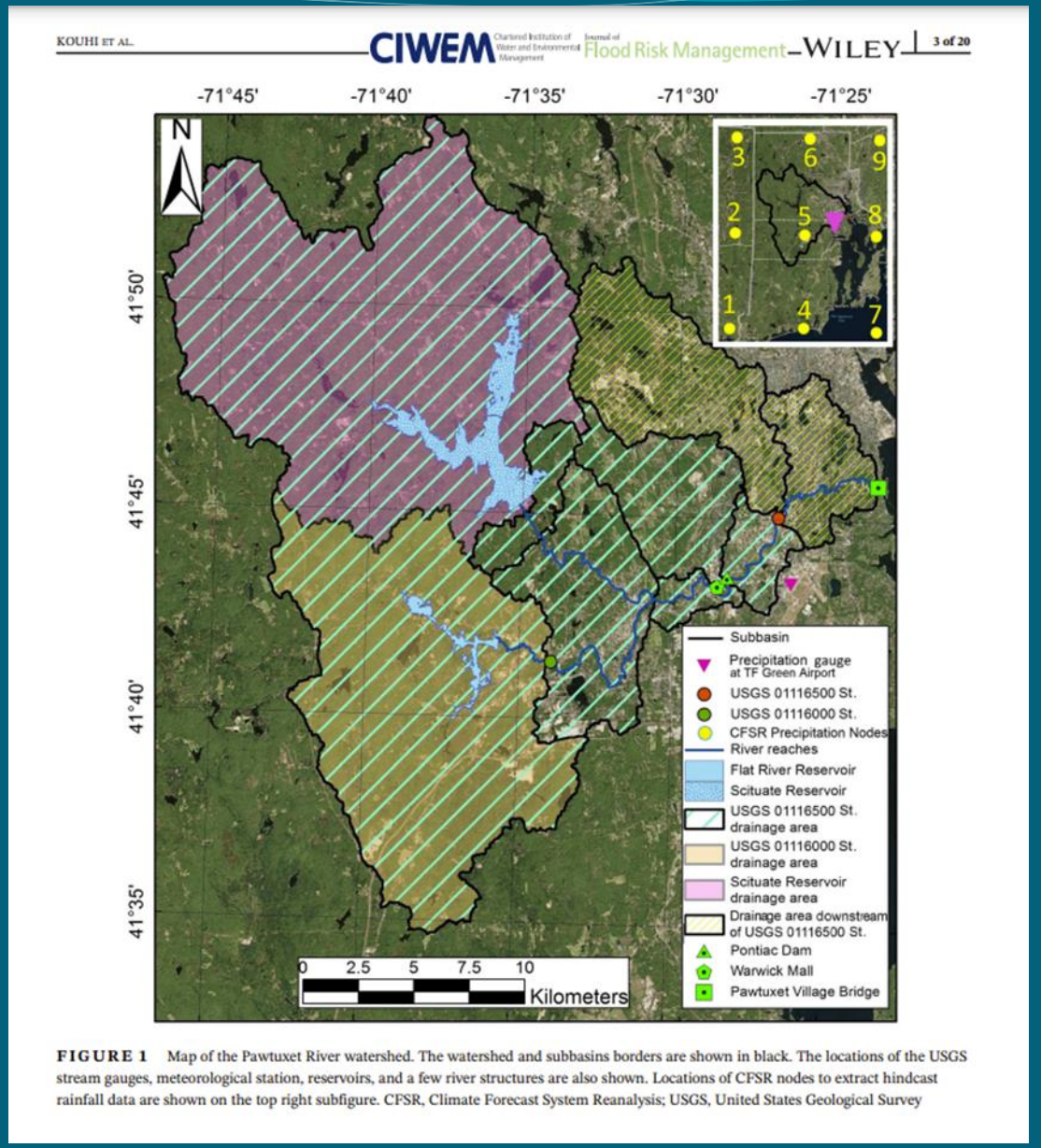
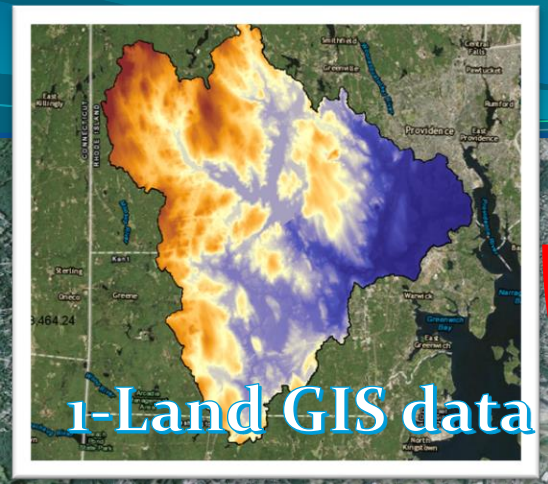
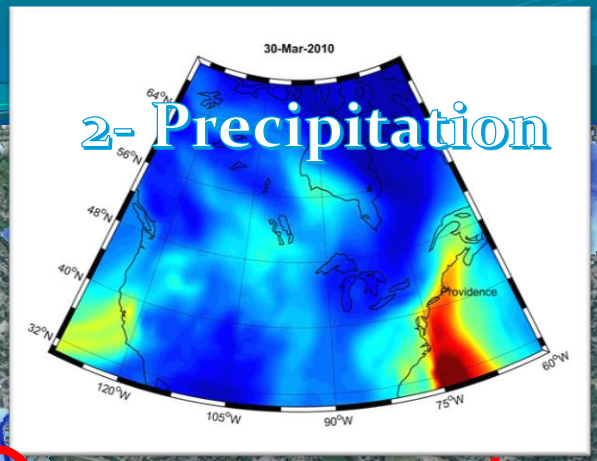


FIGURE 1 Map of the Pawtuxet River watershed. The watershed and subbasins borders are shown in black. The locations of the USGS stream gauges, meteorological station, reservoirs, and a few river structures are also shown. Locations of CFSR nodes to extract hindcast rainfall data are shown on the top right subfigure. CFSR, Climate Forecast System Reanalysis; USGS, United States Geological Survey

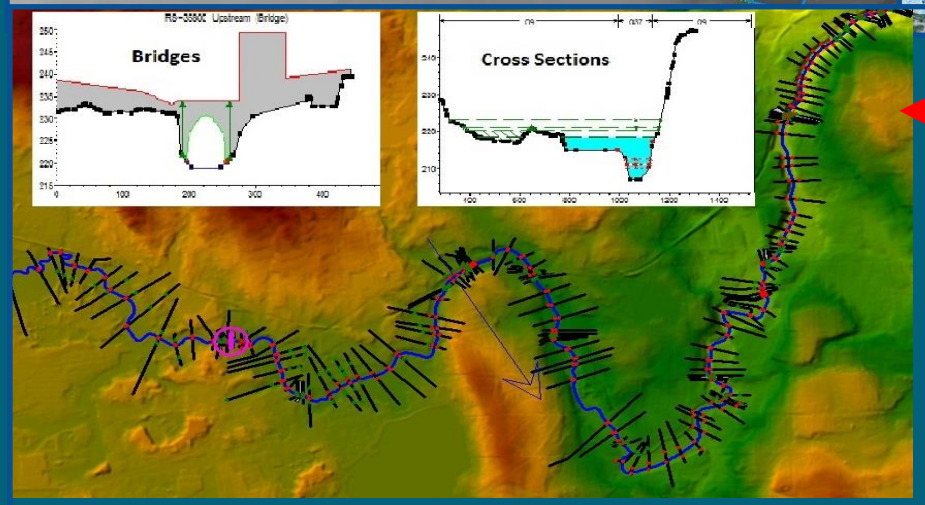
Kouhi et al, 2020

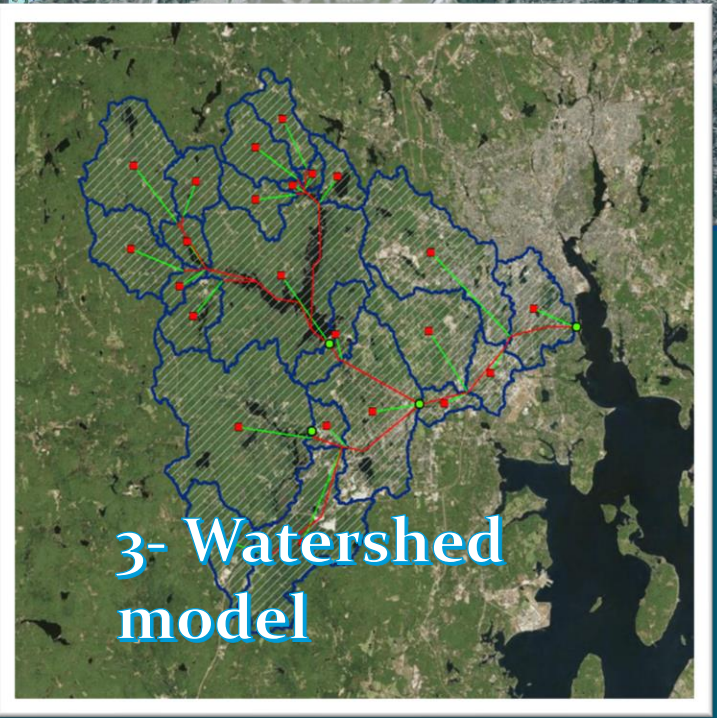
Overview of the modeling system

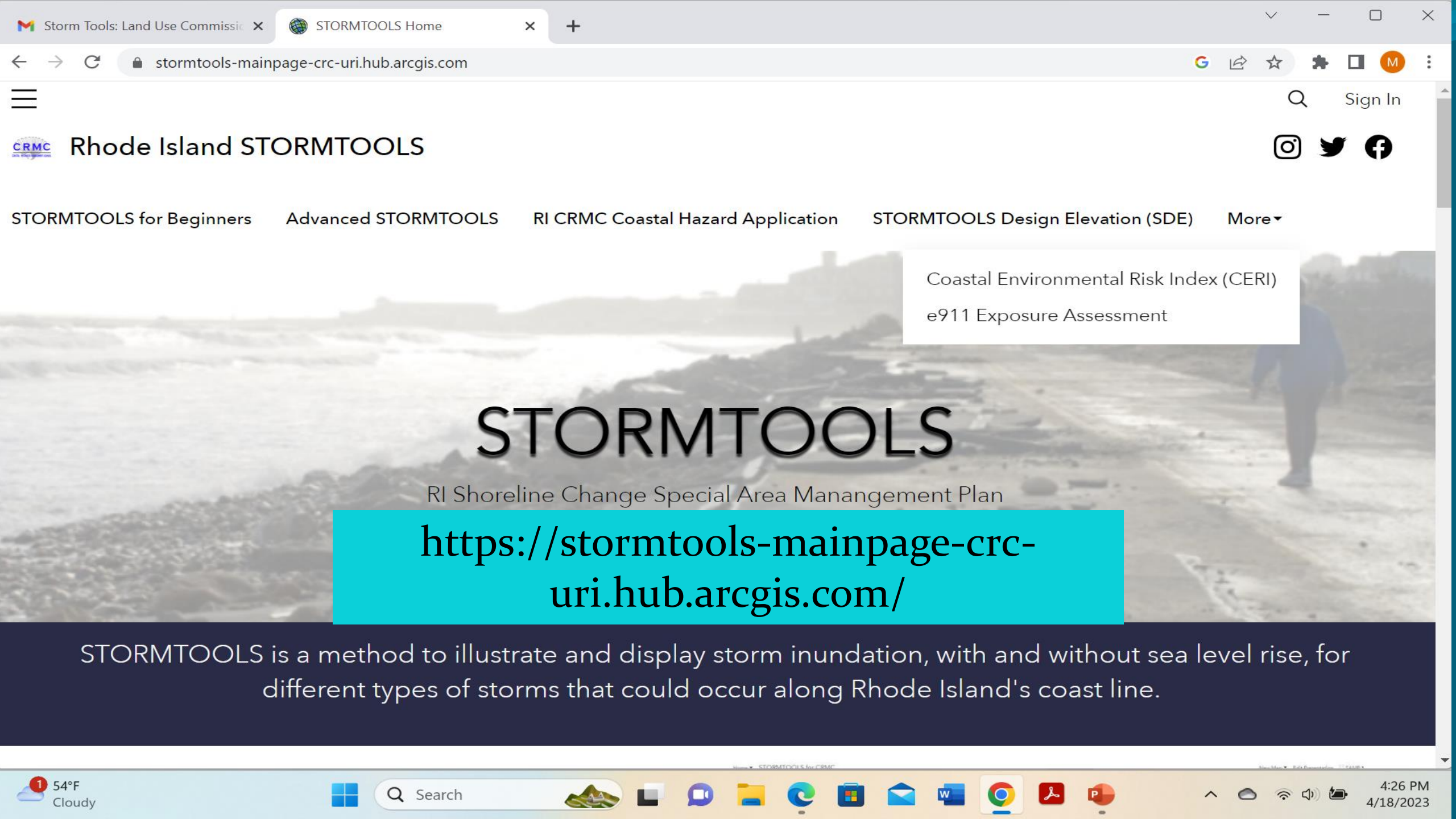











Storm Tools: Land Use Commissi
STORMTOOLS Home
stormtools-mainpage-crc-uri.hub.arcgis.com
Sign In
Rhode Island STORMTOOLS
STORMTOOLS for Beginners
Advanced STORMTOOLS
RI CRMC Coastal Hazard Application
STORMTOOLS Design Elevation (SDE)
More
Coastal Environmental Risk Index (CERI)
e911 Exposure Assessment
STORMTOOLS
RI Shoreline Change Special Area Manangement Plan
https://stormtools-mainpage-crc-uri.hub.arcgis.com/
STORMTOOLS is a method to illustrate and display storm inundation, with and without sea level rise, for different types of storms that could occur along Rhode Island's coast line.
54°F
Cloudy
Search
4:26 PM
4/18/2023

Ocean Engineering Capstone Design Projects

- 2023-2024 Application of the STORMTOOLS Coastal Environmental Risk Index (CERI) to Infrastructure and Extension to Address Wind Damage.
- 2022-2023 Application of Coastal Flood Risk Index to Structures and Infrastructure, Block Island, RI.
- 2021-2022 Impact of Coastal Flooding on Commercial Structures and Infrastructure on the Warren, Rhode Island Waterfront.
- 2020-2021 Assessing the Vulnerability of a Fresh Water Reservoir in Newport, RI to the Effects of Storm Surge and Sea Level Rise
- 2019-2020 Development and Application of STORMTOOLS Design Load Maps, Misquamicut and Watch Hill, RI.
- 2018 -2019 Evaluating and Improving the Resilience of Wastewater Treatment Facilities and Above Ground Storage Tanks in Upper Narragansett Bay to Coastal Flooding.
- 2017-2018 Application of the Coastal Environment Risk Index (CERI) to Providence, RI and the Fox Point Hurricane Barrier.

Ocean Engineering Capstone Design Projects

- 2016- 2017 Assessment of Damage for the Misquamicut, RI Community from a 100 Year Storm Event and Sea Level Rise.
- 2015- 2016 Assessment of Damage from Storm Surge and Sea Level Rise Along Matunuck Beach Road and Surrounding Communities.
- 2014- 2015 The Impact of Climate Change on Rhode Island, Marinas: Sea Level Rise and Storm Surge.
- 2013- 2014 Evaluation of Storm Surge & Sea Level Rise in Wickford, RI.

https://storymaps.arcgis.com/stories/03880b4e67c740bba740f29730c5dc4c

cAfee Security Dell Other favorite



Integrated Coastal Resilience Capstone

A tour through time to explore coastal hazard risk, design options, policy needs, and economic questions in the Ocean State, 2014-2022.

Coastal Resilience

April 29, 2022

STORMTOOLS Impact

- RI one of (the) first in nation to have storm flooding maps (BFEs)(SDE) fully integrated into coastal permitting system, that explicitly include climate change (SLR).
- Method developed and implemented(CERI) to estimate damage to residential and commercial structures and infrastructure (WWTF, Above ground Storage Tanks (AST), roads/highways, and bridges). First in the nation. Accessible via mobile app (free).
- Researchers' trailblazing work lauded as 'amazing', *R.I. 'leading the charge' in projecting risks from coastal storms* (Rising seas, rising stakes: R.I. researchers project future flooding (providencejournal.com), ProJo, Nov 2016.
- "Your work on STORMTOOLS and Beach SAMP appear to be the closest to what my colleagues and I had hoped to find for the whole country", Library of Congress, Congressional Research Office, April 2023..
- Papers published in Journal of Marine Science and Engineering (JMSE), 2016 to present (10 papers), total reads: 43,694, citations: 74. CERI app featured paper in JMSE.
- STORMTOOLS GIS Hub, maps and data available on-line, integrated into RI CRMC coastal hazard permitting system.

MARKETPLACE
earch For & Place Classifieds

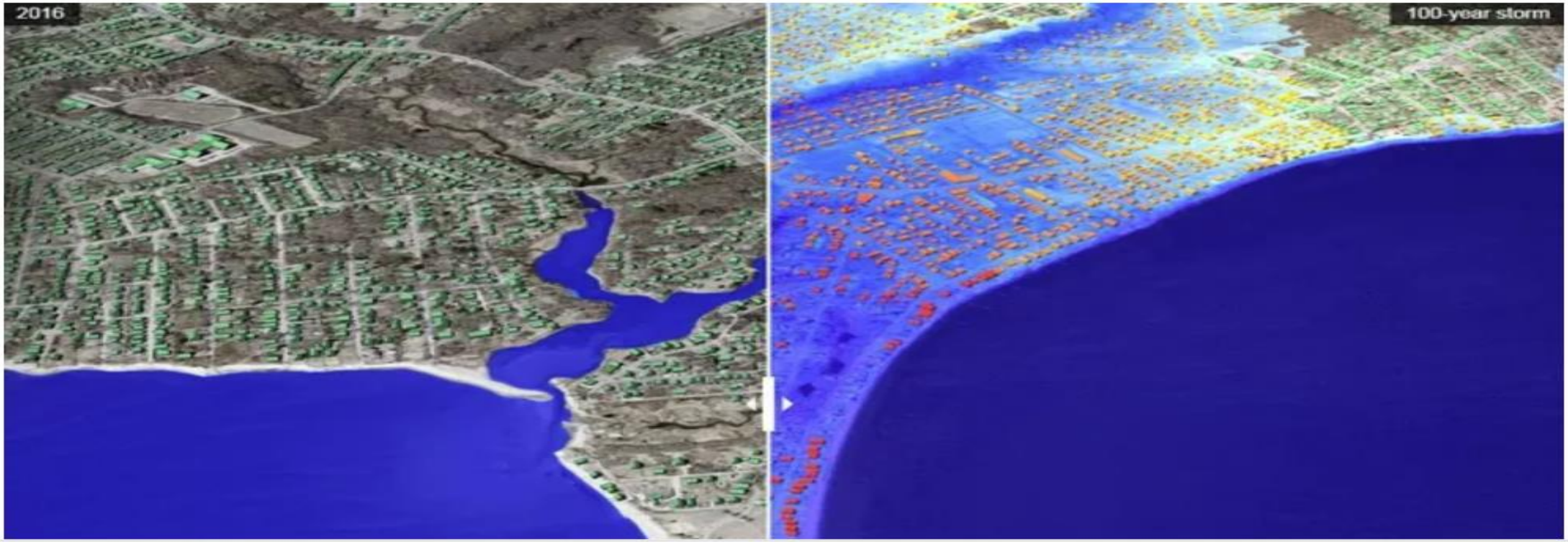
The Providence Journal

ENVIRONMENT

Rising seas, rising stakes: R.I. researchers project future flooding

Alex Kuffner akuffner@providencejournal.com

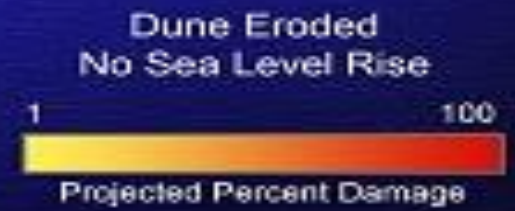
Published 11:01 p.m. ET Nov. 26, 2016 | **Updated 9:39 a.m. ET Nov. 27, 2016**



Publication Record STORMTOOLS (2016-present)

STORMTOOLS Reader Statistics
Date: December 16, 2023

Paper	Publication Date	Views	Citations
WWTF 2010 flood	2022	1119	0
Design Load maps	2021	2086	0
CERI Application to South County	2020	2159	4
SDE Maps for RI	2020	2734	6
CERI App	2020	3435	5
CERI development	2016	7994	26
Flooding Exposed Coastal Area	2017	6506	14
Flooding Protected Bay	2017	5248	5
East Matunuck CERI	2016	6430	7
Coastal Erosion- Southern RI Coast	2016	5983	6
	Total	43694	73



Stempel 2016

Supplemental Material

THE UNIVERSITY OF RHODE ISLAND Integrated Coastal Resilience Capstone

Integrated Coastal Resilience ... | South Coast | West Bay | Metro Bay | East Bay | Aquidneck Island

