

# Town of Salisbury



## Community Resilience Building Workshop

Summary of Findings

December 2018

## TABLE OF CONTENTS

|                                                                                          | Page       |
|------------------------------------------------------------------------------------------|------------|
| TABLE OF CONTENTS .....                                                                  | i          |
| LIST OF FIGURES & TABLES .....                                                           | ii         |
| LIST OF APPENDICES .....                                                                 | iv         |
| <b>1.0 OVERVIEW .....</b>                                                                | <b>1-1</b> |
| <b>1.1 Environmental Risk in Salisbury.....</b>                                          | <b>1-1</b> |
| <b>1.2 Land Use in Salisbury.....</b>                                                    | <b>1-1</b> |
| <b>1.3 Demographics in Salisbury .....</b>                                               | <b>1-2</b> |
| <b>2.0 COMMUNITY RESILIENCE BUILDING WORKSHOP: SUMMARY OF FINDINGS .....</b>             | <b>2-1</b> |
| <b>3.0 TOP HAZARDS AND VULNERABLE AREAS.....</b>                                         | <b>3-1</b> |
| <b>3.1 Top Hazards .....</b>                                                             | <b>3-1</b> |
| 3.1.1 Sea Level Rise, Coastal Storm Surge, and Erosion .....                             | 3-1        |
| 3.1.2 Extreme Precipitation .....                                                        | 3-1        |
| 3.1.3 Extreme Storms.....                                                                | 3-2        |
| 3.1.4 Extreme Temperatures .....                                                         | 3-2        |
| <b>3.2 Vulnerable Areas.....</b>                                                         | <b>3-2</b> |
| <b>4.0 CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE .....</b> | <b>4-1</b> |
| <b>4.1 Specific Categories of Concerns and Challenges .....</b>                          | <b>4-1</b> |
| 4.1.1 Infrastructural .....                                                              | 4-1        |
| 4.1.2 Societal .....                                                                     | 4-2        |
| 4.1.3 Environmental .....                                                                | 4-2        |
| <b>5.0 CURRENT STRENGTHS AND ASSETS.....</b>                                             | <b>5-1</b> |
| <b>6.0 TOP RECOMMENDATIONS TO IMPROVE RESILIENCE .....</b>                               | <b>6-1</b> |
| <b>6.1 Highest Priorities.....</b>                                                       | <b>6-1</b> |
| <b>6.2 Additional Priorities .....</b>                                                   | <b>6-2</b> |
| <b>7.0 REFERENCES .....</b>                                                              | <b>7-1</b> |
| <b>7.1 CRB Workshop Participants: .....</b>                                              | <b>7-1</b> |
| <b>7.2 Citation .....</b>                                                                | <b>7-2</b> |
| <b>7.3 Workshop Project Team: .....</b>                                                  | <b>7-2</b> |
| <b>7.4 Acknowledgements .....</b>                                                        | <b>7-2</b> |
| <b>7.5 Works Cited .....</b>                                                             | <b>7-3</b> |
| <b>7.6 Additional Resources .....</b>                                                    | <b>7-3</b> |



LIST OF FIGURES

Figure 1 ..... Beach Road in Salisbury, MA

Figure 2 ..... A Map of Communities Participating in the MVP Program

Figure 3 ..... Discussions During the Community Workshop

Figure 4 ..... Salisbury Beach Center After a Storm

Figure 5 ..... Weather Causes Serious Erosion

Figure 6 ..... State Replenishes Sand on Salisbury Beach

Figure 7 ..... Areas of Concern

Figure 8 ..... Erosion at Salisbury Beach

Figure 9 ..... Participants Created Matrices of Risks

LIST OF TABLES

Table 1 ..... Salisbury Natural Hazards Risk Assessment

Table 2 ..... Vulnerable Areas in Salisbury



Ocean Front at Salisbury Beach. Source: The Daily News of Newburyport

## LIST OF APPENDICES

|                  |                                                 |
|------------------|-------------------------------------------------|
| Appendix A.....  | Workshop Handouts                               |
| Appendix B ..... | Workshop Presentation                           |
| Appendix C ..... | Participant Matrices                            |
| Appendix D ..... | Annotated Maps from Participants                |
| Appendix E.....  | Core Team Meeting Minutes and List of Attendees |

DRAFT

Salisbury Beach Post-Winter Storm. Source: The Eagle-Tribune



## 1.0 OVERVIEW



Figure 1. Beach Road in Salisbury, MA  
Source: The Daily News of Newburyport

The Northeastern U.S. has already experienced the effects of climate change. Since 1970, annual temperatures in this region have increased by two degrees Fahrenheit. Average temperatures in Salisbury, Massachusetts could increase further, possibly by almost 11 degrees by the end of the century (NECASC 2018). With these temperature changes, winter snowpack has decreased and the number of extremely hot summer days has increased. But extreme temperatures are not the only risks faced by Salisbury and the surrounding area. Riverine and stormwater flooding due to heavy rains have become Merrimack Valley region's most frequent and costly natural disasters.

### 1.1 Environmental Risk in Salisbury

The Town of Salisbury has already experienced extreme weather. In 2018 alone, a February storm led to substantial rebuilding and a summer drought led to town-wide water restrictions. In the aftermath of past storms, main roads have been inundated and residents have been left without power for up to four days. A 2017 analysis of Salisbury's assets found that there were critical facilities, public-utility stations, underground storage tanks, and a transportation hub located in both the 2013 and the 2070 Hazard Zone (National Wildlife Federation (NWF) and Ipswich River Watershed Association (IRWA), 2017). Please refer to the list of Works Cited and Additional Resources in Sections 7.5-7.6 for more information on climate change projections and adaptation plans in Massachusetts, Merrimack Valley, and Salisbury.

### 1.2 Land Use in Salisbury

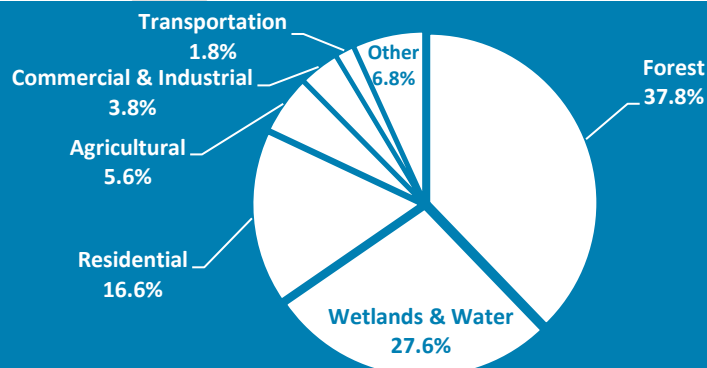
Salisbury is facing a range of environmental risks, and adaptation strategies will need to consider Salisbury's varying landscape conditions. The town's beach, forest, and farmlands will be impacted differently by flooding, extreme temperatures, and drought, and will require localized solutions. Considering the full scope of Salisbury's environmental risks can lead to a comprehensive set of strategies to prepare for extreme events and mitigate their impact.

The Town of Salisbury is primarily made up of forest, salt marsh and wetlands, and residential development. The Town is also home to a 3.8-mile-long barrier beach owned by the Massachusetts Department of Conservation and Recreation. Additional land uses are shown below (Merrimack Valley Planning Commission (MVPC), 2015).

#### SALISBURY FLOODPLAIN



43% OF TOWN  
IS INCLUDED  
IN THE 100-  
YEAR  
FLOODPLAIN  
(MVPC, 2015)



### 1.3 Demographics in Salisbury

The needs of vulnerable populations should be carefully considered when planning for environmental risk. Vulnerable populations can include the elderly, the infirm, residents with language barriers, residents with special needs, and residents with low or moderate income. Census data for the Town of Salisbury shows that approximately 20% of children and 7% of seniors live in poverty (American Community Survey (ACS), 2016).

Children (under 18)



■ Poverty ■ Non-poverty

Seniors (65 and over)



■ Poverty ■ Non-poverty

Other demographic information for the Town of Salisbury is summarized below:

#### Population

- 8,283 residents were recorded by the 2010 Census (MVPC, 2015)
- 10,100 residents are projected by 2035 (MVPC, 2015)
- Summer population can increase to an estimated 24,000 residents (NWF and IRWA, 2017)

#### Age

- 16.0% of residents are under age 18 (ACS, 2016)
- 18.4% of residents are 65 or older (ACS, 2016)

#### Education

- 91.6% of residents have a high school diploma (U.S. Census, 2012-2016)
- 28.3% of residents have a bachelor's degree (U.S. Census, 2012-2016)

#### Income

- Median household income is \$65,347 (U.S. Census, 2012-2016)
- 10.3% of residents are below the poverty level (ACS, 2016)

#### Employment

- There are 4,650 employed civilians 16 years old and over (MVPC, 2015)
- 1,596 are employed in Management & Professional fields (MVPC, 2015)
- 889 are employed in Service fields (MVPC, 2015)
- 1,299 are employed in Sales and Office fields (MVPC, 2015)
- 382 are employed in Natural Resources, Construction, and Maintenance fields (MVPC, 2015)
- 484 are employed in Production, Transportation, and Material Moving fields (MVPC, 2015)

#### Residential Property Values

- There are 4,563 housing units (MVPC, 2015)
- The average property value is \$326,800 (MVPC, 2015)



## 2.0 COMMUNITY RESILIENCE BUILDING WORKSHOP: SUMMARY OF FINDINGS

The timeline of climate adaptation and mitigation efforts in Salisbury extends for more than a decade. Salisbury introduced a Multi-Hazard Mitigation Plan in 2008, which was later updated in 2015 (MVPC, 2015). The Federal Emergency Management Agency (FEMA) updated the area's Flood Insurance Rate Maps (FIRM) in 2009 and 2012, which included most of Salisbury's beach in the floodplain. The Town has been proactive in planning for increased environmental risks, from requiring new development to be elevated or sited outside of the floodplain, to joining the National Flood Insurance Program's (NFIP) Community Rating System (CRS). Communities participating in the CRS can earn community-wide discounts on flood insurance in exchange for floodplain management exceeding FEMA's minimum requirements. In addition, Salisbury has used grants to fund flood mitigation work at Town Creek and to relocate the Police Station to a site with a lower level of flood risk (MVPC, 2015).

Additional examples of climate mitigation work range from the Great Marsh Restoration Project, to the Dune Nourishment work in 2010 and 2014. The Great Marsh Restoration Project was a joint effort between seven coastal communities to improve flood mitigation by protecting the Marsh's ability to buffer storm surge, mitigate erosion, and absorb flooding (MVPC, 2015). The Dune Nourishment work brought together the Massachusetts Department of Conservation and Recreation (DCR), University of New Hampshire, Conservation Commission, and local stakeholders to restore more than 20-acres of dunes across three towns. This project involved the addition of thousands of cubic yards of sand, planting vegetation, installing fencing for stabilization, and creating a "living classroom" to educate students and other stakeholders about restoration efforts (NWF and IRWA, 2017). These climate adaptation projects were made more urgent by the winter storms that Salisbury experienced between January and March 2015, and the severe coastal flooding during January 2018 (Chiaramida, 2016; CBS News, 2018).

Salisbury's application to the Municipal Vulnerability Preparedness (MVP) Planning Grant continues the Town's history of climate change planning. The MVP program helps support Massachusetts communities in preparing for extreme weather and implementing priority resilience projects. Eligible communities complete the MVP program, become certified, and apply for MVP Action grant funding. As a participating community, Salisbury can use this funding to improve resilience and preparedness for natural and climate-driven hazards; collaborate with stakeholders regarding climate change, natural hazards and impacts; and increase education, planning, and implementation of priority actions.

Salisbury's MVP application outlined the impact of extreme weather events and pledged to incorporate findings from the MVP Project into future updates of the Town's Hazard Mitigation Plan, and into considerations by the Planning Board, Zoning Board of Appeals, Board of Health, and Conservation Commission.

On October 10, 2018, the Town of Salisbury worked with Weston & Sampson to host a Community Resilience Buildings (CRB) workshop as part of the MVP Program. The Workshop's central objectives were to:

- Define top local, natural, and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for the Community
- Identify immediate opportunities to collaboratively advance actions to increase resilience

## Municipal Vulnerability Preparedness Program

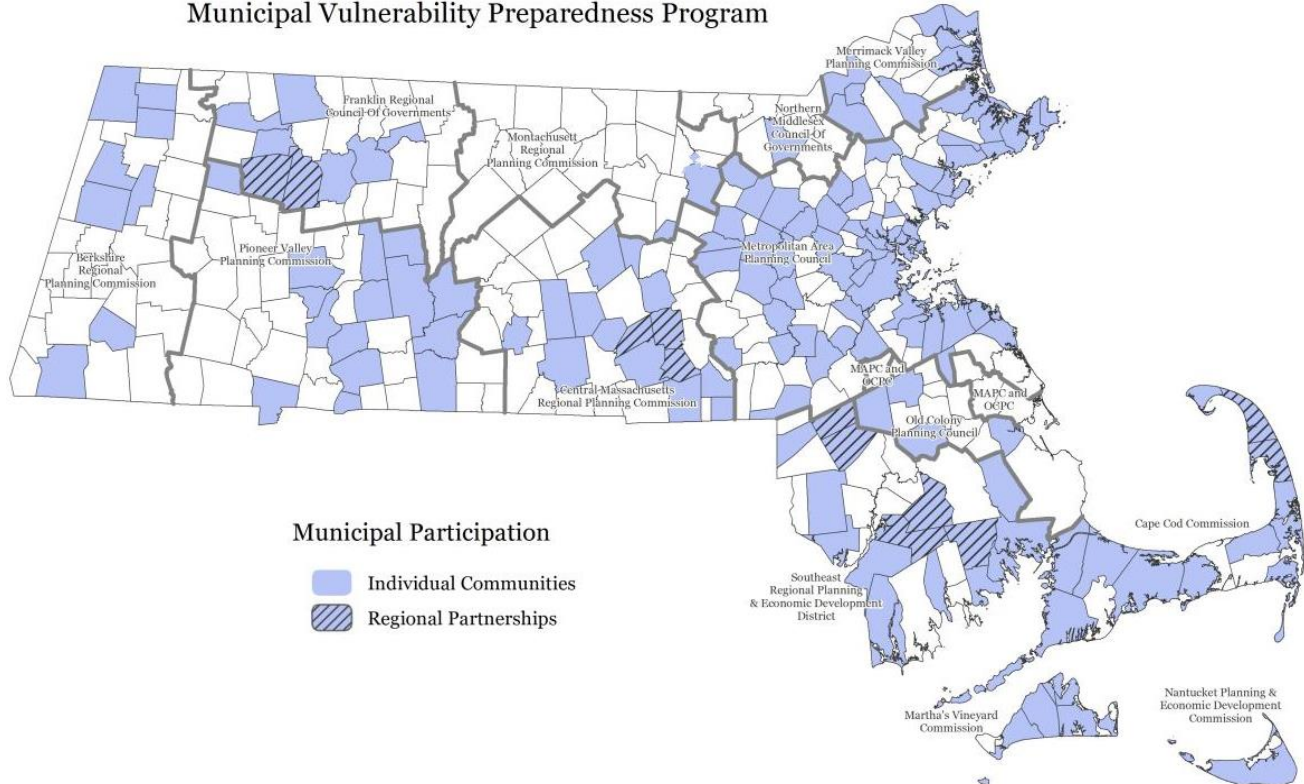


Figure 2. A map of communities participating in the MVP Program

The Municipal leadership involved in this workshop included the Town Manager, Planning Director, Building Inspector, Water Superintendent, and representatives from the Fire Department, Emergency Management, Public Works, the Police Department, and Conservation. More than twenty stakeholders participated in the event, working alternatively in large and small groups to identify hazards, at-risk areas, and recommendations related to environmental risk and climate adaptation. This report summarizes the CRB workshop process and findings.



Figure 3. Discussions during the community workshop

### 3.0 TOP HAZARDS AND VULNERABLE AREAS

Natural hazards in Salisbury include extreme heat, sea level rise and storm surge, heavy precipitation, wind, drought, snow and ice, and erosion. A 2015 Risk Assessment ranked the following natural hazards from high to low risk:

| Table 1: Salisbury Natural Hazards Risk Assessment |                       |
|----------------------------------------------------|-----------------------|
| Natural Hazard                                     | Community Risk Rating |
| Floods                                             | High                  |
| Winter Storms (blizzard/snow/ice)                  | High                  |
| Northeasters                                       | High                  |
| Power Outages                                      | High                  |
| Hurricanes                                         | Moderate              |
| Drought                                            | Moderate              |
| Wildfire/Brush Fires                               | Moderate              |
| Tornadoes                                          | Low                   |
| Earthquakes                                        | Low                   |
| Landslides                                         | Low                   |
| Dam Failures                                       | Low                   |

Table reproduced from the Merrimack Valley Region Multi-Hazard Mitigation Plan (MVPC, 2015)

#### 3.1 Top Hazards

All climate risks were presented and discussed during the CRB workshop. The top hazards identified by participants during the workshop include:



Sea level rise, coastal storm surge, and erosion



Extreme precipitation: both heavy rain and drought



Extreme storms; including wind, ice, and Nor'easters



Extreme temperatures

##### 3.1.1 Sea Level Rise, Coastal Storm Surge, and Erosion

While sea level rise projections vary depending on emission scenarios and time horizons (NECASC 2018), the region has identified 40" of sea level rise by 2070 as a planning benchmark. Increased coastal flooding will lead to increased shoreline erosion, which is also a serious concern in Salisbury. The beach has experienced erosion during extreme weather and the State replenished sand on Salisbury Beach in July of 2018.

##### 3.1.2 Extreme Precipitation

This category includes both heavy rain and drought. Between 1961 and 2015, the 24-hour, 100-year rain event increased from 6.5 inches to 8.4 inches (NOAA, 2015; U.S. Department of Commerce, 1961). Drought will impact water supply; local rivers, streams, and wetlands; and the crops on local farmlands.

### 3.1.3 Extreme Storms

This category includes strong winds, ice, and Nor'easters. High winds will impact infrastructure, trees, and properties.

### 3.1.4 Extreme Temperatures

This category includes both very low and very high temperatures. Average temperatures in the Merrimack Basin, including Salisbury, could increase by 3.0°F to 6.4°F by mid-century, and by 3.9°F to 10.9°F by the end of the century. There could also be an increase in days with temperatures above 100°F. The number of these extremely hot days could increase to between 1 and 5 days by 2050, and between 1 and 22 days by 2100 (NECASC 2018).

## 3.2 Vulnerable Areas

Vulnerable areas identified as part of the 2017 NWF and IRWA *Great Marsh Coastal Adaptation Plan* are shown below:

| Table 2: Vulnerable Areas in Salisbury                     |                                               |
|------------------------------------------------------------|-----------------------------------------------|
| High Hazard Concerns                                       | Type of Hazard                                |
| Salisbury Beach                                            | Erosion                                       |
| Salisbury Beach at Broadway                                | Storm over-wash during storms                 |
| Neighborhoods along Blackwater River                       | Flooding during extreme high tides and storms |
| US Route 1 North at Town Creek                             | Tidally influenced flooding                   |
| US Route 1 South; March Road and 1 <sup>st</sup> St.       | Tidally influenced flooding                   |
| US Route 1A (Beach Road)                                   | Tidally influenced flooding                   |
| Jak-Len Drive                                              | Freshwater flooding from storms               |
| Smallpox Brook                                             | Freshwater flooding from storms               |
| North End Boulevard (Old Town Way to 18 <sup>th</sup> St.) | Storm-related flooding                        |

Participants discussed vulnerable areas during the CRB workshop. The impact of extreme events on Salisbury Beach was cited as a concern. Route 1A experiences frequent flooding. Ring Island and Ferry Road were identified as vulnerable to severe weather. Participants also discussed the impact of environmental risk on vulnerable populations, which can include children, the elderly, the infirm, those with language barriers, low-income populations, and the homeless. Due to its tourism economy, Salisbury also has a large transient population. These vulnerable communities will need support and access to shelters, information, cooling centers, and evacuation plans in the event of an emergency.



Figure 4. Salisbury Beach Center after a storm. Source: *The Daily News*, February 10, 2016



Figure 5. Weather causes serious erosion at Salisbury Beach, January 2016



Figure 6. State replenishes sand on Salisbury Beach, July 2018



## 4.0 CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE

1,710 BUILDINGS IN THE  
100-YEAR FLOODPLAIN



\$418M PROPERTY  
VALUE

\$258M CONTENT VALUE  
(MVPC, 2015)

Floods have had a significant impact on the Town of Salisbury. The Town's 100-year floodplain is home to 1,710 buildings with a property value of \$418 million and a content value estimated at \$258 million. Since 1978, 37 sites in Salisbury have already had 114 payouts from the NFIP totaling \$2.9 million (MVPC, 2015).

Flooding is not Salisbury's only concern. During the CRB workshop, long-term residents remarked on erosion along Salisbury Beach, which they had observed during frequent walks and from photos taken over the course of decades. The State also declared a drought in the summer of 2016, which led to town-wide water restrictions. Workshop participants expect that these hazards will worsen in the future and may even lead to

new risks. For example, worsening drought conditions could lead to forest fires or to a decrease in the drinking water supply. Participants expressed the need to plan for multiple hazards and to prepare for the impact of these hazards on vulnerable populations, including the elderly and the homeless.

### 4.1 Specific Categories of Concerns and Challenges

The main areas of concern were grouped within the following three categories or "features:" infrastructural, societal, and environmental.

#### 4.1.1 *Infrastructural*

Concerns within the infrastructural category include:

- Roads: this was the most commonly cited infrastructural area of concern. Participants discussed the need to protect transportation and evacuation routes, including Route 1A (Beach Road), March Road, and Ferry Road.
- Reliable power supply
- The Salisbury Beach Reservation, owned by the Massachusetts DCR
- Buildings: buildings were another frequently cited area of concern. Participants discussed the need to protect shelters and municipal buildings like the police station and the fire station.
- Wells
- Communication
- Utilities, including gas and sewer systems
- Bridges, tide gates, and culverts



Figure 7. Areas of concern include the Fire Department, transportation, assisted living facilities, and the Police Department

#### 4.1.2 *Societal*

Concerns related to the societal category include:

- Municipal services and facilities, including emergency management at Town Hall, the Fire Department, and the Police Department
- Businesses, including the need to protect the Salisbury Beach Center
- Commercial and economic vulnerability, due to the impact of environmental risks on tourism
- Children, including special needs youth
- Shelter availability and accessibility
- Elderly populations, senior centers, and assisted living facilities
- Low income communities
- Transient populations, including seasonal populations, renters, the homeless, and those living in a campground, motel, or mobile home park

#### 4.1.3 *Environmental*

Concerns related to the environmental category include:

- Beachfront
- Marsh
- Aquifers
- Merrimack River

## 5.0 CURRENT STRENGTHS AND ASSETS

Despite the range of risks that Salisbury faces, participants in the workshop were able to identify several existing strengths and assets within the town. Those examples include:

- Buildings that are currently used as shelters during emergencies
- Existing cooling centers
- Areas that encourage tourism and contribute to the town's economy, like the beach
- Public open space, like trails and parks
- Landscape features that help manage stormwater and mitigate extreme temperatures, like trees and the 37.8% of forested land in Salisbury (MVPC, 2015)
- Programs fostering community resilience, like the Boys and Girls Club
- Children
- Elderly residents and their local knowledge
- Aquifers and wells
- The Merrimack River and the Black Water Creek
- The Great Marsh and other wetlands
- The Power Grid
- Communication systems
- Sewage Treatment
- Municipal services, including the Police and the Fire Station
- Local farmland
- Infrastructure, including bridges and tide gates
- The State Reservation



Figure 8. Erosion at Salisbury Beach after a pair of Noreasters in March 2018

## 6.0 TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

After listing vulnerabilities, hazards, and possible actions, participants ranked their recommendations from high to low priority. A summary of findings from the final group matrix is included below.



Figure 9. Participants created matrices of risks and vulnerabilities at each table, before consolidating their findings into one matrix and ranking priority actions

### 6.1 Highest Priorities

- Protect roads as evacuation routes and investments. Strategies could include designing alternative modes of transportation; training and emergency management planning; raising roads and protecting Beach Road, Ferry Road, and Route 1A. There should also be regular maintenance programs and work to improve drainage and reduce surface flooding.
- Protect the beachfront including residents, existing buildings, environmental resources, and businesses, such as those at the Salisbury Beach Center. Strategies could include maintaining dunes, maintaining seawalls, maintaining and creating dunes through regular beach nourishment, diversifying plant species, retreat, elevation of structures and infrastructure, reduction of impervious surfaces, and education and advocacy.
- Evaluate and study the addition of tide gates or other flood protection measures, as appropriate, on floodprone streets/areas.
- Provide and prepare existing shelters. This will require emergency transportation options, communication, planning, reliable power, backup power, adequate staffing and equipment, evacuation routes, and the materials and facilities needed to sustain evacuated residents.
- Disaster management, including a tailored evacuation and notification plan, being prepared with evacuation equipment, and protecting related infrastructure, that serves residents, businesses, tourists, and others.
- Protect the marsh by implementing strategies that eliminate restrictions, studying options for buffer protection and resilience, increasing biodiversity, and planting drought-resistant species.
- Protect critical municipal facilities and services by implementing strategies that provide backup power to Town Hall and Library and other critical municipal facilities. Protect other municipal buildings, provide adequate staffing and training, and provide equitable access to facilities with power.
- Protect the State Reservation through beach nourishment, the beach nourishment plan, tide gates under the reservation road, and other related efforts.
- Protect aquifers and current water sources.



## 6.2 Additional Priorities

- Protect public health by conducting water quality monitoring, and by providing shade trees and structures, at the State Reservation, and other public spaces.
- Improve communication before, during, and after extreme events.
- Educate children to prepare the next generation to tackle climate change.
- Protect underground utilities like gas, water, and sewers through redundancy and back-up power.
- Protect wells by seeking new water sources.
- Expand sanitary sewers in critical areas.
- Prevent exposed utilities.

DRAFT

## 7.0 REFERENCES

### 7.1 CRB Workshop Participants:

Salisbury Assistant Planner / Bart McDonough  
 \* Salisbury Board of Selectmen / Freeman Condon / Table 3  
 \* Salisbury Planning Board / Gina Park / Table 3  
 Salisbury Planning Board / Lou Masiello  
 Salisbury PTA President / Jennifer Roketenetz  
 Salisbury Conservation Commission / Jessica Stucker  
 \* Salisbury Citizens for Change / Jim Baskin / Table 3  
 Salisbury Zoning Board of Appeals / Joe Stucker  
 Salisbury Zoning Board of Appeals / Kevin Henderson  
 \* Salisbury Conservation Agent / Michelle Rowden / Table 3  
 Salisbury Town Manager / Neil Harrington  
 \* Salisbury Community Management Director / Robert Cook / Table 1  
 Salisbury Board of Health / Ron Lafferly  
 \* Salisbury Beach Betterment Association / Ray Champagne / Table 5  
 \* Salisbury Fire Chief / Scott Carrigan / Table 3  
 \* Salisbury Police Department / Sargent Robert Roy / Table 4  
 \* Salisbury Chamber of Commerce / Tracy Brown / Table 1  
 \* Director of Public Works / Lisa DeMeo / Table 5  
 \* Director of Planning and Development / Lisa Pearson / Table 2  
 \* Director of Council of Aging / Liz Pettis / Table 5  
 \* Director of Health / Jack Morris / Table 1  
 \* Merrimack Valley Planning Commission / Joe Cosgrove / Table 4  
 Merrimack Valley Planning Commission / Peter Phippen  
 \* MA DCR / Darryl Forgione / Table 2  
 MA State Representative / James Kelcourse  
 \* North Shore Regional Coordinator CZM / Kathryn Glenn / Table 4  
 \* Seabrook Water Superintendent / Curtis Slayton / Table 1  
 \* Building Inspector, Zoning Officer / Scott Vandewalle / Table 2  
 Environmental Protection Agency / Ed Reiner  
 UNH Department of Biological Sciences / Gregg Moore  
 W.C. Cammett Engineering Inc. / Woodbury Cammett  
 Engineer / Joe Serwatka  
 Laffely Real Estate Associates / Sally Laffely  
 \* Tom Saab Real Estate / Tom Saab / Table 2  
 SPL Development Group LLC / Steve Paquette  
 \* Rings Island Tax Payer, Coastal Trails Coalition / Jerry Klima / Table 2  
 \* Rick Rigoli / Table 4  
 \* Wilma McDonald  
 \* Weston & Sampson / Chris Perkins  
 \* Weston & Sampson / Kathleen Baskin  
 \* Weston & Sampson / Jim Riordan / Table 3  
 \* Weston & Sampson / Adria Boynton / Table 2

- \* Weston & Sampson / Rob Almy / Table 4
- \* Weston & Sampson / Sarah Miller / Table 5
- \* Weston & Sampson / Steve Roy / Table 1

*Notes:*

*Asterisks (\*) are placed next to attendees*

*While the listed table numbers reflect table assignments, some invitees may have moved*

## 7.2 Citation

Town of Salisbury. 2018. *Community Resilience Building Workshop Summary of Findings*. Prepared by Weston & Sampson. Salisbury, Massachusetts.

## 7.3 Workshop Project Team:

Town of Salisbury, Municipal Leadership:  
Neil Harrington, Town Manager  
Lisa Pearson, Planning Director

Town of Salisbury, Core Team Members:  
Scott Carrigan, Fire Chief  
Robert Cook, Emergency Management  
Lisa DeMeo, Public Works  
Tom Fowler, Police Chief  
Michelle Rowden, Conservation  
Scott Vandewalle, Building

*Note: for contact information for the Core Team Members, please refer to the meeting minutes included in Appendix E.*

Weston & Sampson, Team Assisting with the Workshop:  
Chris Perkins, Principal-in-Charge  
Kathy Baskin, Project Manager/Facilitator  
Rob Almy, Table Facilitator  
Adria Boynton, Table Facilitator  
Sarah Miller, Table Facilitator  
Jim Riordan, Table Facilitator  
Steve Roy, Table Facilitator

## 7.4 Acknowledgements

A special thanks to the Massachusetts Executive Office of Energy and Environmental Affairs for providing the grant that funded the Community Resilience Building Workshop. Additional thanks to all the participants and to the Workshop Project Team for a successful event.

.....

## 7.5 Works Cited

- American Community Survey. 2016. 5-year Estimates. "Census Reporter: Salisbury, MA." [censusreporter.org/profiles/16000US2559210-salisbury-ma/](https://censusreporter.org/profiles/16000US2559210-salisbury-ma/) and [census.gov/quickfacts/fact/table/salisburytownessexcountymassachusetts/INC110216#INC110216](https://census.gov/quickfacts/fact/table/salisburytownessexcountymassachusetts/INC110216#INC110216).
- CBS News. 2018. "Dangerous Flooding in Massachusetts Amid Winter Storm." [cbsnews.com/news/flooding-massachusetts-bomb-cyclone-winter-storm/](https://www.cbsnews.com/news/flooding-massachusetts-bomb-cyclone-winter-storm/)
- Chiaramida, Angeljean. 2016. "Storm, Flooding Hits Coast, but Barely Scratches 2015 Snowfall." The Eagle-Tribune. [eagletribune.com/news/storm-flooding-hits-coast-but-barely-scratches-snowfall/article\\_8b4d0b5e-23f5-57af-b9a9-f81bc1c03033.html](https://www.eagletribune.com/news/storm-flooding-hits-coast-but-barely-scratches-snowfall/article_8b4d0b5e-23f5-57af-b9a9-f81bc1c03033.html)
- Ipswich River Watershed Association (IRWA). 2018. *Great Marsh Barriers Assessment: Regional Inventory and Assessment of Risk and Impact of Barriers to Flow in Coastal Watersheds of the North Shore of Massachusetts*.
- Merrimack Valley Planning Commission (MVPC). 2015. *Merrimack Valley Region Multi-Hazard Mitigation Plan Update 2015*.
- National Oceanic and Atmospheric Administration (NOAA). 2015. *NOAA Atlas 14: Precipitation Frequency Atlas of the United States*. Volume 10 Version 2.0: Northeastern States. [nws.noaa.gov/oh/hdsc/PF\\_documents/Atlas14\\_Volume10.pdf](https://www.nws.noaa.gov/oh/hdsc/PF_documents/Atlas14_Volume10.pdf).
- National Wildlife Federation (NWF) and Ipswich River Watershed Association (IRWA). 2017. *Great Marsh Coastal Adaptation Plan*.
- Northeast Climate Adaptation Science Center (NECASC). 2018. *Massachusetts Climate Change Projections*. Resilient MA Climate Change Clearinghouse for the Commonwealth (Resilient MA). Massachusetts Executive Office of Energy and Environmental Affairs. [resilientma.org/resources/resource::2152/massachusetts-climate-change-projections-statewide-and-for-major-drainage-basins](https://resilientma.org/resources/resource::2152/massachusetts-climate-change-projections-statewide-and-for-major-drainage-basins).
- U.S. Census Bureau. 2012-2016. "Quick Facts: Salisbury town, Essex County, Massachusetts." [census.gov/quickfacts/fact/table/salisburytownessexcountymassachusetts/INC110216#INC110216](https://census.gov/quickfacts/fact/table/salisburytownessexcountymassachusetts/INC110216#INC110216).
- U.S. Department of Commerce. 1961. *Technical Paper No. 40: Rainfall Frequency Atlas of the United States for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years*. [http://www.nws.noaa.gov/oh/hdsc/PF\\_documents/TechnicalPaper\\_No40.pdf](http://www.nws.noaa.gov/oh/hdsc/PF_documents/TechnicalPaper_No40.pdf).

## 7.6 Additional Resources

- Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate* (Union of Concerned Scientists, 2018)
- Community Exposure to Potential Climate-Driven Changes to Coastal-Inundation Hazards for Six Communities in Essex County, Massachusetts* (U.S. Department of the Interior, U.S. Geological Survey, 2016)
- Massachusetts Climate Change Adaptation Report* (Massachusetts Executive Office of Energy and Environmental Affairs, Adaptation Advisory Committee, 2011)



**APPENDIX A**

**Workshop Handouts**

Workshop Agenda

Handout, *Modeling Future Effects of Coastal Storms and Sea Level Rise*

Base Maps used for participatory mapping exercise

Town of Salisbury  
Municipal Vulnerability Preparedness Planning Project  
Community Resilience Building Workshop  
Colchester Room, Town Hall, 5 Beach Road, Salisbury, MA 01952  
Wednesday, October 10, 2018  
8:30 am – 4:30 pm

- |                     |                                                                                                                                                                                                                                                                                       |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8:30 am – 9:00 am   | <b>Registration and Refreshments</b>                                                                                                                                                                                                                                                  |
| 9:00 am – 9:20 am   | <b>Welcome and Introductions</b> <ul style="list-style-type: none"><li>• Neil Harrington, Town Manager</li><li>• Lisa Pearson, Planning Director</li><li>• Core Team Members</li><li>• Weston &amp; Sampson Team</li><li>• Participant Introductions</li></ul>                        |
| 9:20 am – 9:30 am   | <b>MVP Workshop Purpose and Overview</b> <ul style="list-style-type: none"><li>• MVP Program Background</li><li>• Purpose, Desired Outcomes, Objectives, Expectations</li><li>• Review Agenda</li><li>• Logistics</li></ul>                                                           |
| 9:30 am – 10:00 am  | <b>Data Resources and Overview of Science</b> <ul style="list-style-type: none"><li>• Hazards</li><li>• Existing Climate Change</li><li>• Projected Climate Change</li><li>• Recent Planning Efforts</li><li>• Overview of Data and Maps Being Used During Workshop</li></ul>         |
| 10:00 am – 10:30 am | <b>Large Group Exercise #1</b> <ul style="list-style-type: none"><li>• Identify Major Hazards in Community</li><li>• Prioritize Top Four Hazards</li></ul>                                                                                                                            |
| 10:30 am – 10:45 am | <b>BREAK</b>                                                                                                                                                                                                                                                                          |
| 10:45 am – 11:00 am | <b>Risk Matrix</b> <ul style="list-style-type: none"><li>• Hazards</li><li>• Features<ul style="list-style-type: none"><li>• Infrastructure, Societal, Environmental</li><li>• Vulnerability or Strength</li></ul></li><li>• Location</li><li>• Ownership</li><li>• Actions</li></ul> |



Town of Salisbury  
Municipal Vulnerability Preparedness Planning Project  
Community Resilience Building Workshop  
Colchester Room, Town Hall, 5 Beach Road, Salisbury, MA 01952  
Wednesday, October 10, 2018  
8:30 am – 4:30 pm

- |                     |                                                                                                                                                                   |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11:00 am – 11:25 am | <b>Small Group Exercise #1</b> <ul style="list-style-type: none"><li>• Infrastructure Features</li><li>• Vulnerability or Strength, Location, Ownership</li></ul> |
| 11:25 am – 11:50 pm | <b>Small Group Exercise #2</b> <ul style="list-style-type: none"><li>• Societal Features</li><li>• Vulnerability or Strength, Location, Ownership</li></ul>       |
| 11:50 pm – 12:15 pm | <b>Small Group Exercise #3</b> <ul style="list-style-type: none"><li>• Environmental Features</li><li>• Vulnerability or Strength, Location, Ownership</li></ul>  |
| 12:15 pm – 1:15 pm  | <b>LUNCH</b>                                                                                                                                                      |
| 1:15 pm – 1:45 pm   | <b>Community Actions</b> <ul style="list-style-type: none"><li>• Infrastructure</li><li>• Nature-Based Solutions</li></ul>                                        |
| 1:45 pm – 2:00 pm   | <b>BREAK</b>                                                                                                                                                      |
| 2:00 pm – 2:50 pm   | <b>Small Group Exercise #4</b> <ul style="list-style-type: none"><li>• Define Community Actions</li></ul>                                                         |
| 2:50 pm – 3:50 pm   | <b>Large Group Exercise #2</b> <ul style="list-style-type: none"><li>• Identify Priority Actions</li></ul>                                                        |
| 3:50 pm – 4:00 pm   | <b>Wrap-up and Closing Remarks</b>                                                                                                                                |





# Town of Salisbury, Massachusetts

## Modeling Future Effects of Coastal Storms and Sea Level Rise

### Introduction

Like many communities along the North Shore of Massachusetts, the Town of Salisbury is vulnerable to climate-driven hazards, including sea level rise and storm surge. Predicted sea level rise and increased storm surge have the potential to significantly impact the town's coastal economy and the natural systems that the community depends upon. Understanding where and how these hazards are likely to impact the community is a necessary first step in addressing vulnerability.

Given its exposure to climate-driven hazards, the Town of Salisbury took part in a mapping effort to identify areas that are particularly vulnerable to coastal inundation. This poster highlights the results of this effort and is intended to help support the Town of Salisbury as it works to identify adaptation strategies that reduce its vulnerability to sea level rise and storm surge.

### Mapping Coastal Flooding

These maps illustrate current (2013) and future (2070) probability of coastal inundation in Salisbury, Massachusetts. Results are based on a hydrodynamic model developed for the Massachusetts Department of Transportation (Famely et al. 2016). Note: This data does not take into account inland freshwater flooding.

This advanced hydrodynamic model incorporates:

#### Modeled Storm Events

Including hurricanes and nor'easters, as well as climatology projections

#### Sea Level Rise Projections

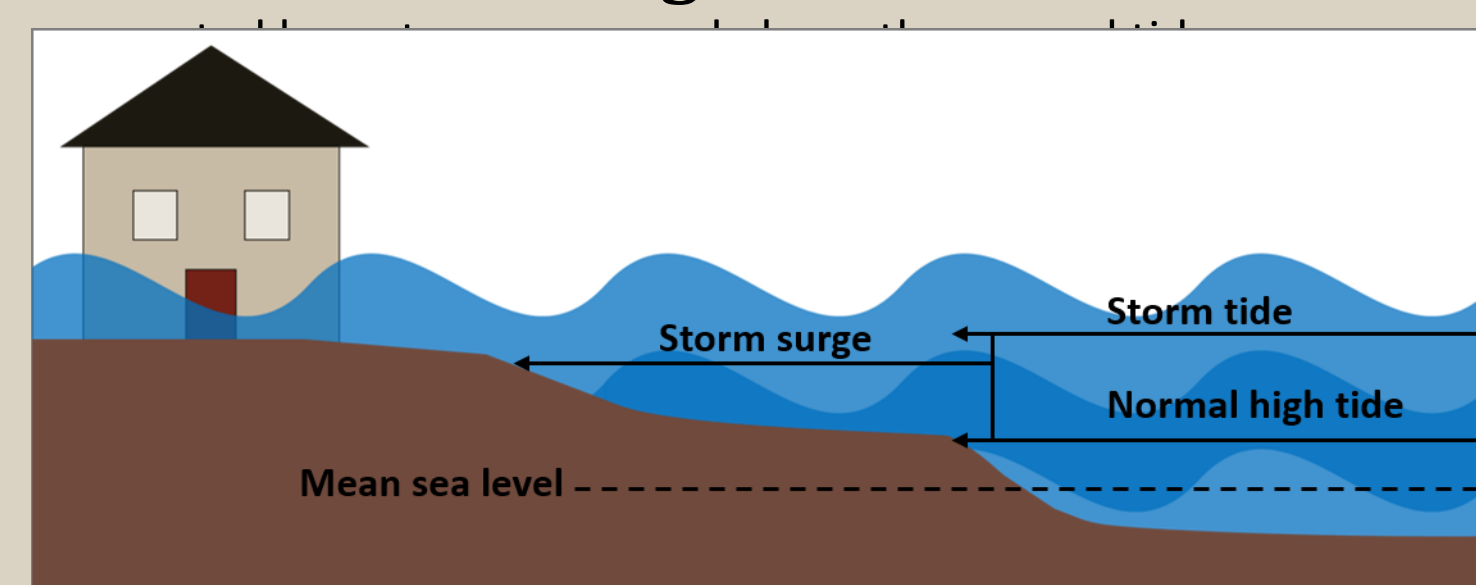
Consistent with both the US National Climate Assessment and projections specific to Massachusetts

#### Dynamic Coastal Processes

Driven by wave effects, wind, tides, and storm surge

#### Hydrodynamic Model

#### What is Storm Surge? An abnormal rise of water



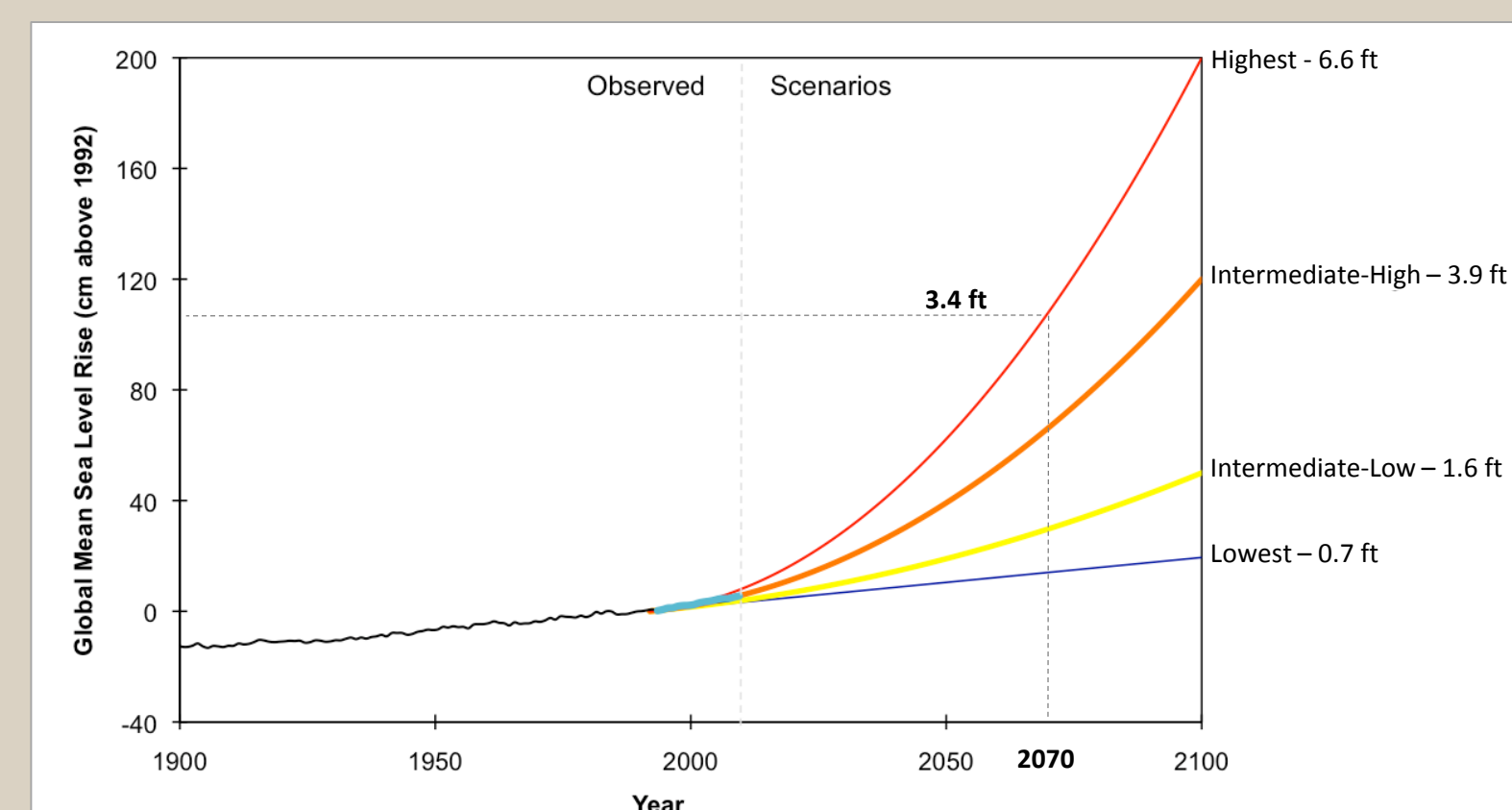
Adapted from NOAA

### Coastal Inundation Probability

Probability of inundation is defined as the likelihood that at least 2 inches of flood water will encroach on the land at a particular location at least once in a calendar year. Note that the 1% probability of inundation shown on the present day maps (2013) roughly corresponds to the Federal Emergency Management Agency's (FEMA) 100-year storm.

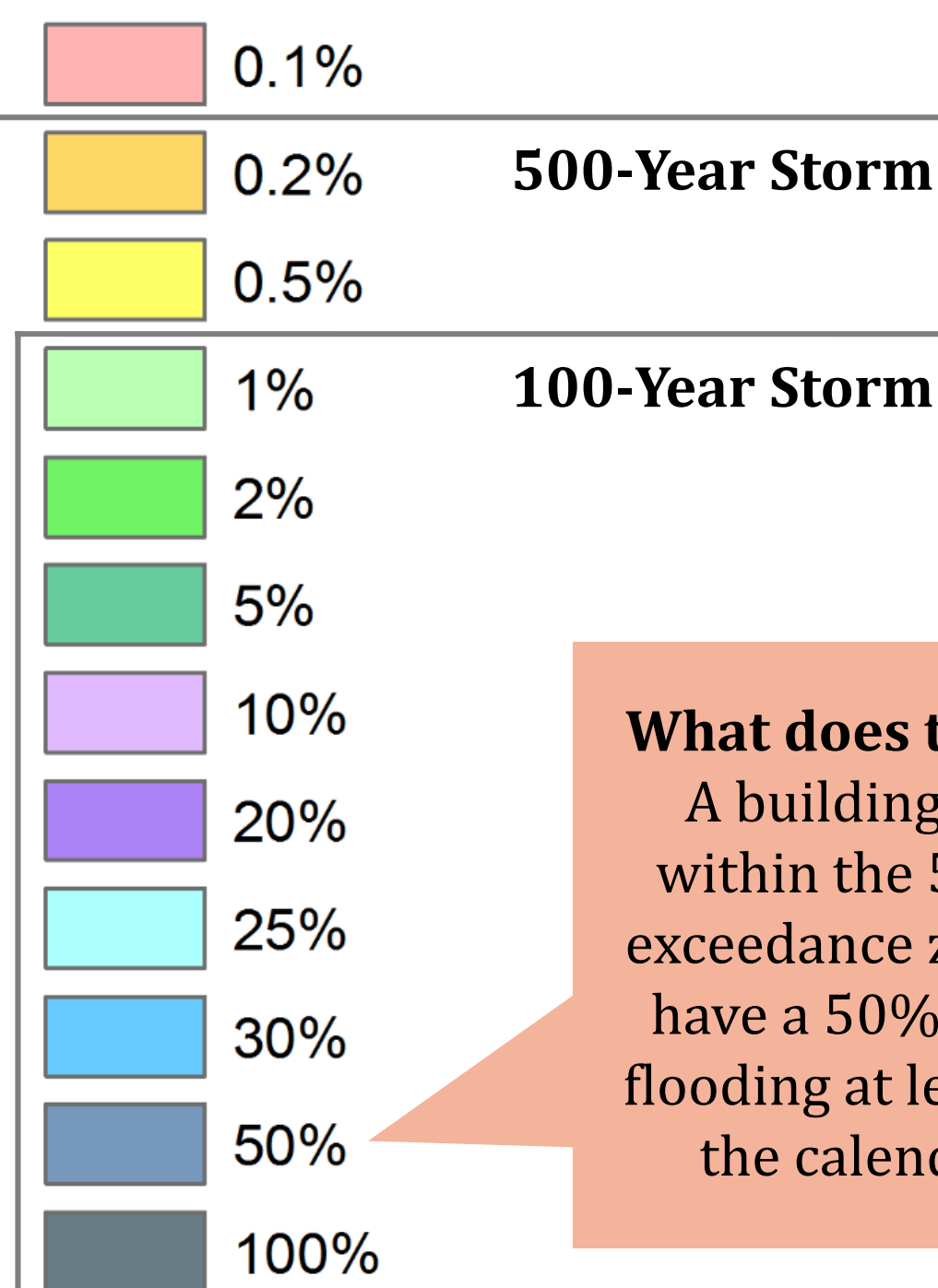
#### How much sea level rise?

- ❖ Present day (considered 2013) results incorporate existing sea level conditions
- ❖ 2070 results incorporate 3.4 feet of sea level rise, which is also approximately the "Intermediate-High" scenario for 2090 (Figure 1)



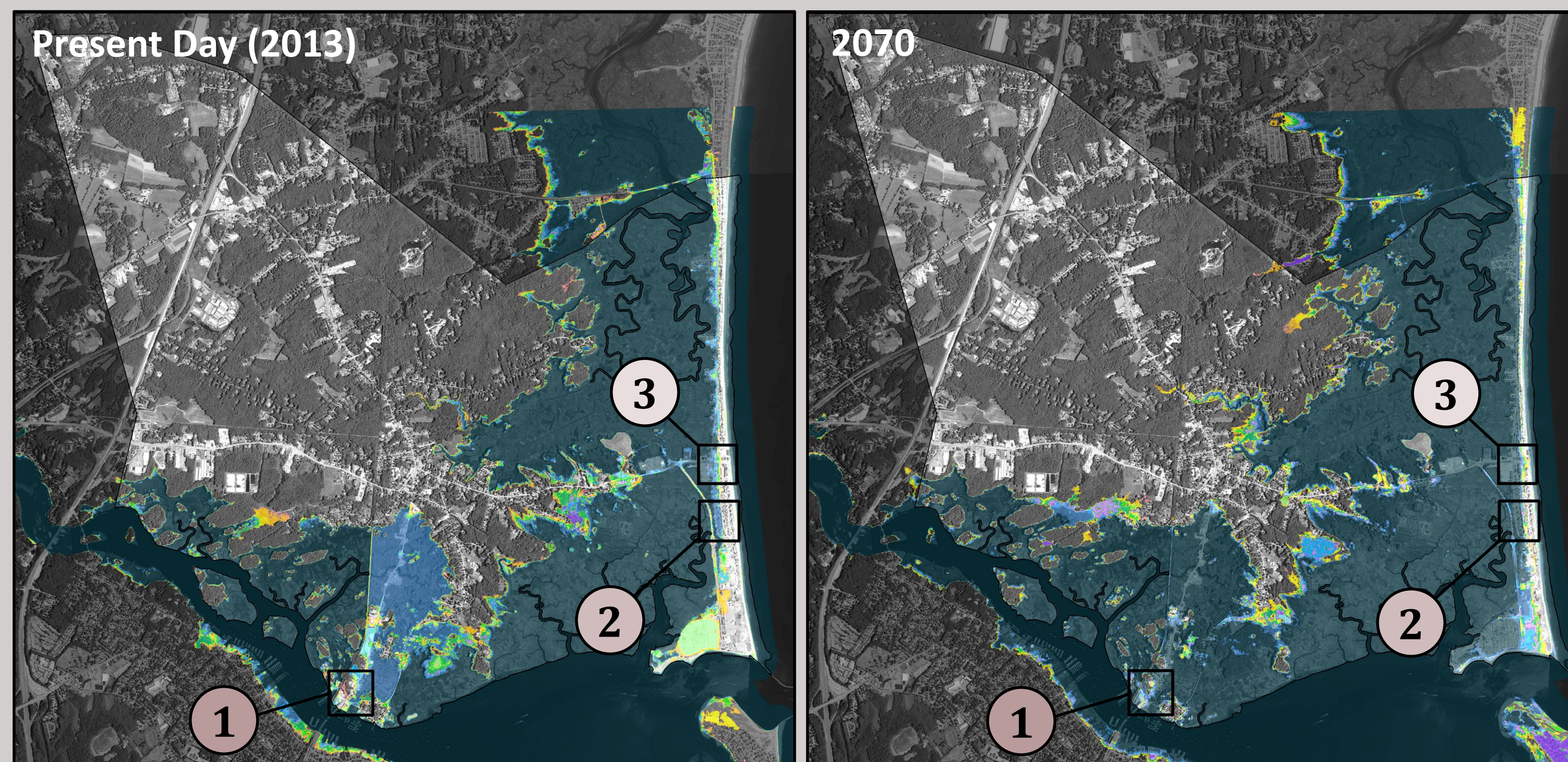
**Figure 1. Global Mean Sea Level Rise Scenarios.** The highest, or worst case, scenario is based on estimated rise in ocean temperatures leading to thermal expansion combined with maximum melting of the glaciers and ice sheets. The lowest scenario assumes a historical rate of sea level rise with no increase due to climate change. Adapted from the US National Climate Assessment (Melillo et al. 2014) and NOAA (Parris et al. 2012).

#### Percent Risk of Coastal Flooding



#### What does this mean?

A building that lies within the 50% flood exceedance zone would have a 50% chance of flooding at least once in the calendar year.



Created by the National Wildlife Federation with funding provided by the Massachusetts Office of Coastal Zone Management through their Coastal Community Resilience Grant Program.

#### Literature Cited

Famely, J., K. Bosma and B. Hoffnagle. 2016. *Sea Level Rise and Storm Surge Inundation Mapping – Great Marsh Communities (Essex County, MA)*. Prepared by Woods Hole Group for National Wildlife Federation and U.S. Geological Survey.

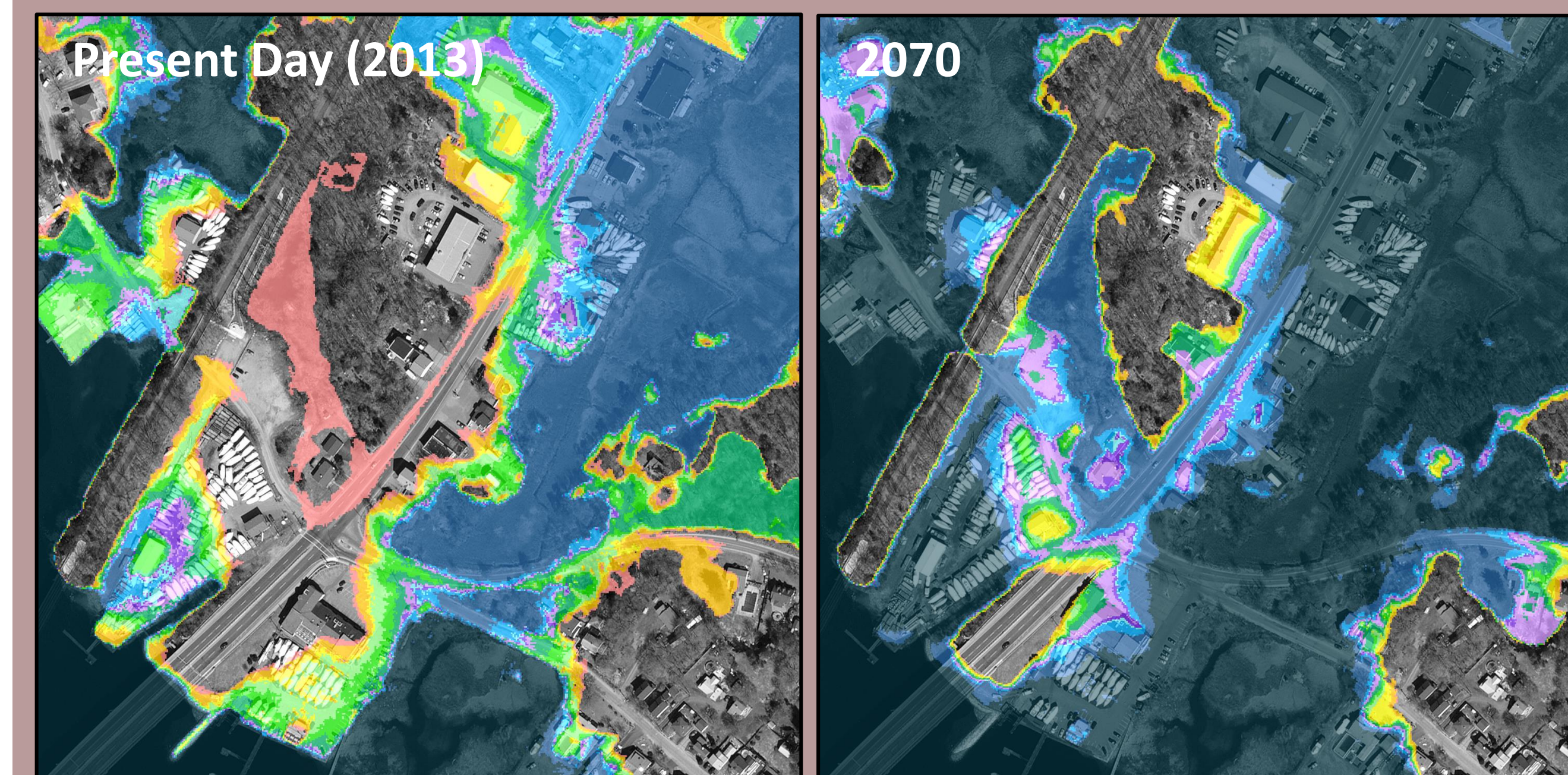
Melillo, J.M., T.C. Richmond, and G.W. Yohe, Eds. 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. Washington, DC: U.S. Global Change Research Program, 841.

Parris, A., P. Bromirski, V. Burkett, D. Cayan, M. Culver, J. Hall, R. Horton, K. Knutti, R. Moss, J. Obeyseker, A. Sallenger, and J. Weiss. 2012. *Global Sea Level Rise Scenarios for the United States National Climate Assessment*. NOAA Tech Memo OAR CPO-1. Silver Spring, MD: National Oceanic and Atmospheric Administration, 37.



**Data Source:** Bosma, K., E. Douglas, P. Kirshen, K. McArthur, S. Miller and C. Watson. 2016. MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery. Photo Science, Inc. (2012). State of Massachusetts (Raster DEM): LIDAR for the North East – ARRA and LIDAR for the North East Part II. (USGS Contract: G10PC00026, ARRA LIDAR Task Order Numbers) USGS Contract: G10PC00026 Task Order Number: G10PD02143 Task Order Numbers: G10PD01027 (ARRA) and G10PD02143 (non-ARRA). Aerial Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community. Coordinate System: NAD 1983 StatePlane Massachusetts Mainland FIPS 2001. Maps created by the National Wildlife Federation using: ArcGIS 10.3 for Desktop (v10.30.1332)

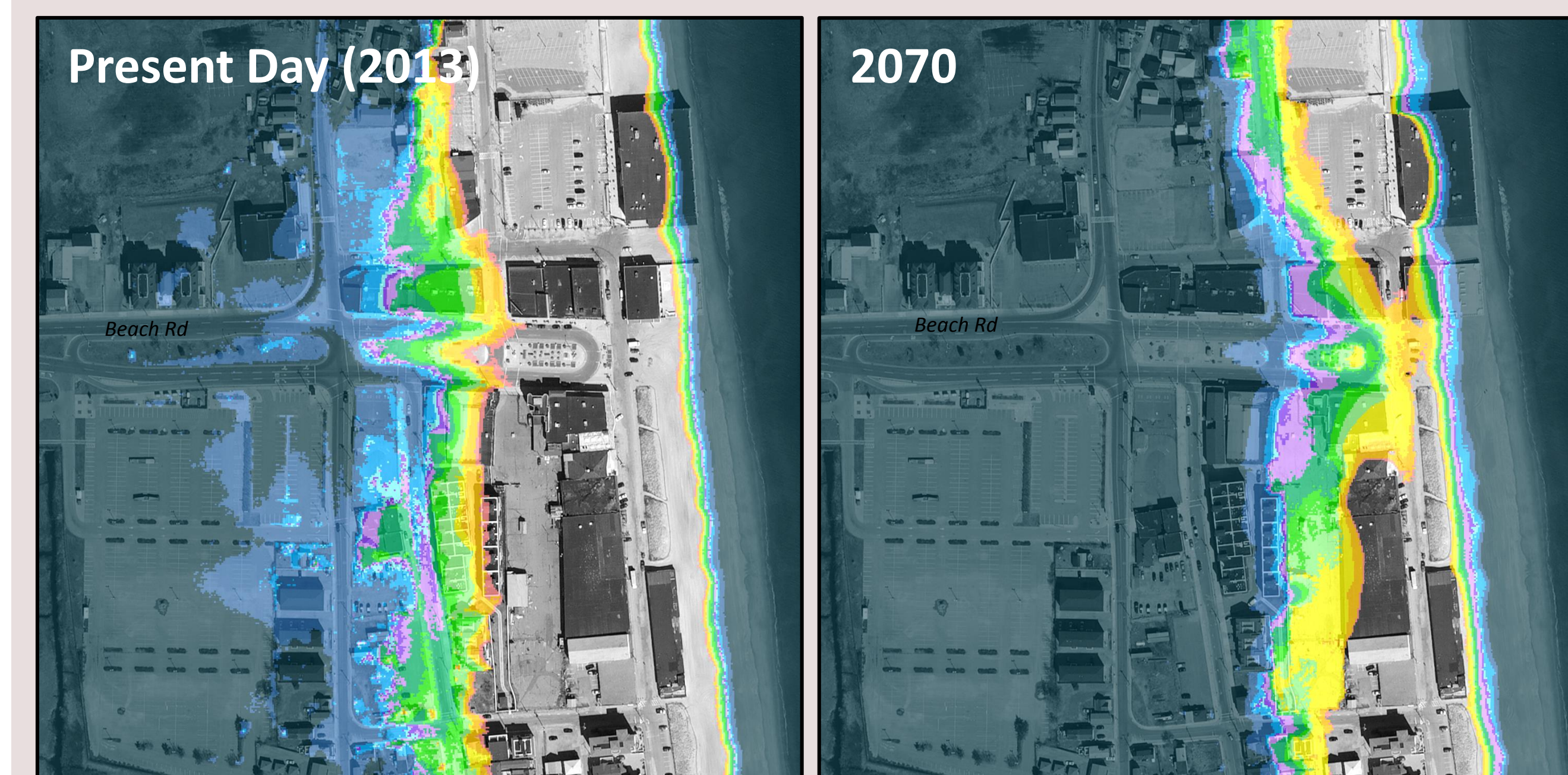
#### 1 Route 1 at Merrimack Bridge



#### 2 Southern end of Cable Avenue



#### 3 Salisbury Beach Center





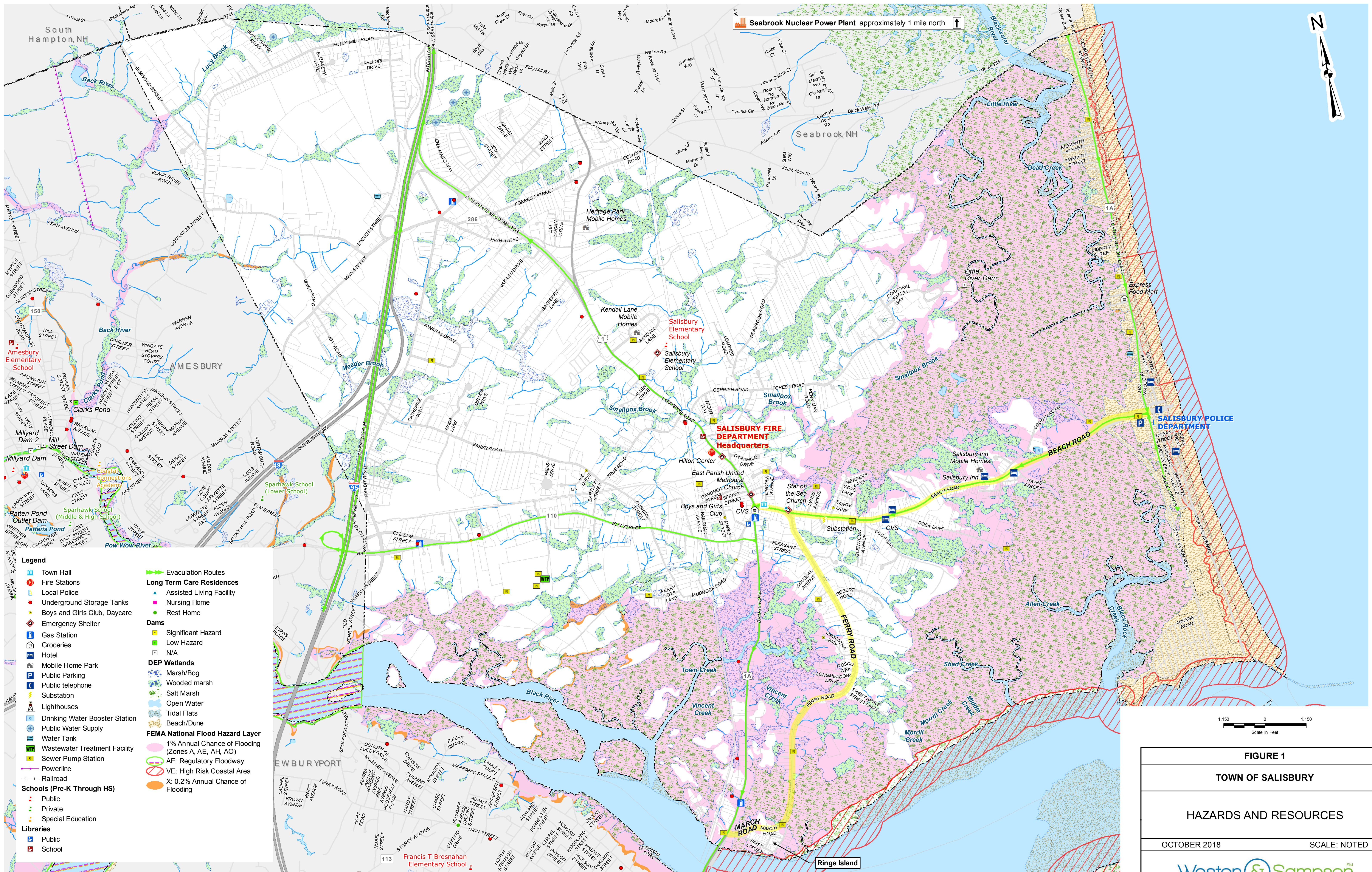
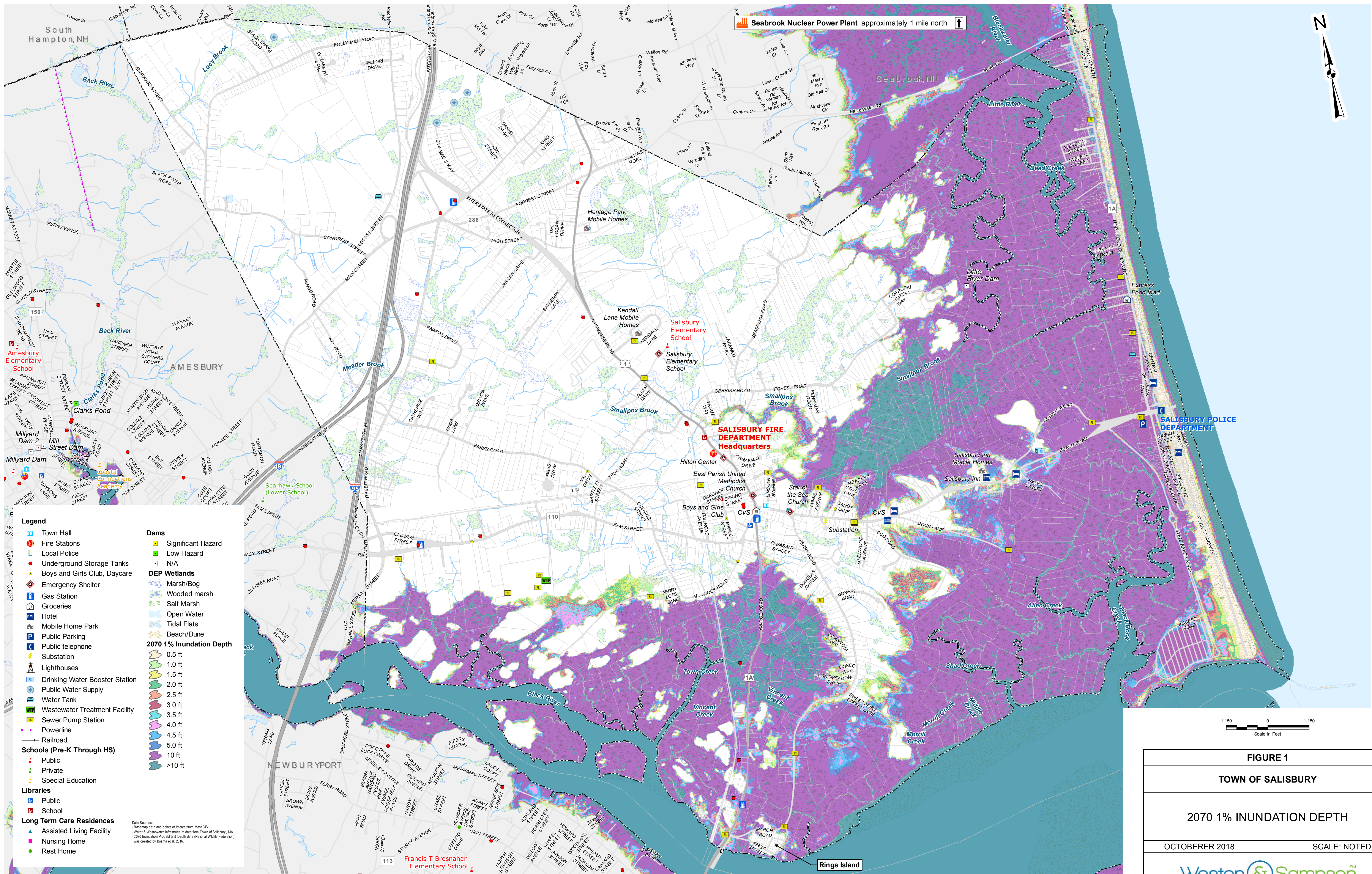
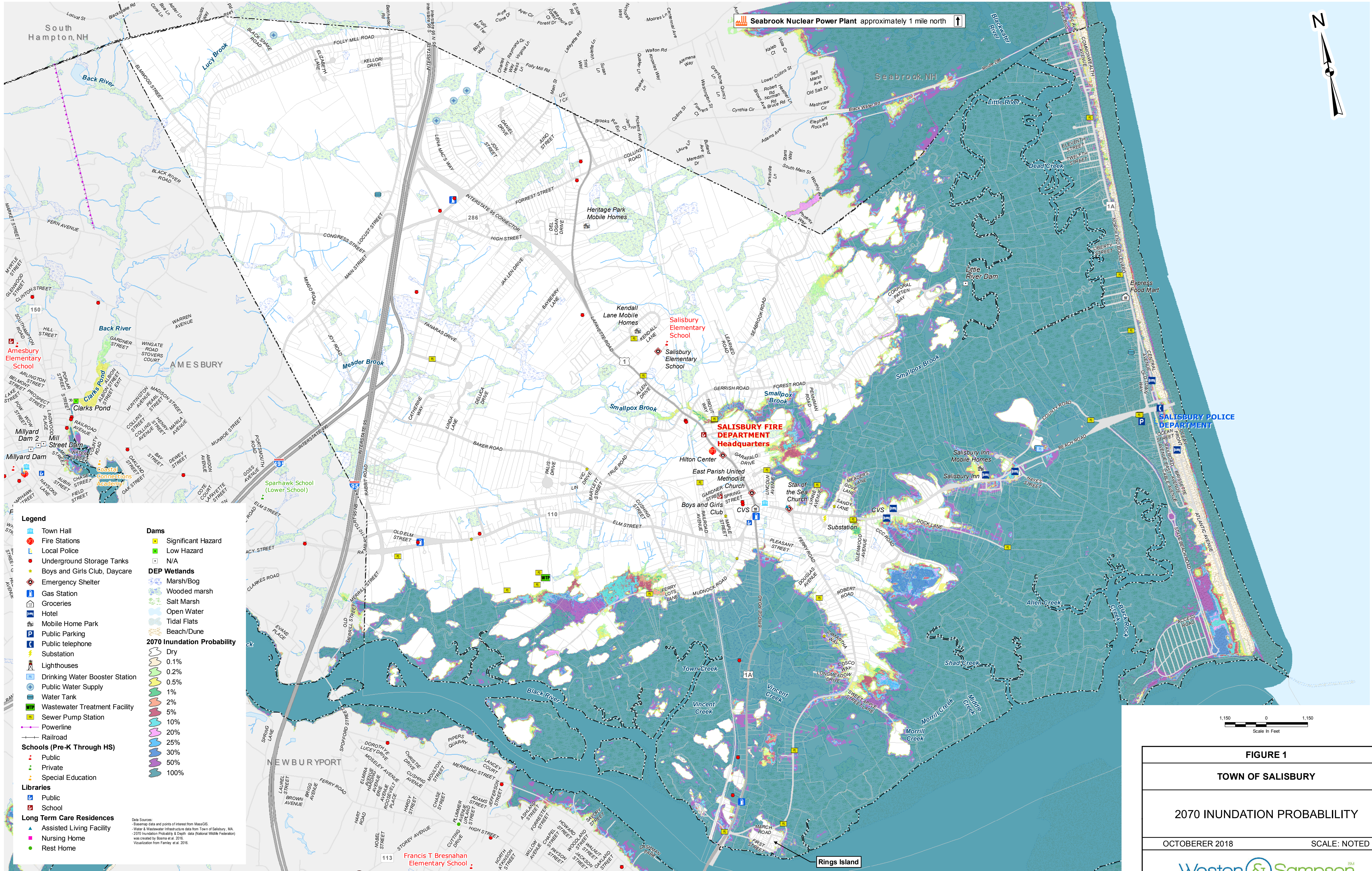


FIGURE 1  
TOWN OF SALISBURY  
HAZARDS AND RESOURCES  
OCTOBER 2018  
SCALE: NOTED  
Weston & Sampson











APPENDIX B  
Workshop Presentation



# welcome



# Community Resilience Building Workshop



## Salisbury, Massachusetts



A coastal scene with waves crashing against a rocky shore. On the right, there is a wooden pier structure with a glass-enclosed upper level. The sky is overcast and grey.

# Welcome & Introductions



# Salisbury Introductions

## Municipal Leadership

- Neil Harrington, Town Manager
- Lisa Pearson, Planning Director
- Core Team Members
  - Scott Carrigan, Fire Chief
  - Robert Cook, Emergency Management
  - Lisa DeMeo, Public Works
  - Tom Fowler, Police Chief
  - Michelle Rowden, Conservation
  - Scott Vandewalle, Building



# Weston & Sampson Introductions

## Assisting with the Workshop

- Chris Perkins, Principal-in-Charge
- Kathy Baskin, Project Manager/Facilitator
- Table Facilitators
  - Rob Almy
  - Adria Boynton
  - Sarah Miller
  - Jim Riordan
  - Steve Roy



# Participant Introductions

- Your name
- Relationship to Salisbury
- Why you are here today



# Workshop Outline

## Workshop-Wide

- Overview of Science & Data Resources
- Characterize Hazards

---

**BREAK**

---

## Individual Tables

- Identify Community Features
  - Infrastructure
  - Societal
  - Environmental

### Post-Workshop

- Combine Ideas
- Prepare Report

---

**LUNCH**

---

## Individual Tables

- Identify and Prioritize Actions

---

**BREAK**

---

## Workshop-Wide

- Determine Overall Priority Actions



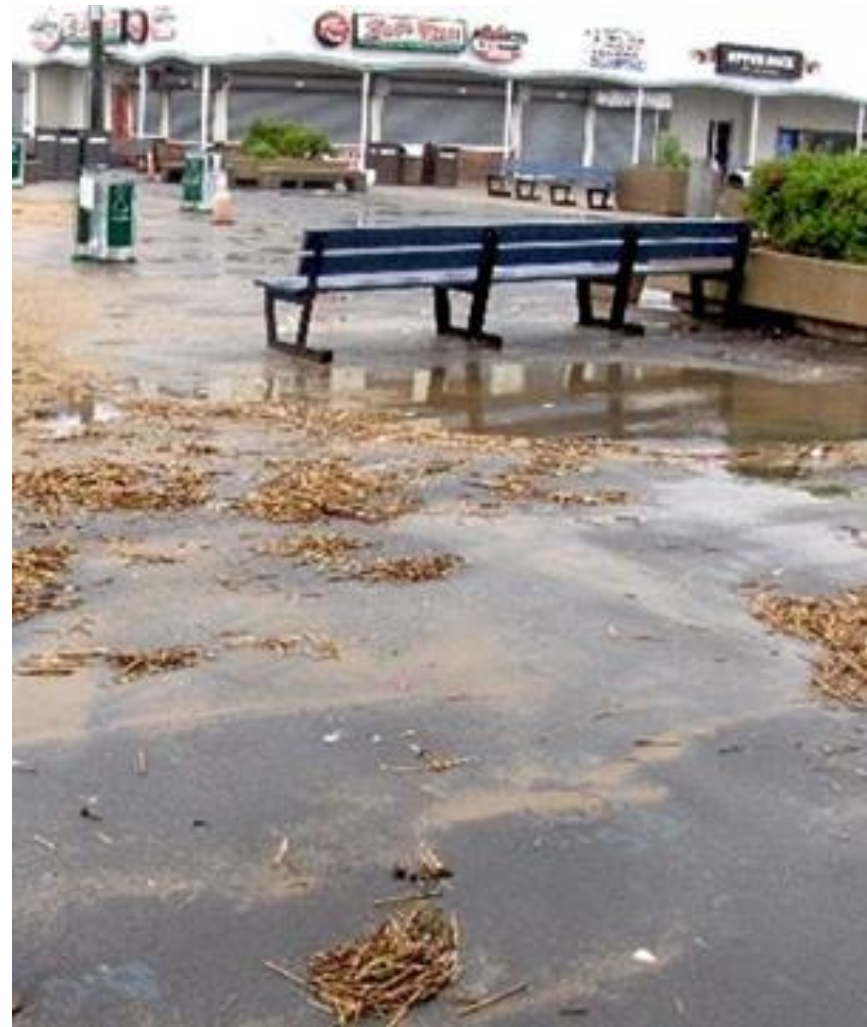
# What is the Municipal Vulnerability Preparedness (MVP) Program?

Massachusetts program:

- Assist municipalities plan for climate change resiliency and implement priority projects

Helps communities:

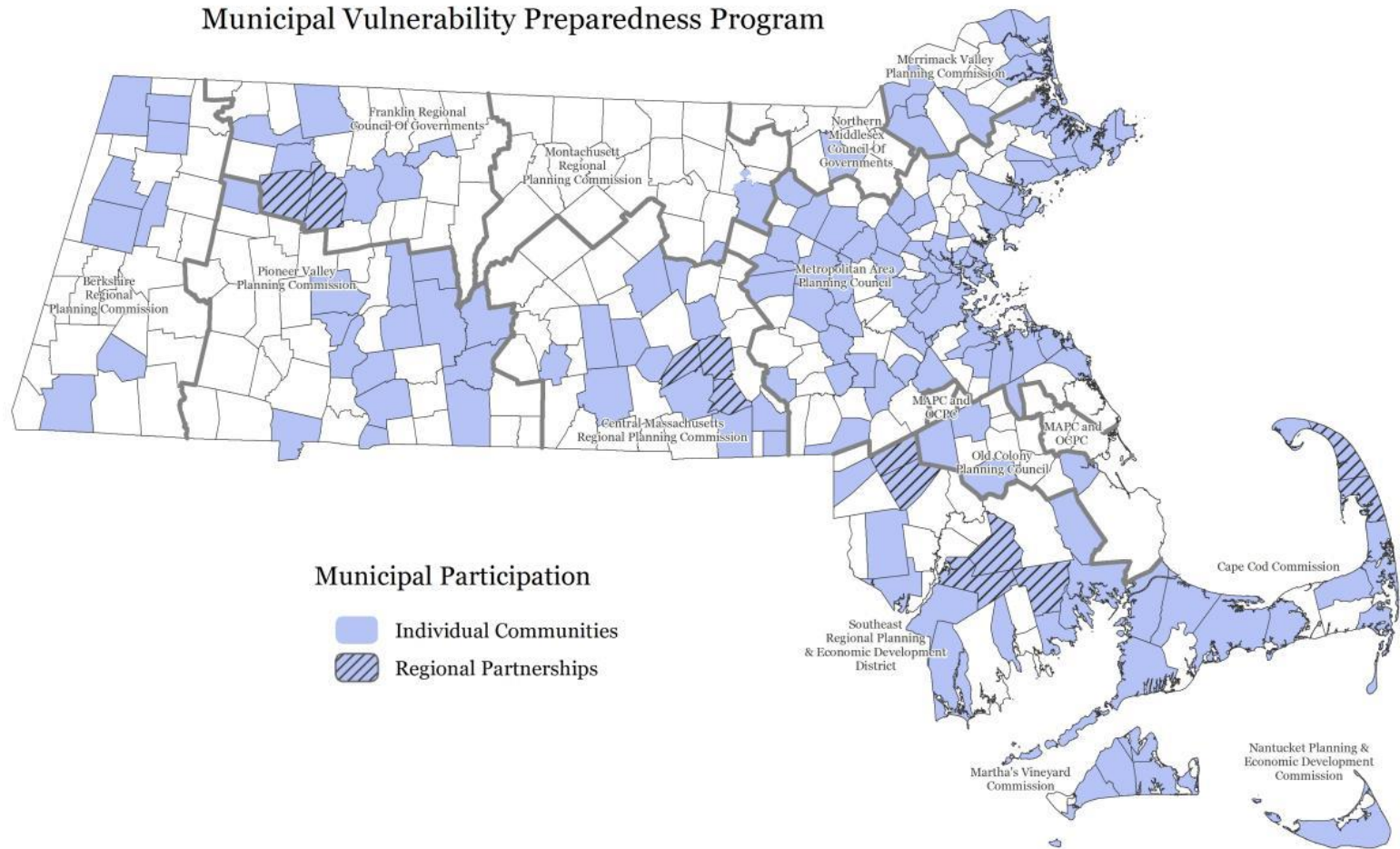
- Define extreme weather hazards and climate change impacts
- Identify key features
- Determine vulnerabilities and strengths
- Develop and prioritize actions
- Complete vulnerability assessments
- Implement key actions





# Eligible Communities

Complete MVP program; become certified; apply for MVP Action grant funding





# What the MVP Program offers Salisbury

- Improved **resilience and preparedness** of natural and climate-driven hazards
- **Collaboration with stakeholders** about climate change, natural hazards and impact
- **Increased education, planning, and implementation** of priority actions





A photograph of a residential area that has been flooded. In the background, several houses are visible, including a prominent yellow house with multiple windows. A concrete retaining wall runs across the middle ground. The foreground is dominated by a large, white, corrugated metal structure, possibly a flood barrier or a large container, which is partially submerged in the floodwater. The water is murky and reflects the overcast sky.

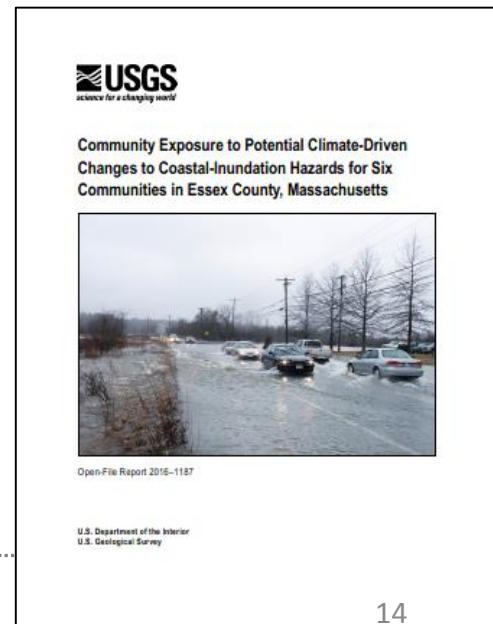
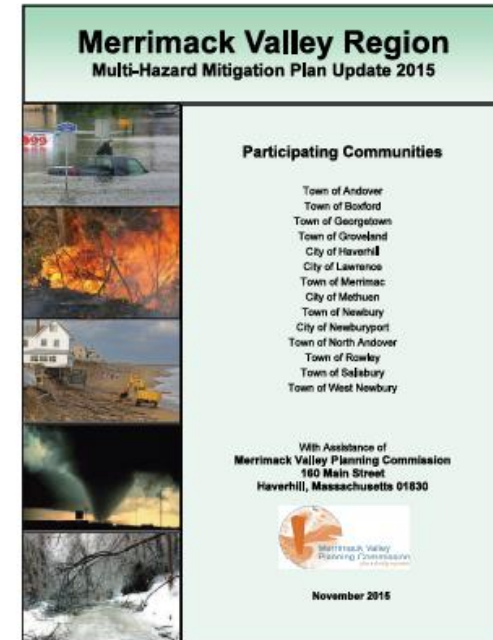
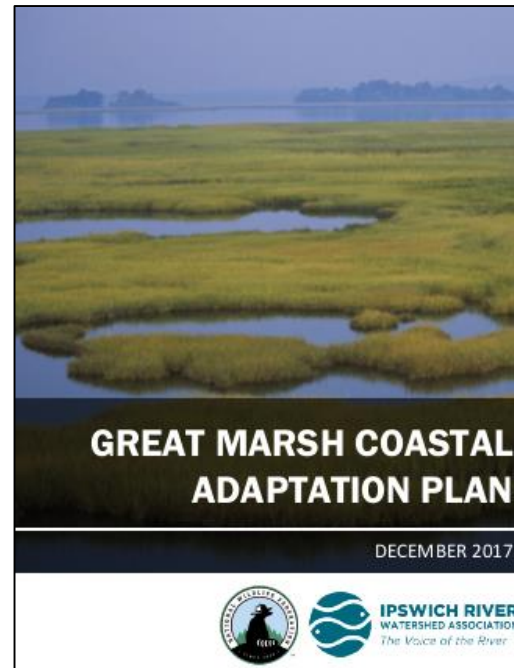
# Data Resources & Overview of Science



# Data Resources

Lots of great work has already taken place recently!

- Salisbury Aquatic Barrier Assessment Report (IRWA, 2018)
- Underwater: Rising Seas, Chronic Floods, and the Implications for US Coastal Real Estate (UCS, 2018)
- Massachusetts Climate Change Projections (NECSC, 2018)
- Great Marsh Coastal Adaptation Plan (NWF, IRWA 2017)
- Merrimack Valley Region Multi-Hazard Mitigation Plan Update (MVRPC, 2016)
- Community Exposure to Potential Climate-Driven Changes to Coastal-Inundation Hazards for Six Communities in Essex County, Massachusetts (USGS, 2016)
- Massachusetts Climate Change Adaptation Report (MA EEA, 2011)







# Salisbury's Land Use

- Salisbury Beach: 3.8 mile long barrier beach
- Infrastructure: mostly in Salisbury Beach & Salisbury Square
- Forest (37.8%)
- Salt marsh/wetlands (27.6%)
- Residential (16.6%)
- Commercial & Industrial (3.8%)
- Agricultural (5.6%)
- Transportation (1.8%)
- Other (6.8%)



*Erosion at Salisbury Beach following a pair of nor'easters in March 2018*



# Natural Hazards in Salisbury

Current and future under climate change

---

**Extreme Heat**



**Sea Level Rise/  
Storm Surge**



**Heavy  
Precipitation**



**Wind**



**Drought**



**Snow/Ice**



**Erosion**





# Hazards in Salisbury

(Source: Merrimack Valley Region Multi-Hazard Mitigation Plan, 2015)

**Table 5.13-4. Salisbury Natural Hazards Risk Assessment**

| Natural Hazard                    |  | Community Risk Rating |
|-----------------------------------|--|-----------------------|
| Floods                            |  | HIGH                  |
| Winter Storms (blizzard/snow/ice) |  | HIGH                  |
| Northeasters                      |  | HIGH                  |
| Power Outages                     |  | HIGH                  |
| Hurricanes                        |  | Moderate              |
| Drought                           |  | Moderate              |
| Wildfire/Brush Fires              |  | Moderate              |
| Tornadoes                         |  | Low                   |
| Earthquakes                       |  | Low                   |
| Landslides                        |  | Low                   |
| Dam Failures                      |  | Low                   |





# Floodplain & Repetitive Loss

## Floodplain

- 11,007 acres (15.5 square miles)
- 4,779 acres in 100-year floodplain (43.4%)
- 1,710 buildings in 100-year floodplain
  - Property value assessed at \$418M
  - Content value estimated at \$258M

## National Flood Insurance Program

- 37 sites have had 114 payouts totaling \$2.9 million since 1978



Salisbury Beach Center  
(source: *The Daily News*, February 10, 2016)



# Hazards in Salisbury

(Source: NWF Great Marsh Coastal Adaptation Plan, 2017)

| High Hazard Concerns                                      | Type of Hazard                                |
|-----------------------------------------------------------|-----------------------------------------------|
| Salisbury Beach                                           | Erosion                                       |
| Salisbury Beach at Broadway                               | Storm over-wash during storms                 |
| Neighborhoods along Blackwater River                      | Flooding during extreme high tides and storms |
| US Route 1 North at Town Creek                            | Tidally influenced flooding                   |
| US Route 1 South; March Road and 1 <sup>st</sup> St.      | Tidally influenced flooding                   |
| US Route 1A (Beach Road)                                  | Tidally influenced flooding                   |
| Jak-Len Drive                                             | Freshwater flooding from storms               |
| Smallpox Brook                                            | Freshwater flooding from storms               |
| North End Boulevard (Old Town Way to 18 <sup>th</sup> St. | Storm-related flooding                        |





# Existing Climate Change



# Increased Temperatures in Northeast

- Warmer annual temperatures - up 2°F since 1970
- Warmer winters - up 1.3°F per decade since 1970
- Decreasing winter snowpack
- Earlier flowering plants
- More frequent extreme summer heat



(Source: MA Coastal Zone Management)



# Heavy Precipitation

## Riverine and Stormwater Flooding

- Merrimack Valley region's most frequent and costly natural disaster
- Affects infrastructure, property damage, natural resources

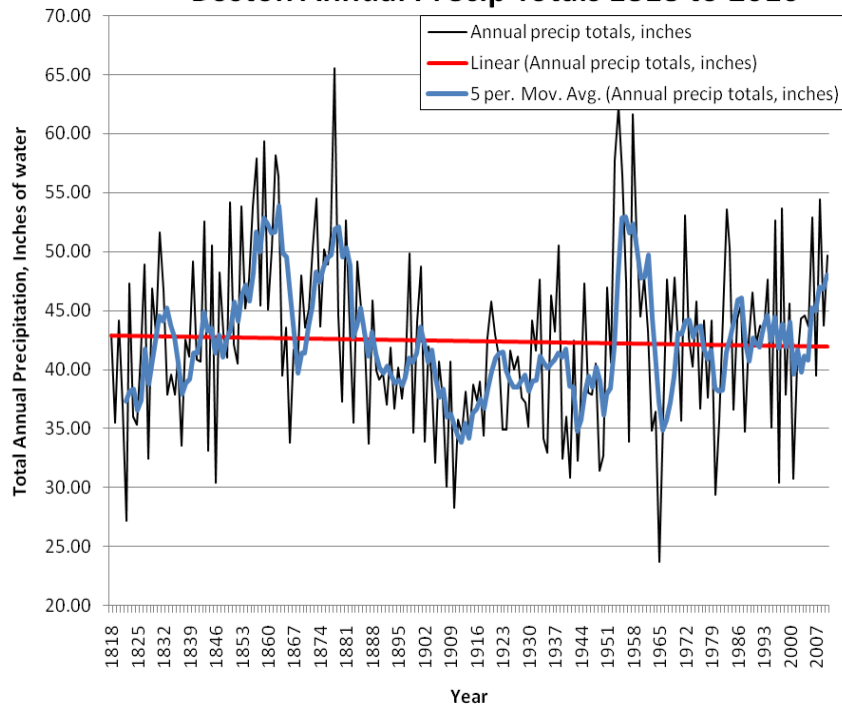




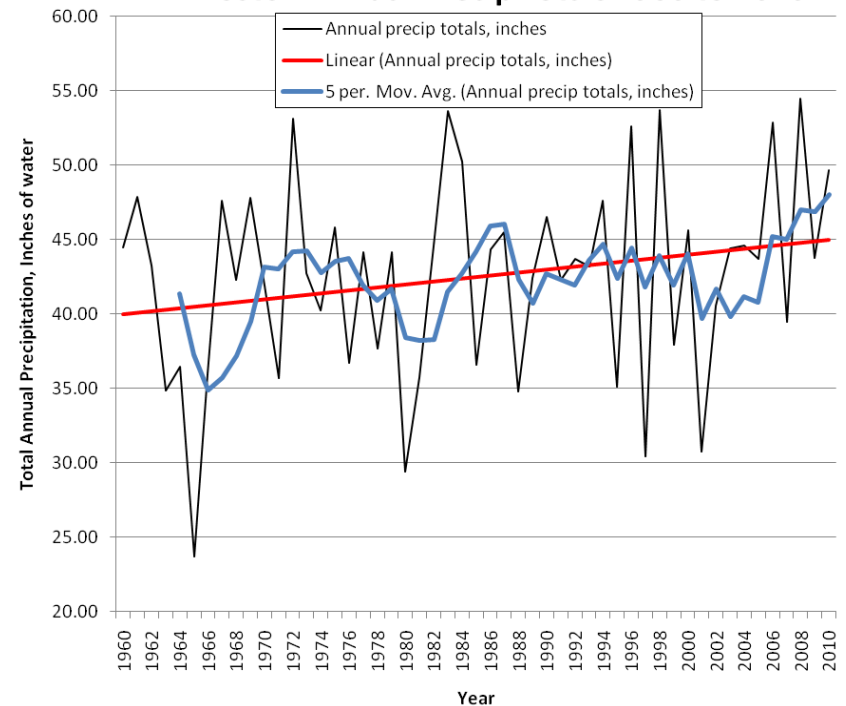
# Annual Precipitation in Boston

## January 1818 to December 2010

**Boston Annual Precip Totals 1818 to 2010**



**Boston Annual Precip Totals 1960 to 2010**



(Source: MA Climate Change Adaptation Report)

The blue line represents a five-year moving average and the red line a least squares regression.



# Change in Precipitation

## 6-hour, 10-year event

- 1961 = 3.2 inches
- 2015 = 3.35 inches

## 24-hour, 100-year event

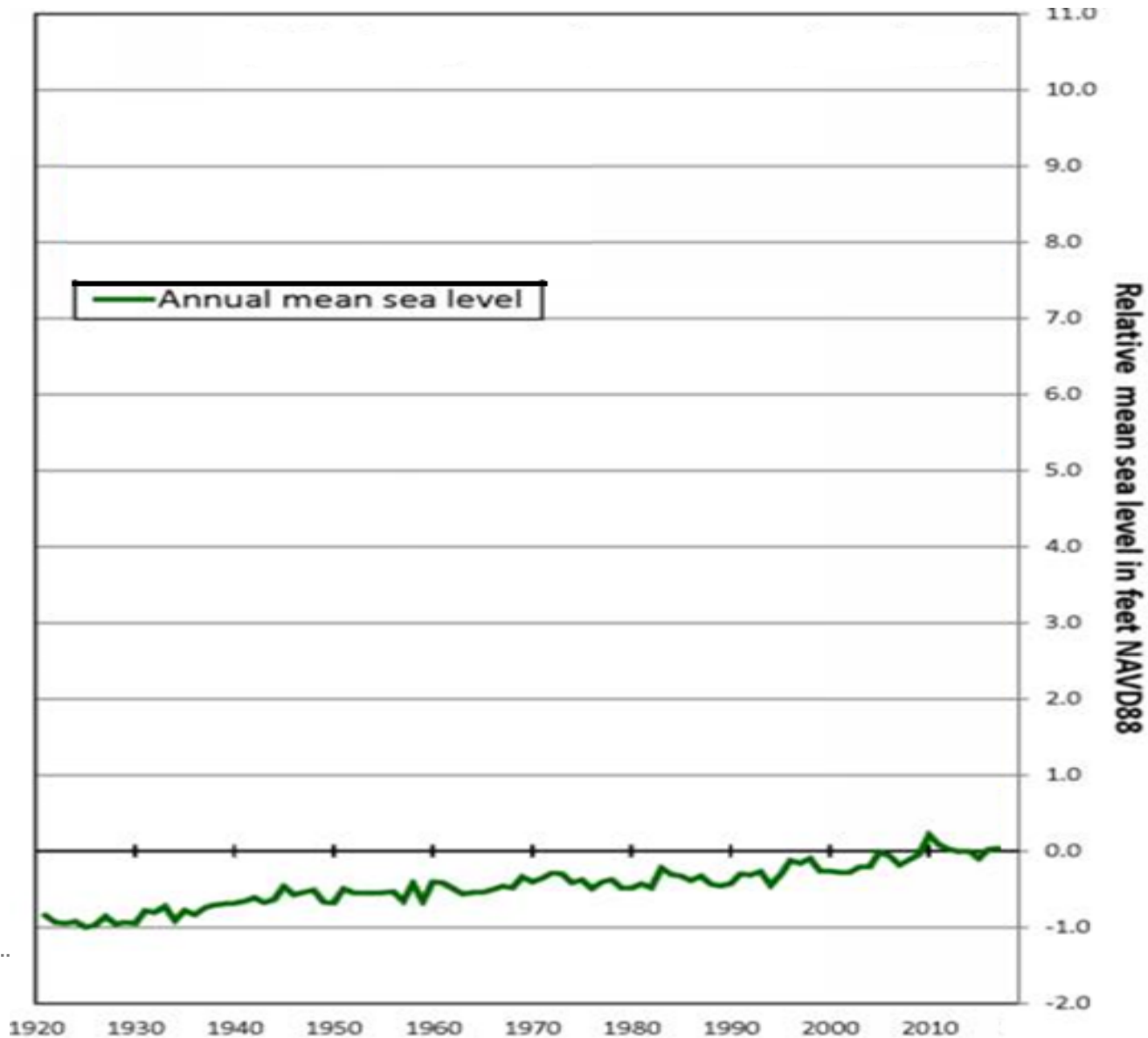
- 1961 = 6.5 inches
- 2015 = 8.40 inches

(Sources: NOAA TP-40 (1961) and  
NOAA Atlas Volume 10 (2015))



# Sea Level Rise

## Relative annual mean sea level



Source:  
Northeast  
Climate  
Adaption  
Science Center

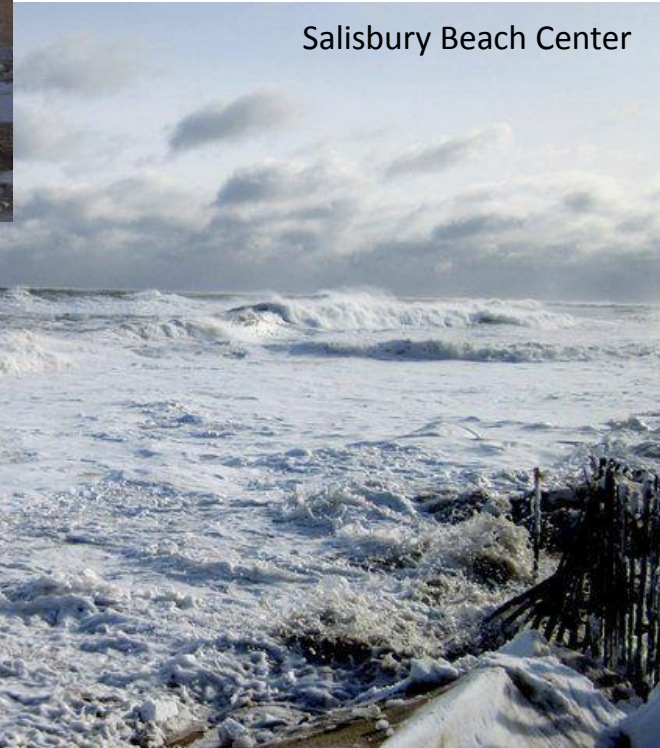




Ocean Front at Salisbury Beach



Salisbury Beach Center



(Source: The Daily News of Newburyport)

# Predicted Climate Change



# Increased Temperatures/Extreme Heat

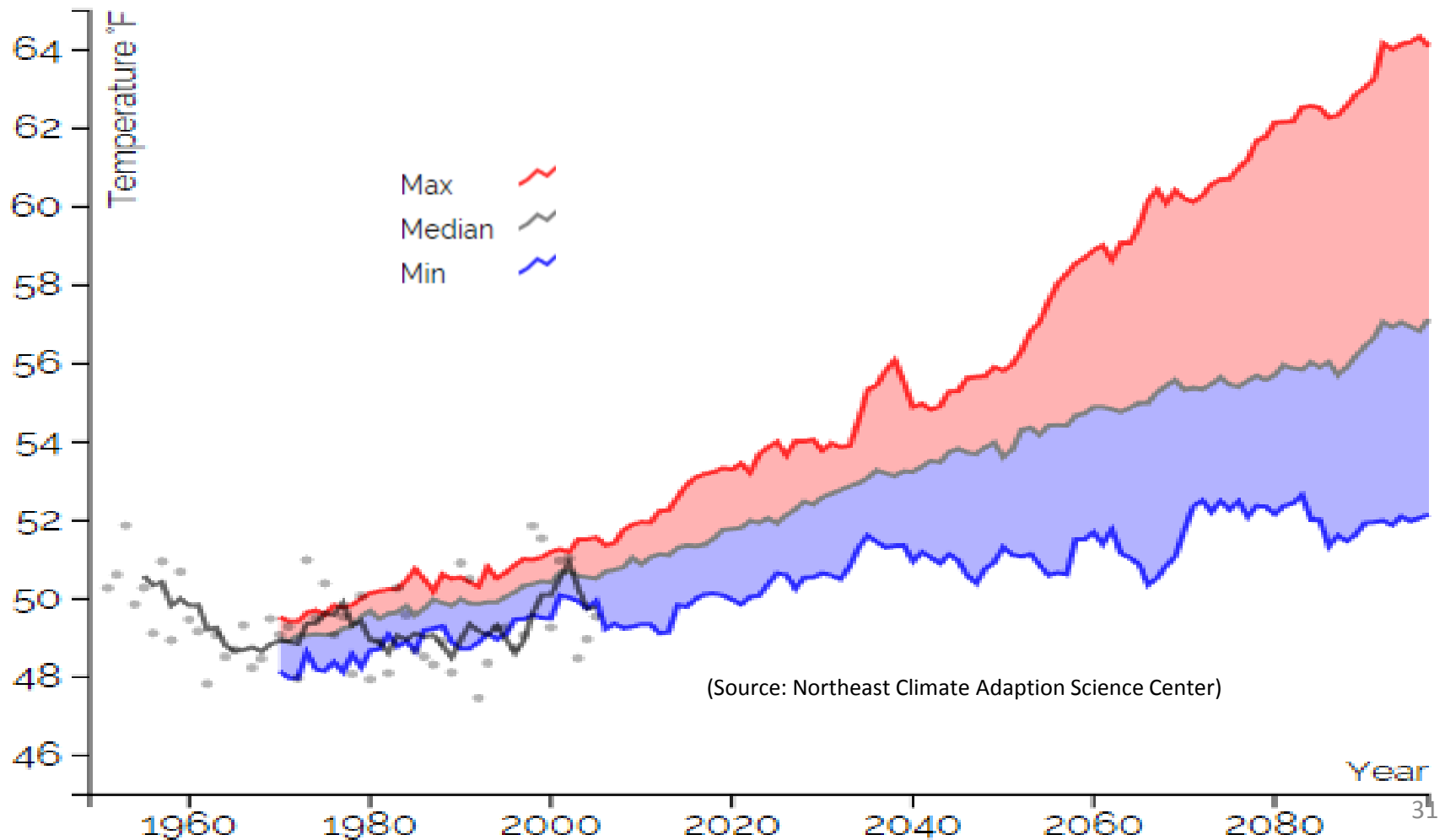


|                                          | Observed<br>Baseline | Projected<br>Change<br>2050's | Projected<br>Change End of<br>Century |
|------------------------------------------|----------------------|-------------------------------|---------------------------------------|
| MA Average Temp<br>(°F )                 | 47.6                 | +2.8 to +6.2                  | +3.8 to +10.8                         |
| Salisbury Average<br>Temp (°F )          | 48.1 to 49.7         | +2.7 to +6.4                  | +3.5 to +10.9                         |
| Days with<br>Temperatures<br>Above 90°F  | 7 to 8               | +7 to +33                     | +10 to +74                            |
| Days with<br>Temperatures<br>Above 100°F | <1 to 1              | 2 to 16                       | 4 to 47                               |
| Days with<br>Temperatures<br>Below 32°F  | 121 to 148           | -18 to -44                    | -23 to -66                            |

# Projected: Annual Average Temperature in Essex County



**Annual Average Temperature  
Essex County, MA**





# Extreme Heat

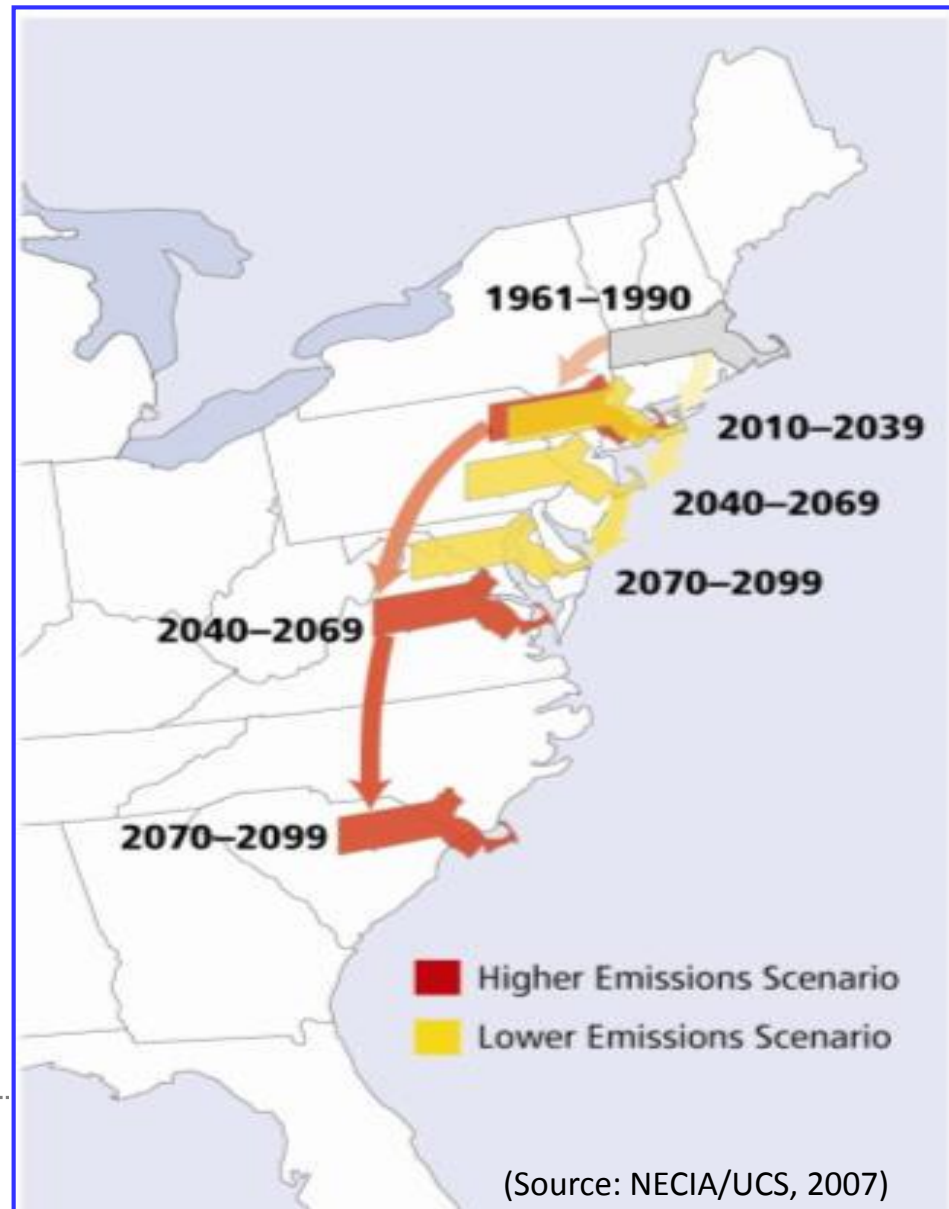


## Temperatures Predicted to Increase

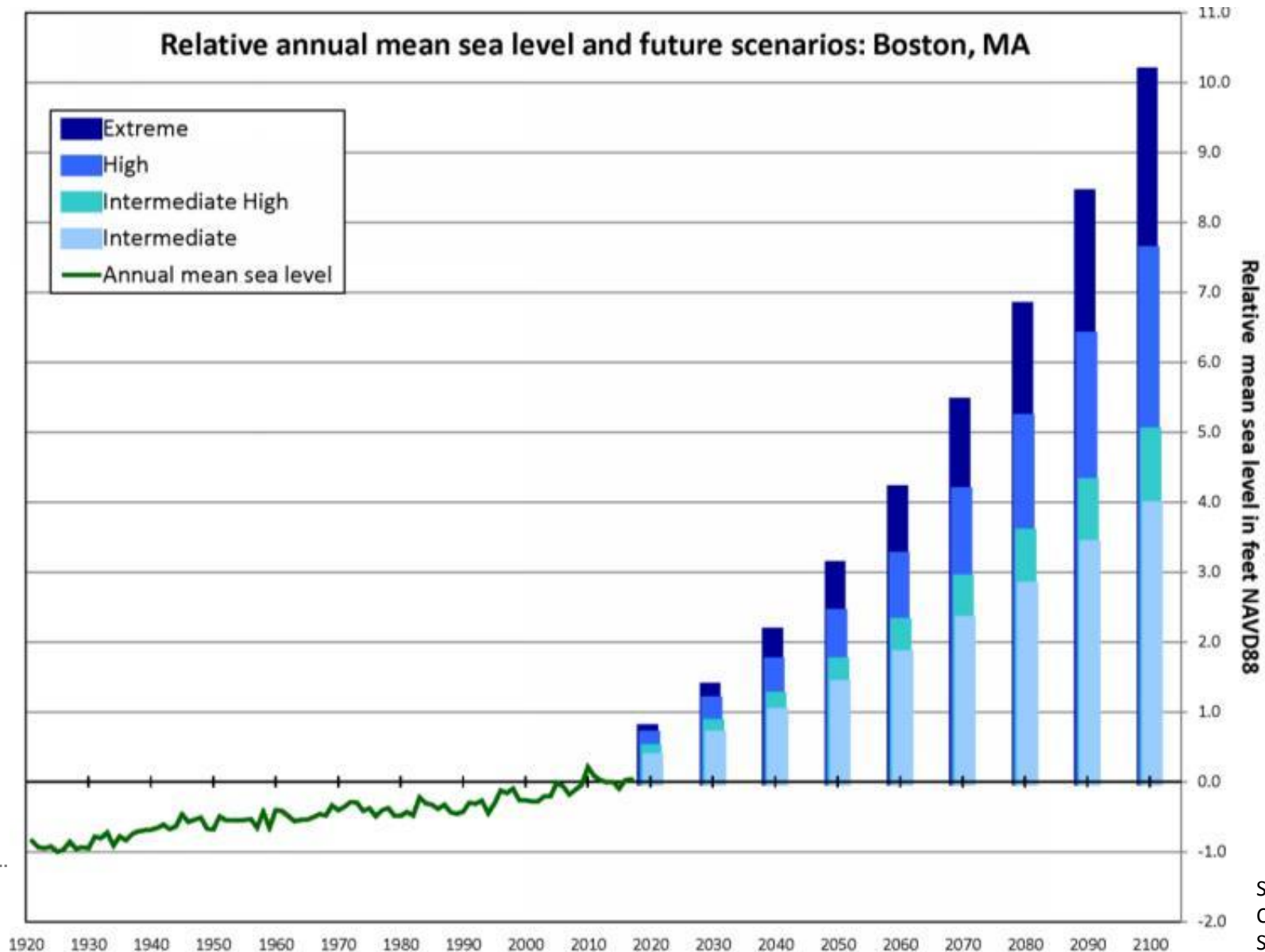
Winter: 15 to 40%



Summer: 6 to 18%



# Sea Level Rise and Storm Surge





# Boston Sea Level Rise Projections

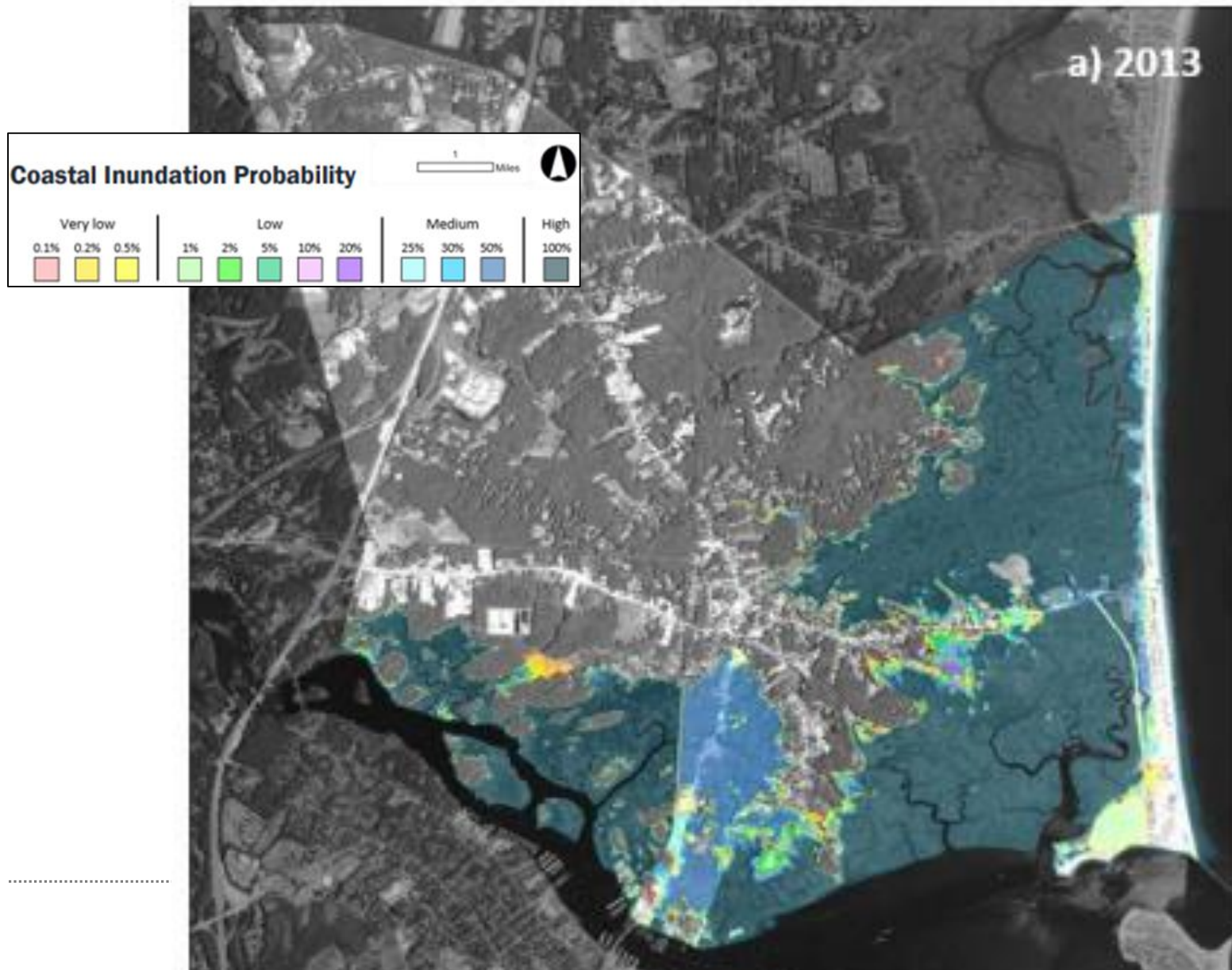


Threatens barrier buildings, infrastructure, beach and dune systems, and people

| Emission Scenario | 2030 (ft) | 2050 (ft) | 2070 (ft) | 2100 (ft) |
|-------------------|-----------|-----------|-----------|-----------|
| Intermediate      | 0.7       | 1.4       | 2.3       | 4.0       |
| Intermediate-High | 0.8       | 1.7       | 2.9       | 5.0       |
| High              | 1.2       | 2.4       | 4.2       | 7.6       |
| Extreme           | 1.4       | 3.1       | 5.4       | 10.2      |

- Increased coastal flooding
- Permanently inundated low-lying coastal areas
- Increased shoreline erosion

# Current Coastal Inundation



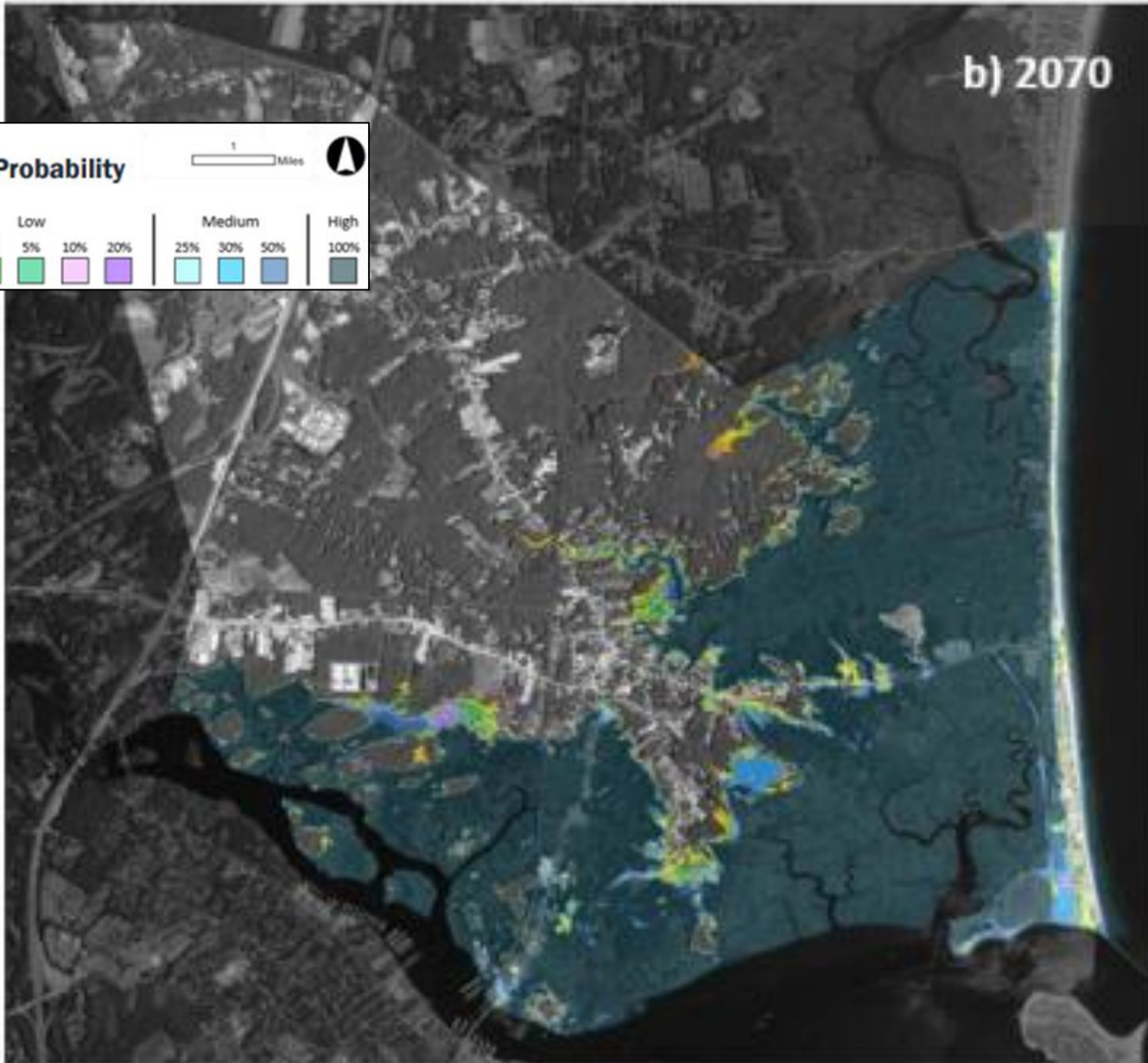


# Projected 2070 Coastal Inundation

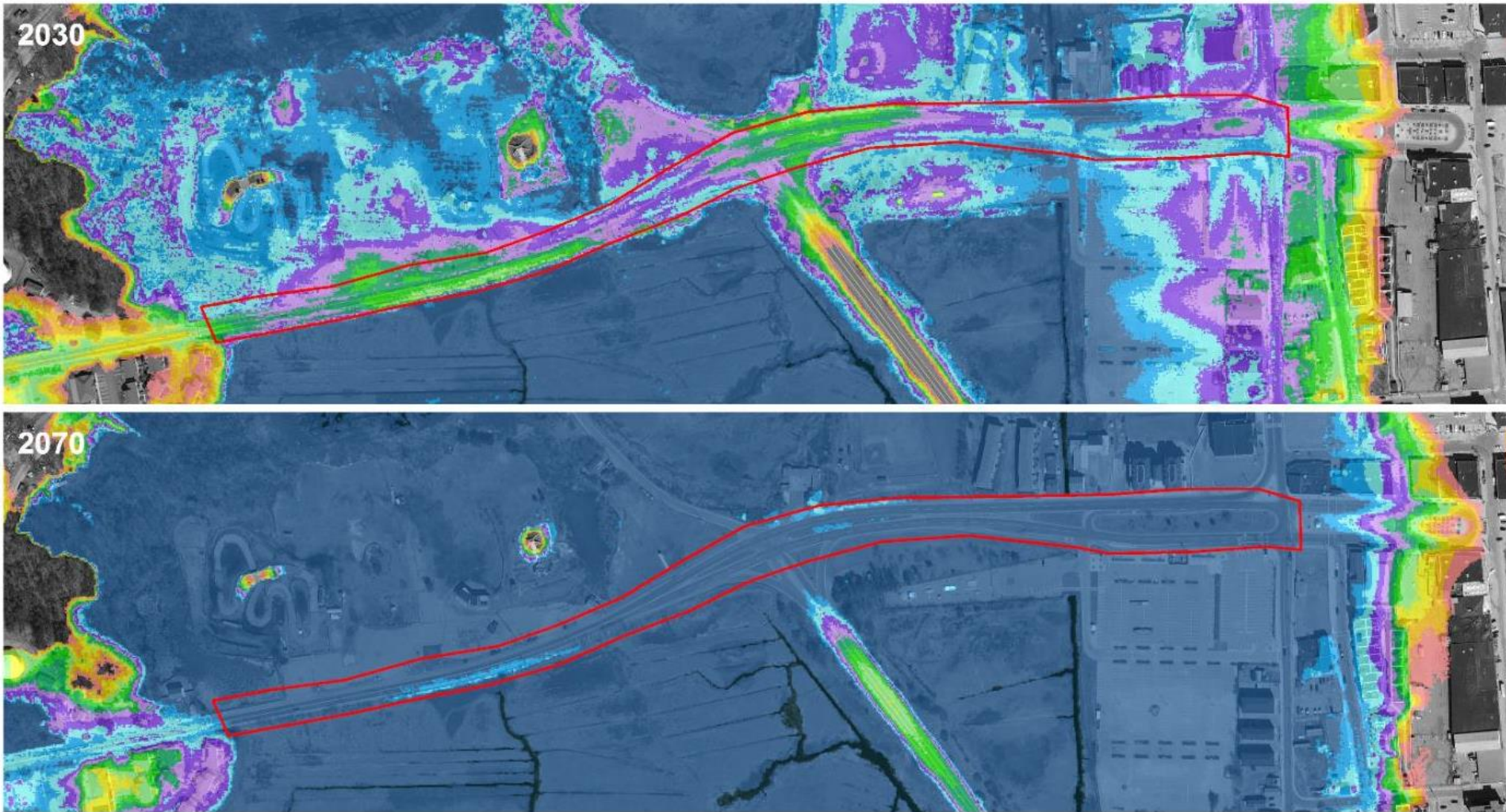


b) 2070

## Coastal Inundation Probability

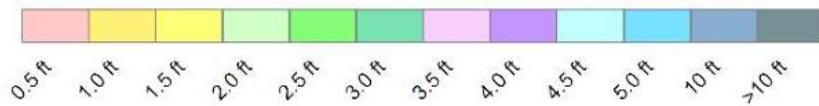


# Projected 2030 & 2070 Coastal Inundation



(Source: NWF Great Marsh Coastal Adaptation Plan, 2017)

1% (100-Year Storm) Inundation Depth



Route 1A (Beach Road)

500  
Feet



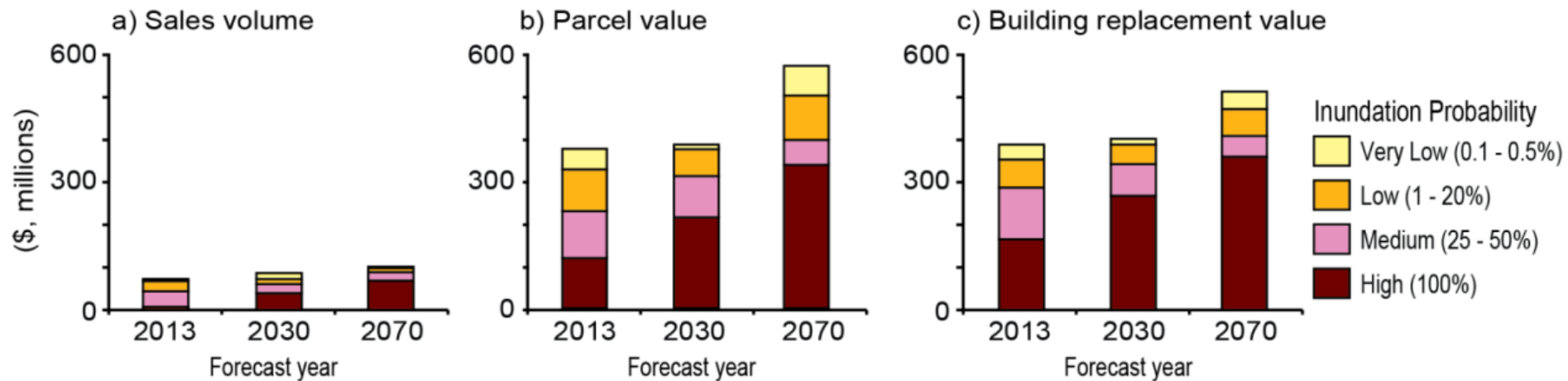


# Underwater Report (UCS, 2018)



| Year | Emissions Scenario | Homes at Risk | Value at Risk | Population currently housed in at risk homes | % Population currently housed in at risk homes |
|------|--------------------|---------------|---------------|----------------------------------------------|------------------------------------------------|
| 2030 | High               | 457           | \$150,005,600 | 827                                          | 9.98                                           |
|      | Intermediate       | 427           | \$141,273,900 | 773                                          | 9.33                                           |
| 2100 | High               | 1,209         | \$398,120,000 | 2,188                                        | 26.42                                          |
|      | Intermediate       | 950           | \$305,105,200 | 1720                                         | 20.77                                          |
|      | Low                | 610           | \$193,553,000 | 1104                                         | 13.33                                          |

# Replacement Costs in Coastal Hazard Zones





# Erosion



**Weather causes serious erosion at  
Salisbury Beach (January 2016)**



**State replenishes sand on Salisbury Beach  
(July 2018)**



# Heavy Precipitation



## Predicted:

- Higher winter flows and flooding
- Earlier peak flows in spring
- Extended summer low flows

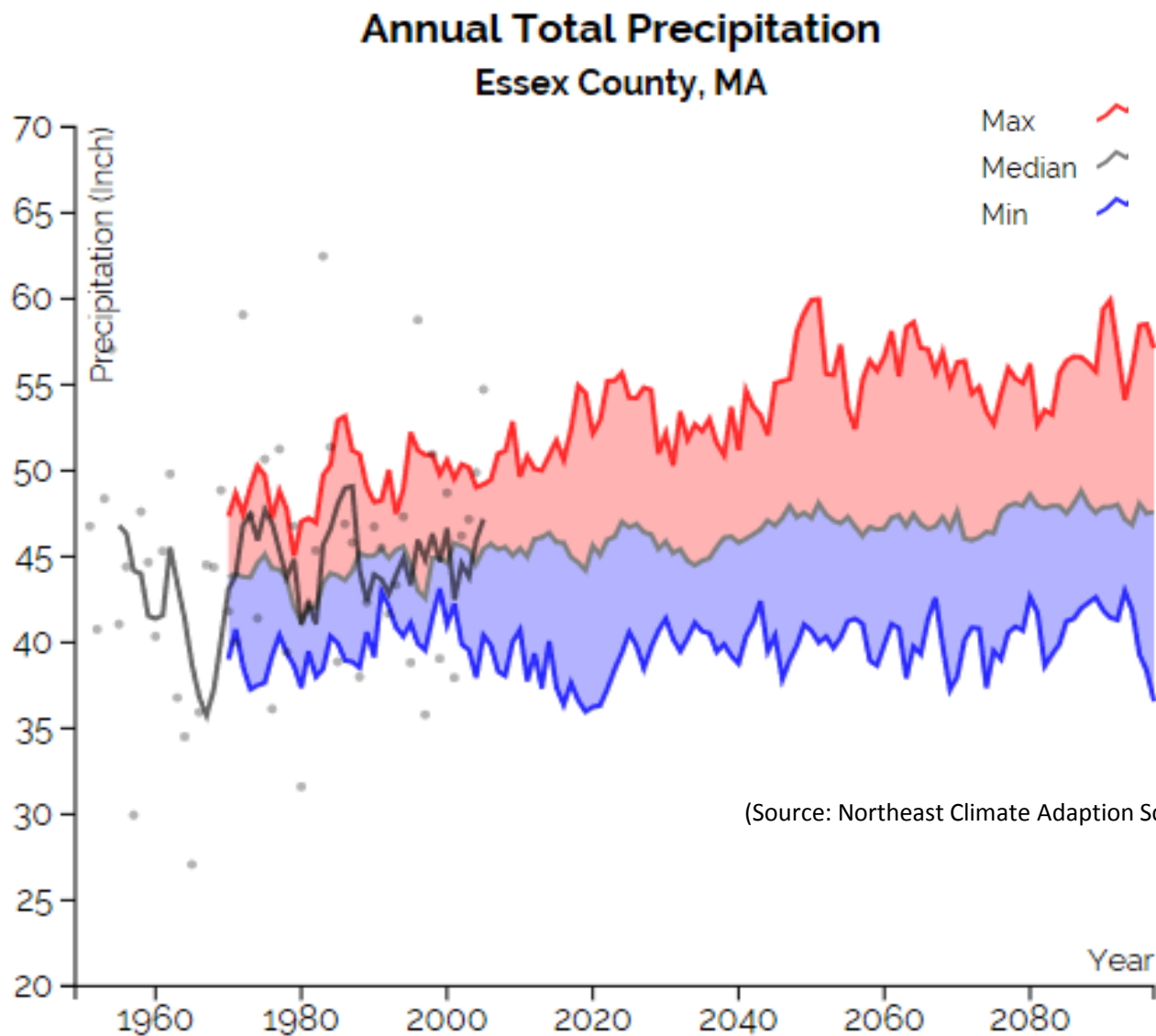


(Source: MA Coastal Zone Management)

Increased flooding, polluted stormwater and wastewater discharges



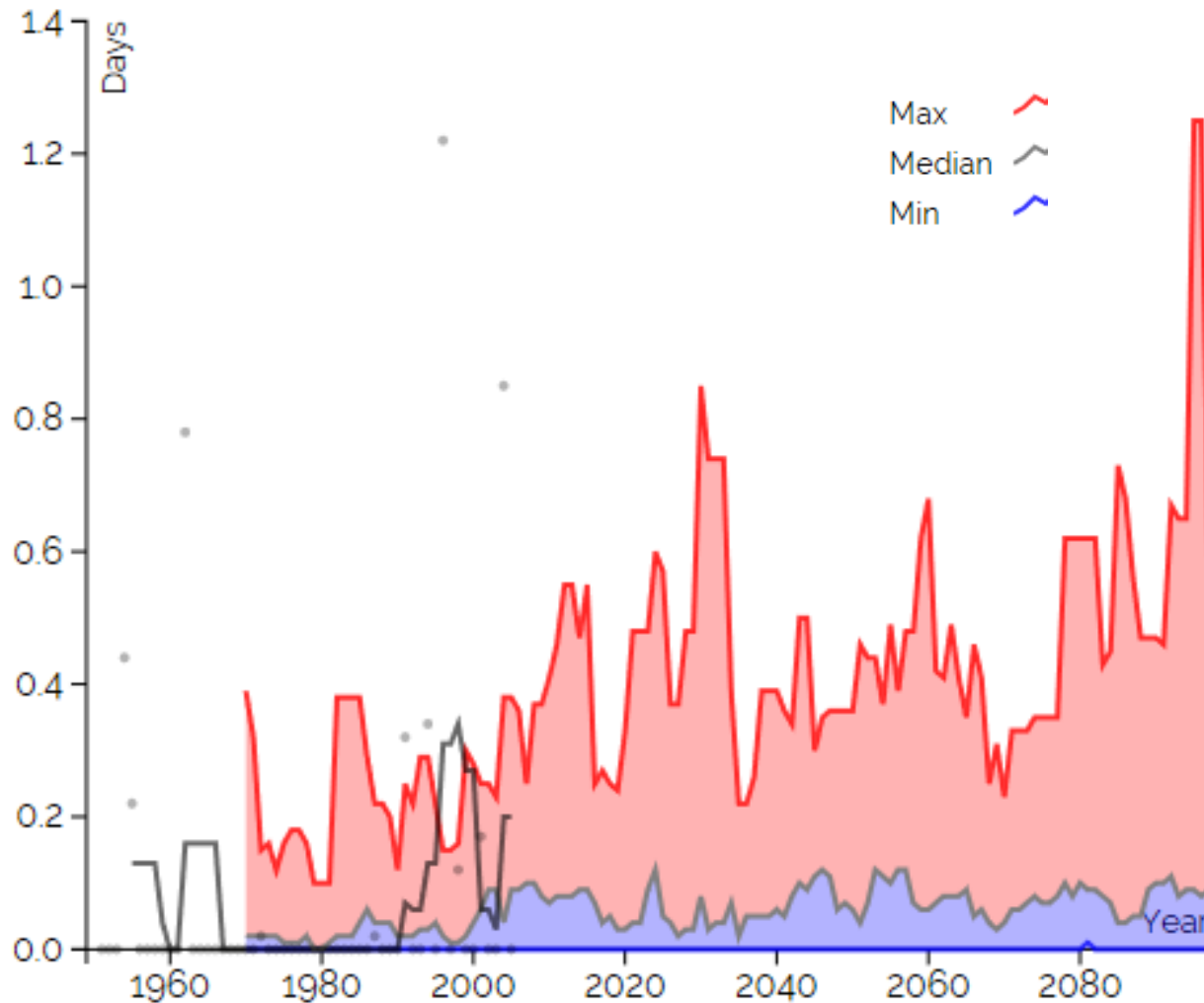
# Heavy Precipitation



# Heavy Precipitation



**Annual Days with Precipitation > 4"**  
**Essex County, MA**



(Source: Northeast Climate  
Adaption Science Center)



# Drought



- Higher risk of drought in summer and fall
- Projected impacts to:
  - Water supply
  - Rivers, streams, wetlands
  - Vegetation and crops



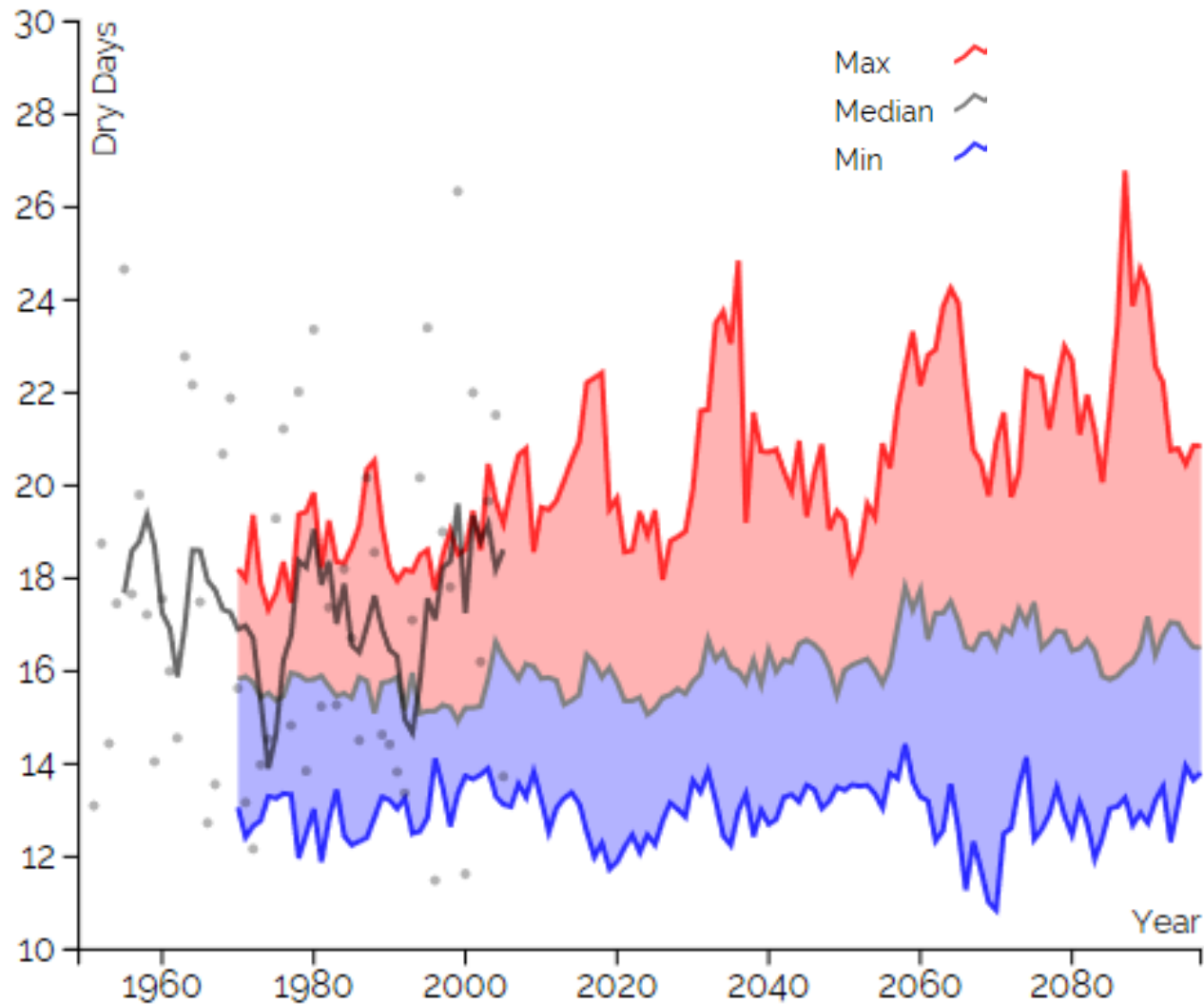
Bartlett Farm in Salisbury

<https://essexheritage.org/attractions/bartlett-farm>

# Drought



## Annual Consecutive Dry Days Essex County, MA



(Source: Northeast  
Climate Adaption  
Science Center )



# Ice/Snow Storms



- Past few decades, more rain in winter
- Projected, more rainy and icy winters

(Example: serious damage caused by Dec 2008 ice storm)

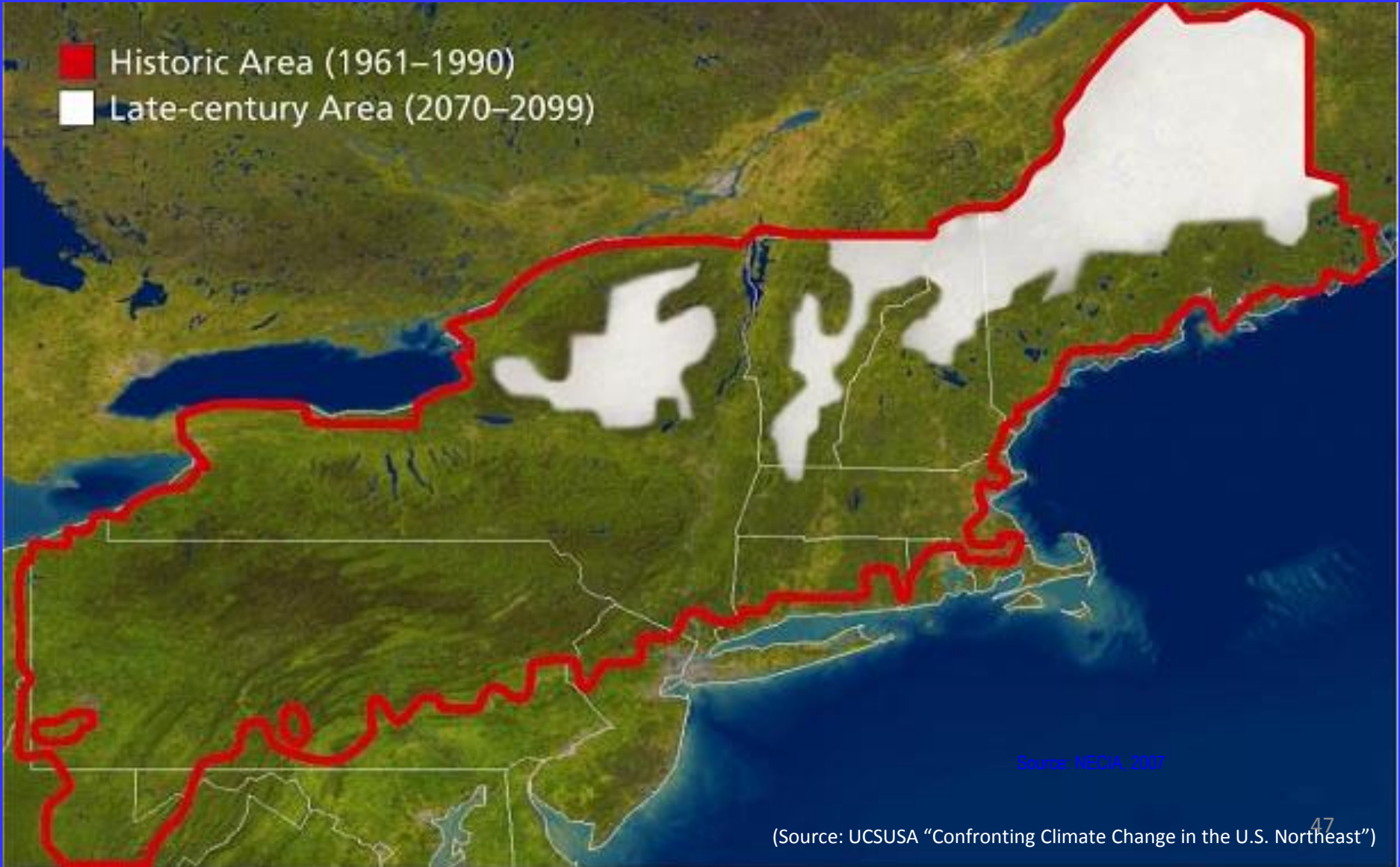


(Source: The Eagle-Tribune)

# Predicted Snow Cover



- Historic Area (1961–1990)
- Late-century Area (2070–2099)



Source: NECIA, 2007

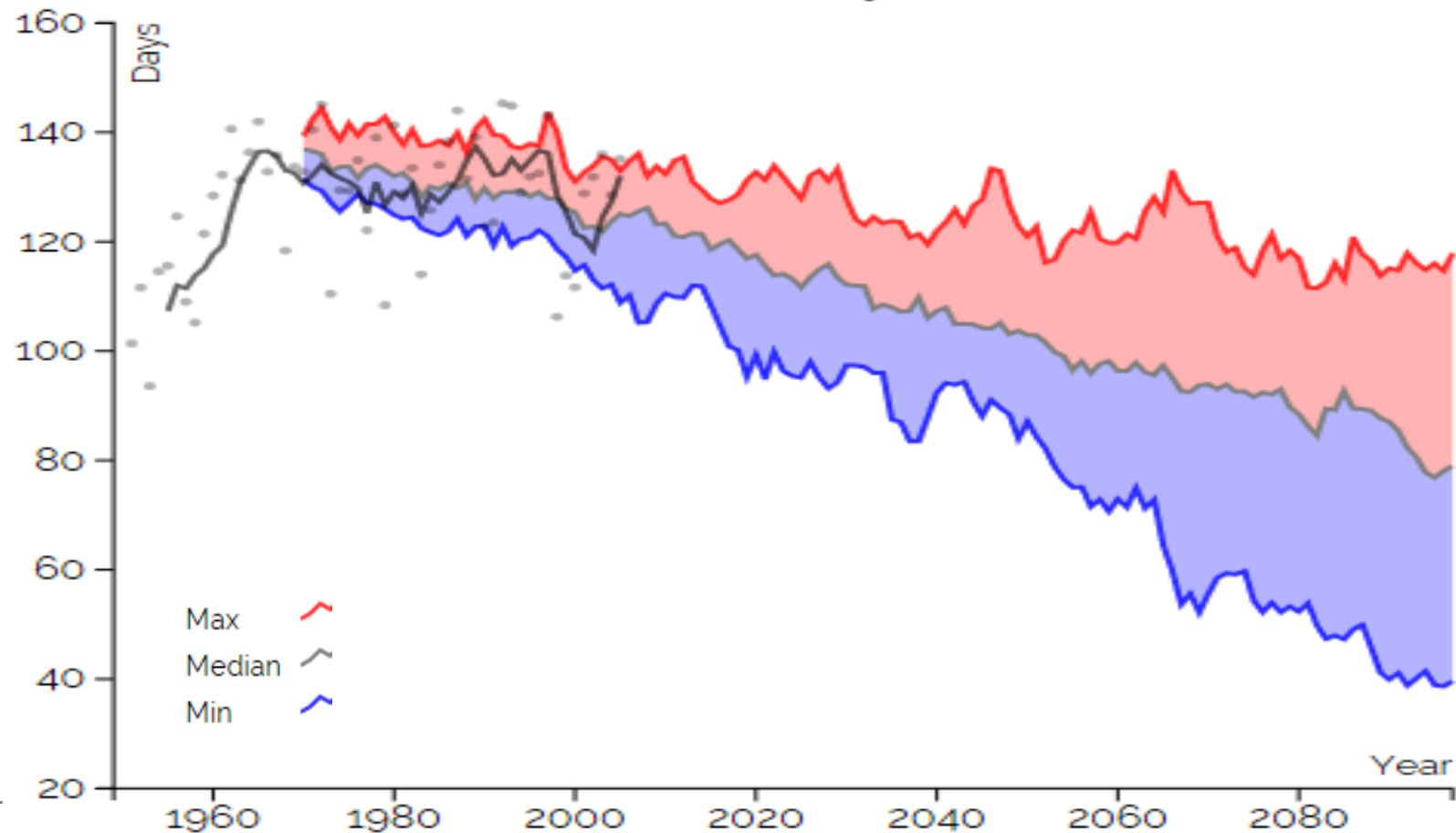
(Source: UCSUSA "Confronting Climate Change in the U.S. Northeast")



# Projection: Annual Days in Essex County with Minimum Temperature Below 32°



**Annual Days with Minimum Temperature Below 32°F**  
**Essex County, MA**

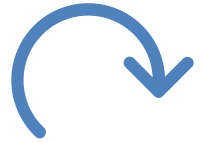


(Source: Northeast Climate Adaption Science Center )



(Source: WGNS Radio)

# Wind



- NWS Wind Advisory:
  - 31 to 39 mph for at least one hour
  - Any wind speed between 46 to 57 mph
- NWS High Wind Warning:
  - 58 mph or higher

Impacts: town resources, infrastructure, trees, private and public property



# Choose Four Hazards

---

**Extreme Heat**



**Sea Level Rise/  
Storm Surge**



**Heavy  
Precipitation**



**Wind**



**Drought**



**Snow/Ice**



**Erosion**



A white snowplow is clearing a snowy parking lot. A dark car is partially visible on the left. The scene is snowy and overcast.

15-Minute Break!



A photograph of a red car parked in a garage. The car is covered in a layer of snow. The garage has a blue wall with several buoys hanging from the ceiling. The text "Risk Matrix" is overlaid on the image.

# Risk Matrix



**www.CommunityResilienceBuilding.com**

**Top Priority Hazards** (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

| Priority | Time |
|----------|------|
|----------|------|

H - M - L

| Short   | Long |
|---------|------|
| Ongoing |      |

## Societal

## Environmental



# Risk Matrix - Hazards

| Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |  |  |  |           |                              |
|--------------------------------------------------------------------------------------------------------------------|--|--|--|-----------|------------------------------|
|                                                                                                                    |  |  |  | Priority  | Time                         |
|                                                                                                                    |  |  |  | H - M - L | Short <u>Long</u><br>Ongoing |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           |                              |
|                                                                                                                    |  |  |  |           | 56                           |

# Risk Matrix- Features

[illegible]



# Features in Salisbury

Infrastructural, societal, and environmental features

**Features**

**Location**

**Ownership**

**Vulnerability or  
Strength**

Infrastructural  
Societal  
Environmental

# Features in Salisbury

## Location

Infrastructural, societal, and environmental features

**Features**

**Location**

**Ownership**

**Vulnerability or  
Strength**

Infrastructural  
Societal  
Environmental

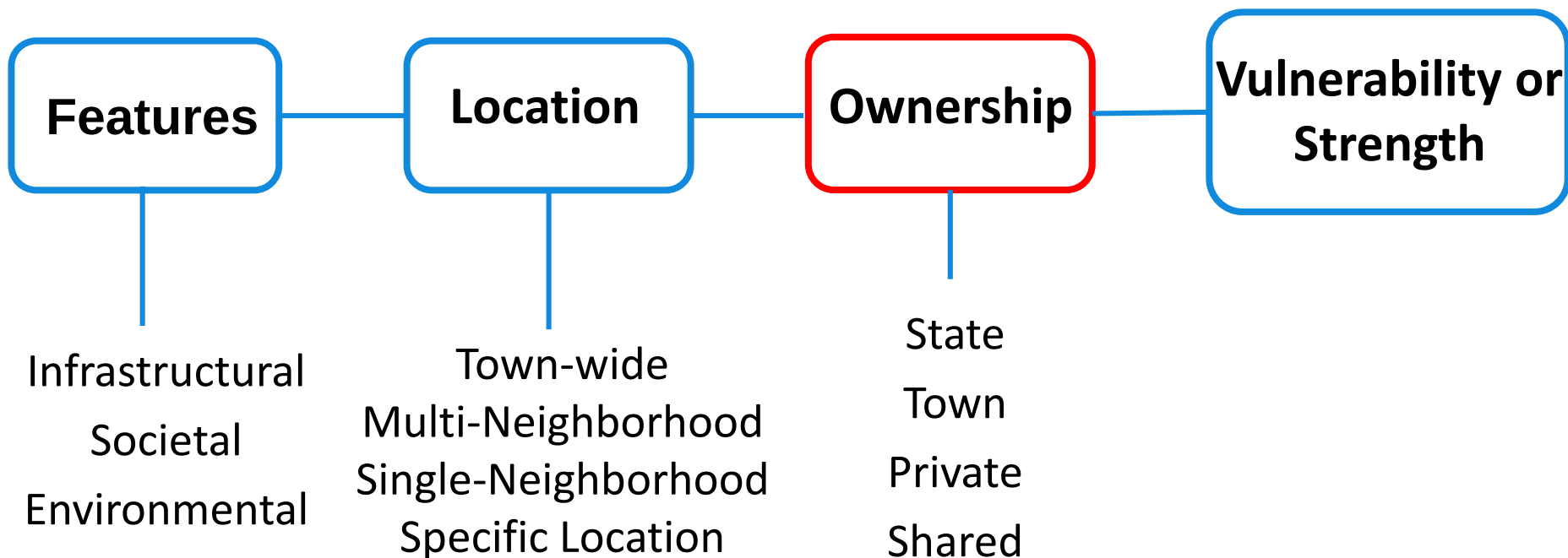
Town-wide  
Multi-Neighborhood  
Single-Neighborhood  
Specific Location



# Features in Salisbury

## Ownership

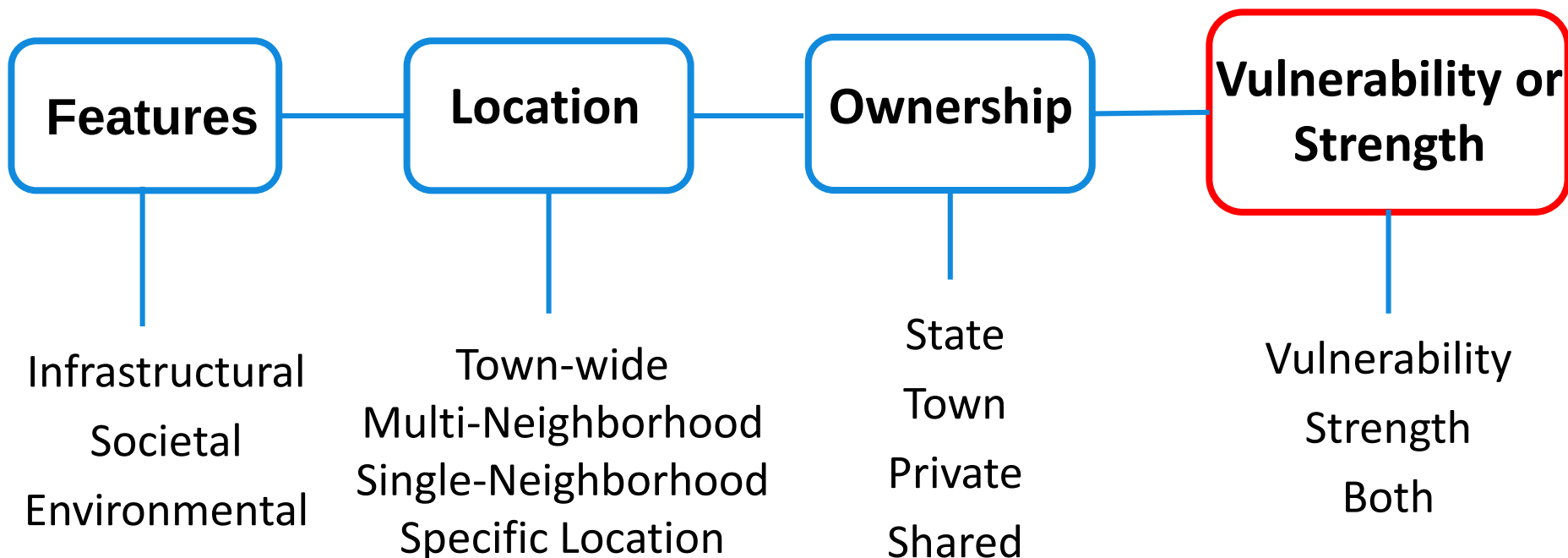
Infrastructural, societal, and environmental features



# Features in Salisbury

## Vulnerability or Strength

Infrastructural, societal, and environmental features







# Infrastructure Features

# Infrastructure

- Utilities such as electric power, gas, water, hydraulics, compressed air, municipal
- Water supply and treatment plants
- Wastewater treatment plants, sanitary & stormwater sewer systems
- Energy
- Manufacturing equipment and pollution control equipment
- Communication, data and voice computer networks
- Transportation



# Energy Generation

## (Seabrook Station Nuclear Power Plant )



# Infrastructure: Police



<http://www.salisburypolice.com/>



# Infrastructure: Fire Department



[http://www.salisburyfirefighters4694.org/?zone=/unionactive/view\\_page.cfm&page=Station](http://www.salisburyfirefighters4694.org/?zone=/unionactive/view_page.cfm&page=Station)

# Infrastructure: Wastewater Treatment and Collection





# Infrastructure: Roadways



# Infrastructure: Water Supply





# Infrastructure: Bridges

## (I-95 Whittier Bridge)



# Critical Facilities and Infrastructure in Salisbury, MA

| <b>Asset Description</b>                     | <b>Located in<br/>2013 Hazard<br/>Zones</b> | <b>Located in<br/>2070 Hazard<br/>Zones</b> |
|----------------------------------------------|---------------------------------------------|---------------------------------------------|
| Critical facilities                          | 3                                           | 3                                           |
| Transportation hub                           | 1                                           | 1                                           |
| Public-utility stations                      | 3                                           | 3                                           |
| Underground storage tanks                    | 2                                           | 2                                           |
| Declared activity and use<br>limitation site | 1                                           | 1                                           |
| Total roads (miles)                          | 18                                          | 19                                          |



A photograph of a residential street completely flooded with murky water. On the left, a two-story white house with a brown roof is partially submerged. A utility pole with many wires stands in the foreground. In the background, other houses and a white pickup truck are visible through the foggy, overcast sky. The text "Societal Features" is overlaid in the center.

# Societal Features



# Societal: Salisbury's People

- Population
  - 2010 Census: 8,283
  - 2035 Projection: 10,100
- Age
  - Under age 20 = 15.2%
  - Age 65 or older = 12.5%
- Education
  - 91.6% high school
  - 28.3% Bachelors degree
- Income
  - Median household = \$65,347
  - 36.5% low to moderate income
  - 10.3% below poverty level





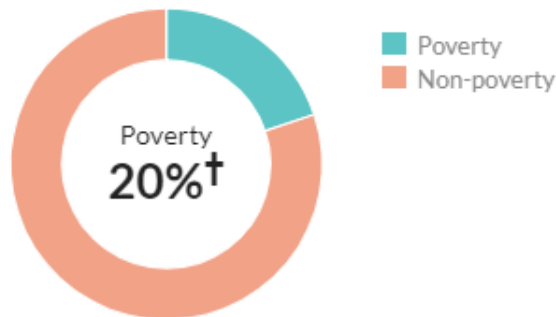
# Societal: Salisbury's Jobs

- Number of Jobs
  - 2010 Census: 2,795
  - 2035 Projection: 4,037
- 876 Companies
  - Retail
  - Manufacturing
  - Accommodation & food
  - Transportation & warehousing

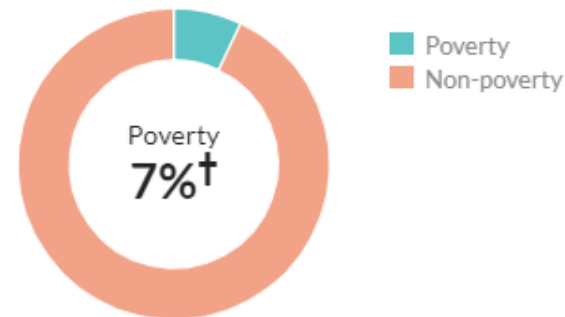
# Societal: Vulnerable Populations

Elderly, low/moderate income, special income, language barriers, infirmed

Children (Under 18)



Seniors (65 and over)



(Source: Censusreporter.com)

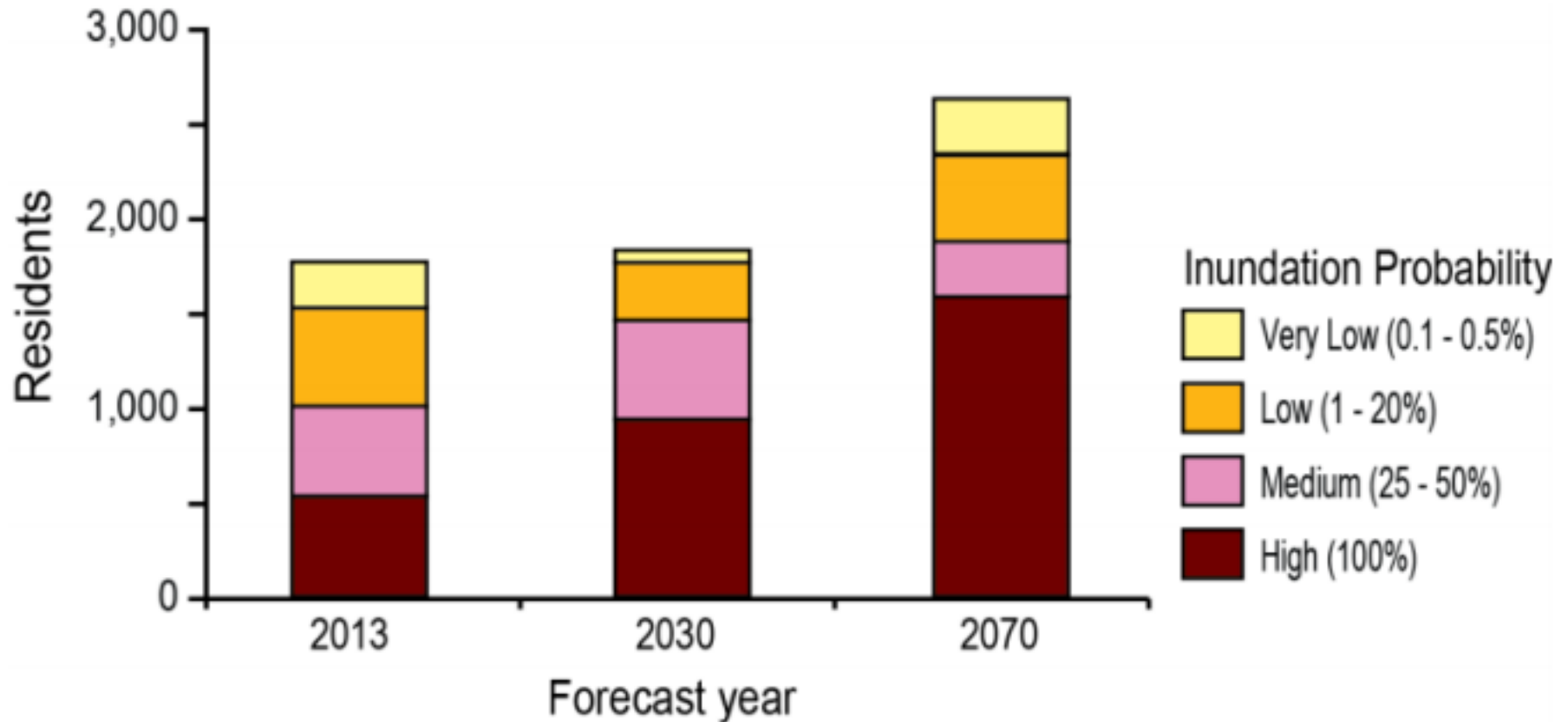
**Census data:** ACS 2016 5-year



# Societal: Assisted Living and Senior Centers



# Societal: Salisbury Resident Exposure to Coastal Inundation







# Environmental Features

# Environmental: Natural Resources

- Merrimack River
- Salisbury Beach
- Coldwater Streams
- Forests
- The Great Marsh
- Other Marshes & Wetlands
- Aquifers



*Salisbury 2015 (Source: MA Coastal Zone Management)*



# Environmental: An Economic Driver



# Environmental: Climate Stressors

- Flooding
- Erosion
- Water quality/quantity impacts
- Invasive fauna and flora
- Wetland soil Impacts
- Increase in stormwater runoff
- Less groundwater recharge
- Disruption of salt marsh



(Source: MA Coastal Zone Management)



# Environmental: Salisbury Beach

- 3.8 mile barrier beach
- Densely developed
- High exposure to erosion
- Defense against storm surge and sea level rise



(Source: Newburyport News, 2018)

# Environmental: Marshes

- Great Marsh = 27% of Salisbury
- Marsh attenuates reduces wave height
- Marshes and dune can migrate inland as a response to sea level rise
- Residential and commercial development has intensified effects of storm surge and erosion by damaging marshes and vegetated dunes



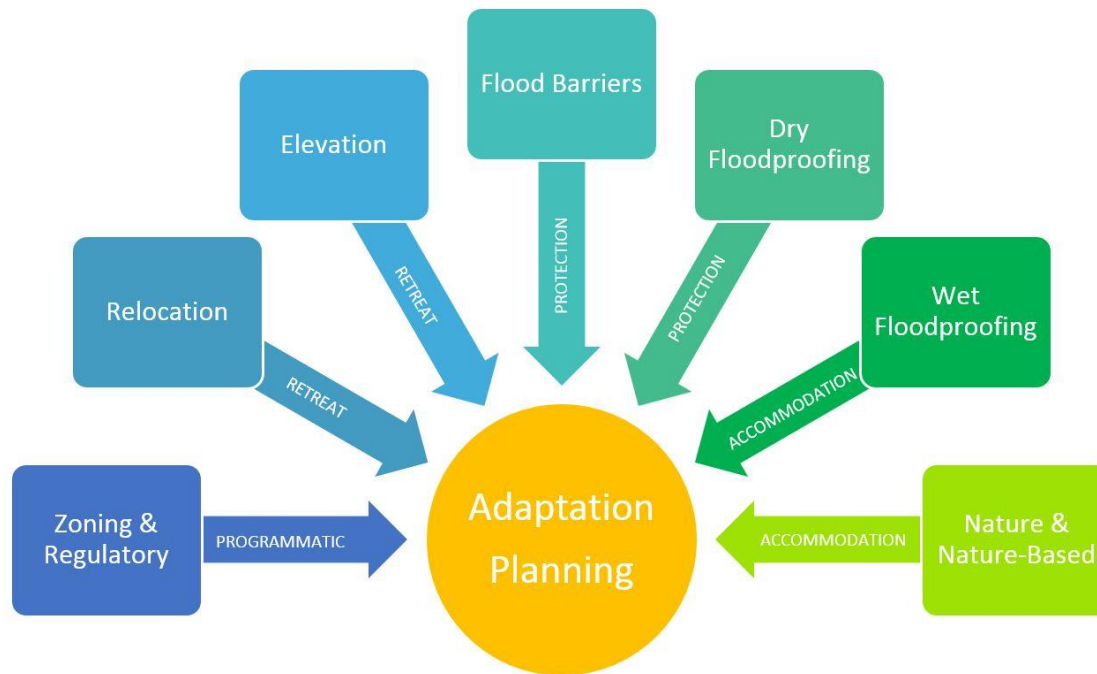
(Source: NWF Great Marsh Coastal Adaptation Plan, 2017)





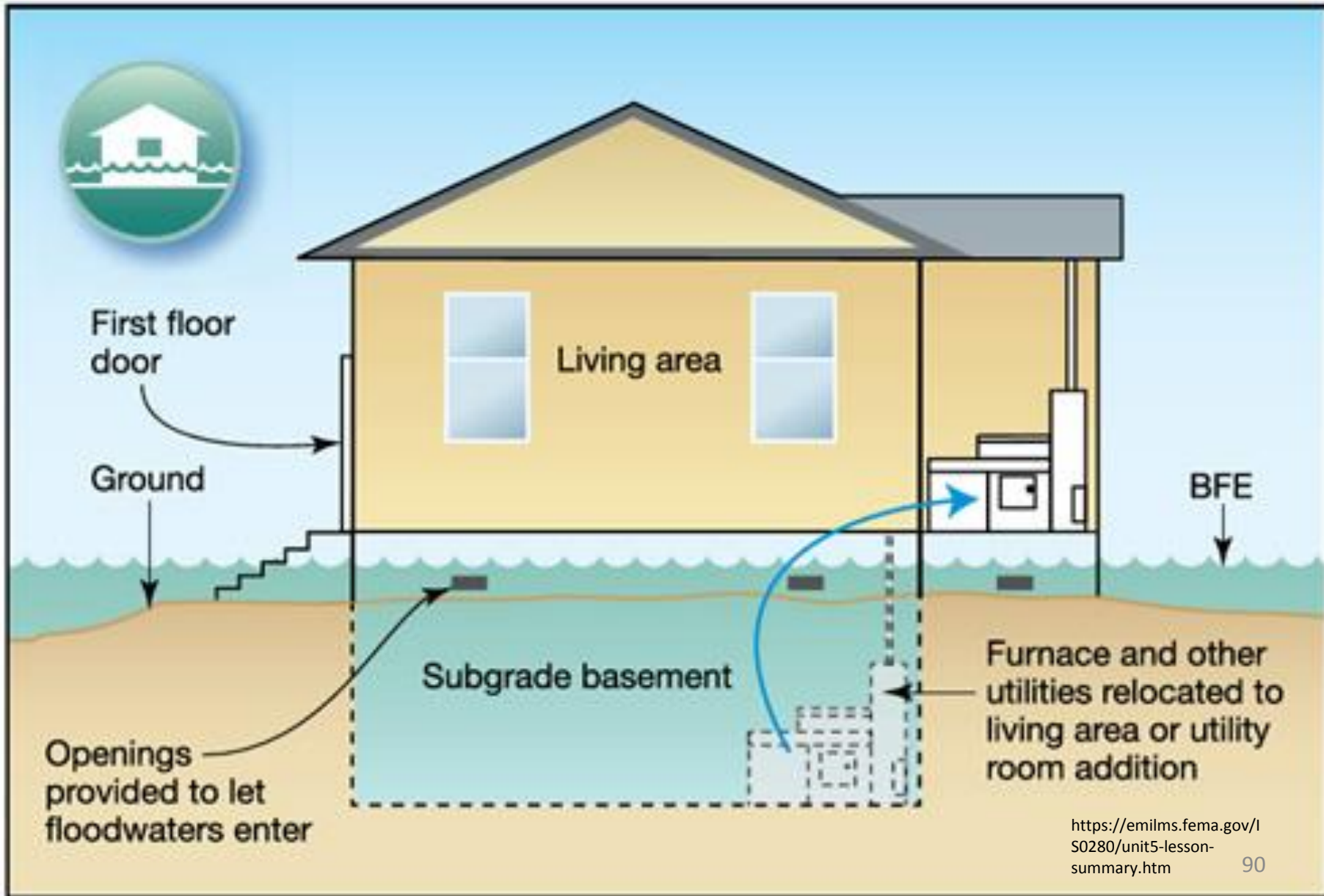
# 1-Hour Lunch

# Community Actions





# Wet Floodproofing

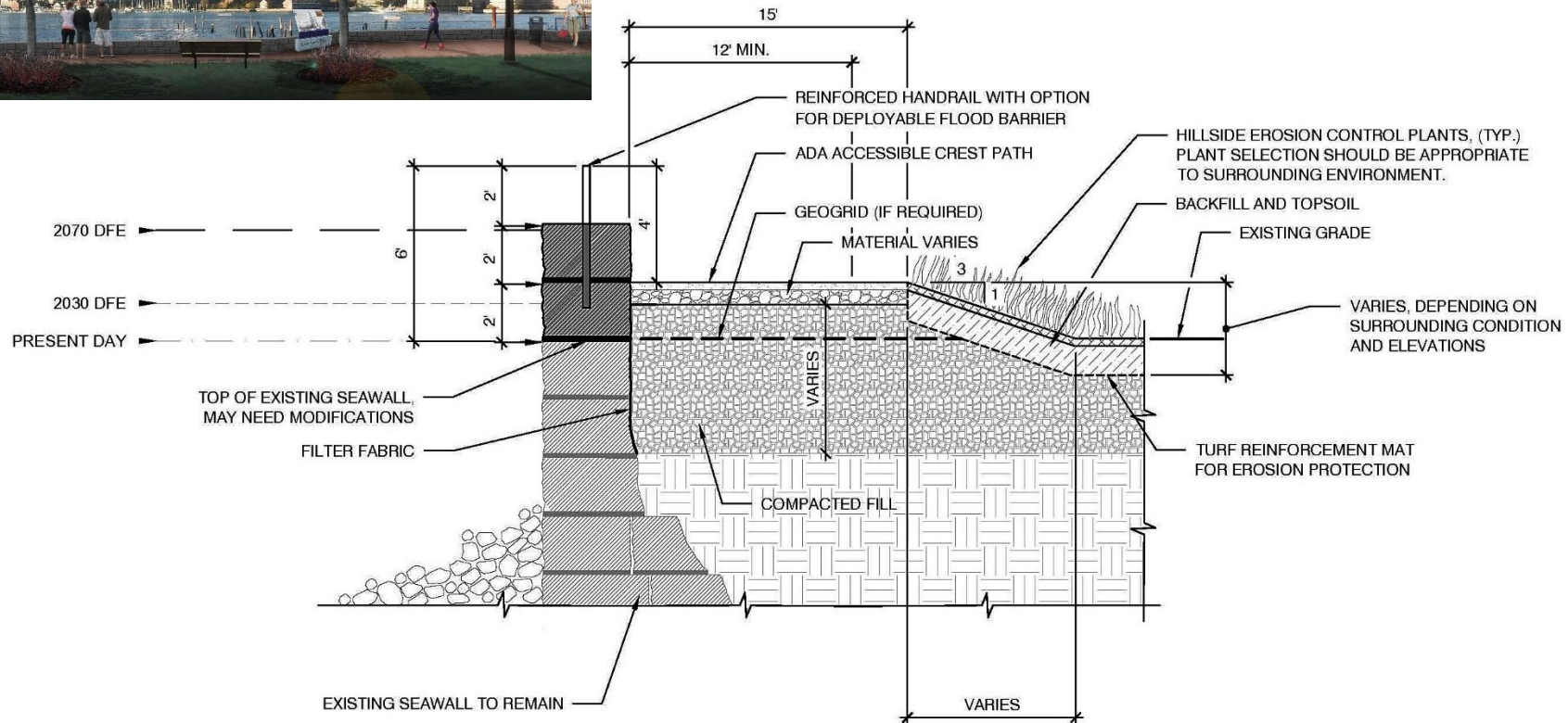


# Raised Buildings



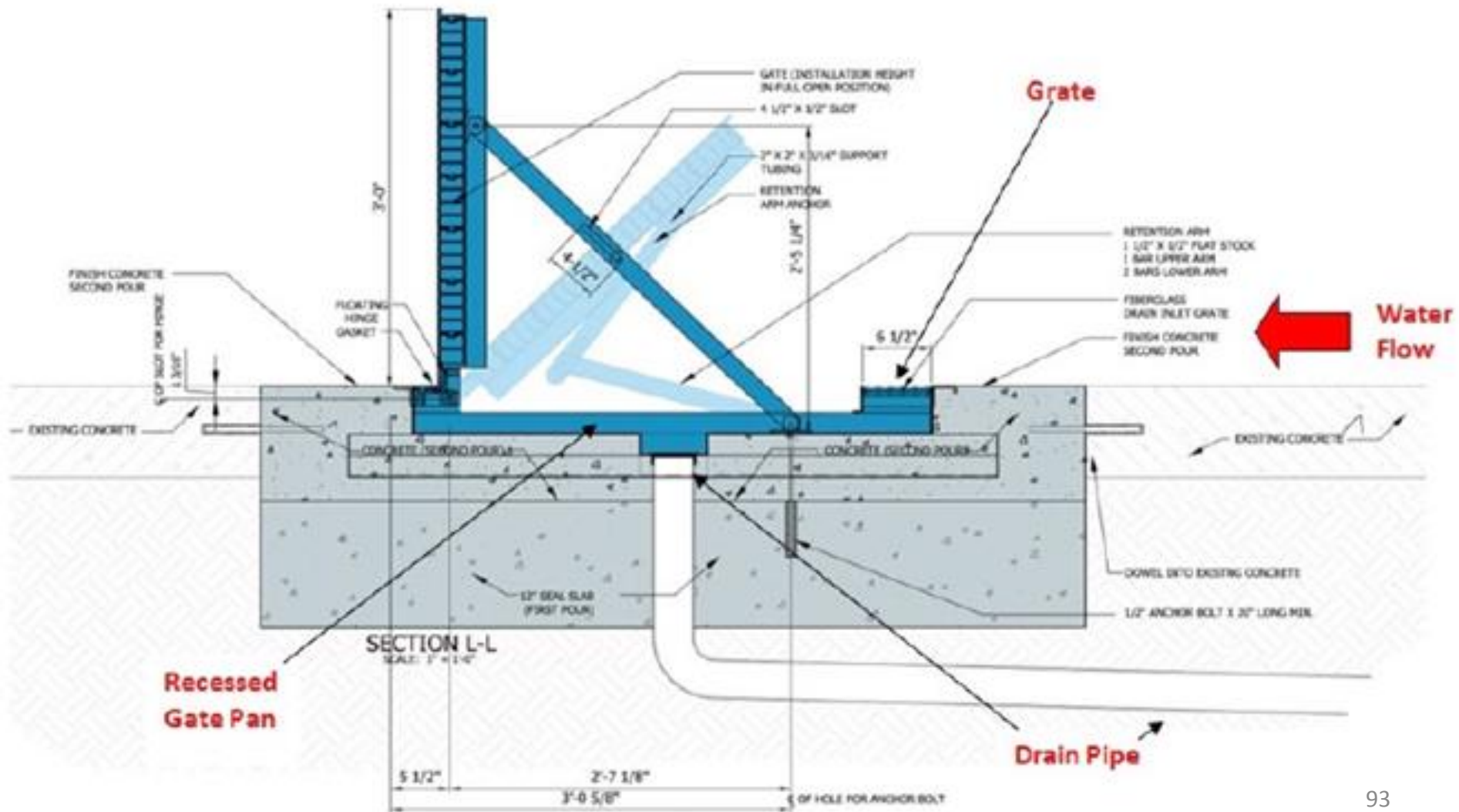


# Flood Walls



**HARBORWALK BARRIER SEAWALL SAMPLE SECTION**

# Deployable Flood Barriers

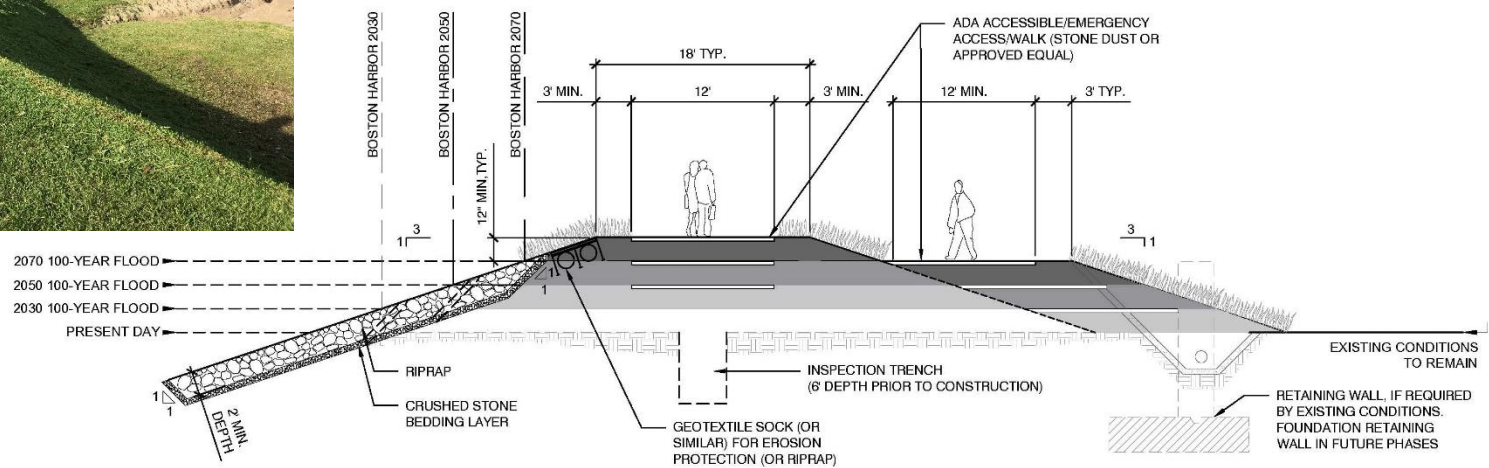




# Preventing Sewer Backflow



# Vegetated Berms



**OVERALL VEGETATED BERM (HT. VS. TIME)**  
**SCALE: N.T.S.**

## NOTES:

- SIMILAR WALL CONSIDERATIONS AS FOR RAISED ROADWAY BARRIER OPTION
- SALT TOLERANT/EROSION CONTROL
- URBAN OR NATIVE PLANT PALLET
- URBAN PLANTS SHOULD BE TOLERANT OF POLLUTANTS (SMOG, OILS, ETC.)
- NATIVE PLANTS SHOULD BE CONSIDERED WHENEVER POSSIBLE
- DIMENSIONS ARE BASED OFF SLOPE TABLE AND DESIRED PROTECTION LEVELS
- HILLSIDE EROSION TYPE PLANTS SHOULD BE USED FOR LANDSIDE SECTIONS. SELECTION SHOULD BE APPROPRIATE TO SURROUNDING HABITAT/ECOSYSTEM
- SUBBASE OF WALKWAY SHOULD SUPPORT VEHICLE LOADS (SERVICE AND EMERGENCY)

| VEGETATED BERM (Crest, slope, and possible access path) |             |             |                   |                              |                                |
|---------------------------------------------------------|-------------|-------------|-------------------|------------------------------|--------------------------------|
| Elevation (+_ft)                                        | Crest Width | Slope Width | Access Path Width | Total Width (no Access Path) | Total Width (with Access Path) |
| 1                                                       | 18          | 6           | Not Recommended   | 24                           | 24                             |
| 2                                                       | 18          | 12          | 15                | 30                           | 45                             |
| 3                                                       | 18          | 18          | 15                | 36                           | 51                             |
| 4                                                       | 18          | 24          | 15                | 42                           | 57                             |
| 5                                                       | 18          | 30          | 15                | 48                           | 63                             |
| 6                                                       | 18          | 36          | 15                | 54                           | 69                             |

| Slope    |
|----------|
| 3H<br>1V |

## VEGETATED BERM - TYPICAL SECTION

Weston & Sampson

**DRAFT**

| CONTRACT NO. | DRAWN BY:    | DETAIL NO. |
|--------------|--------------|------------|
| ####         | L. WADLINGER | T-004      |
| DATE         | SCALE        | SHEET      |
| 4/20/2018    | AS NOTED     | 4 OF 5     |



# Multi-Purpose Flood Storage





# Low Impact Development (LID)



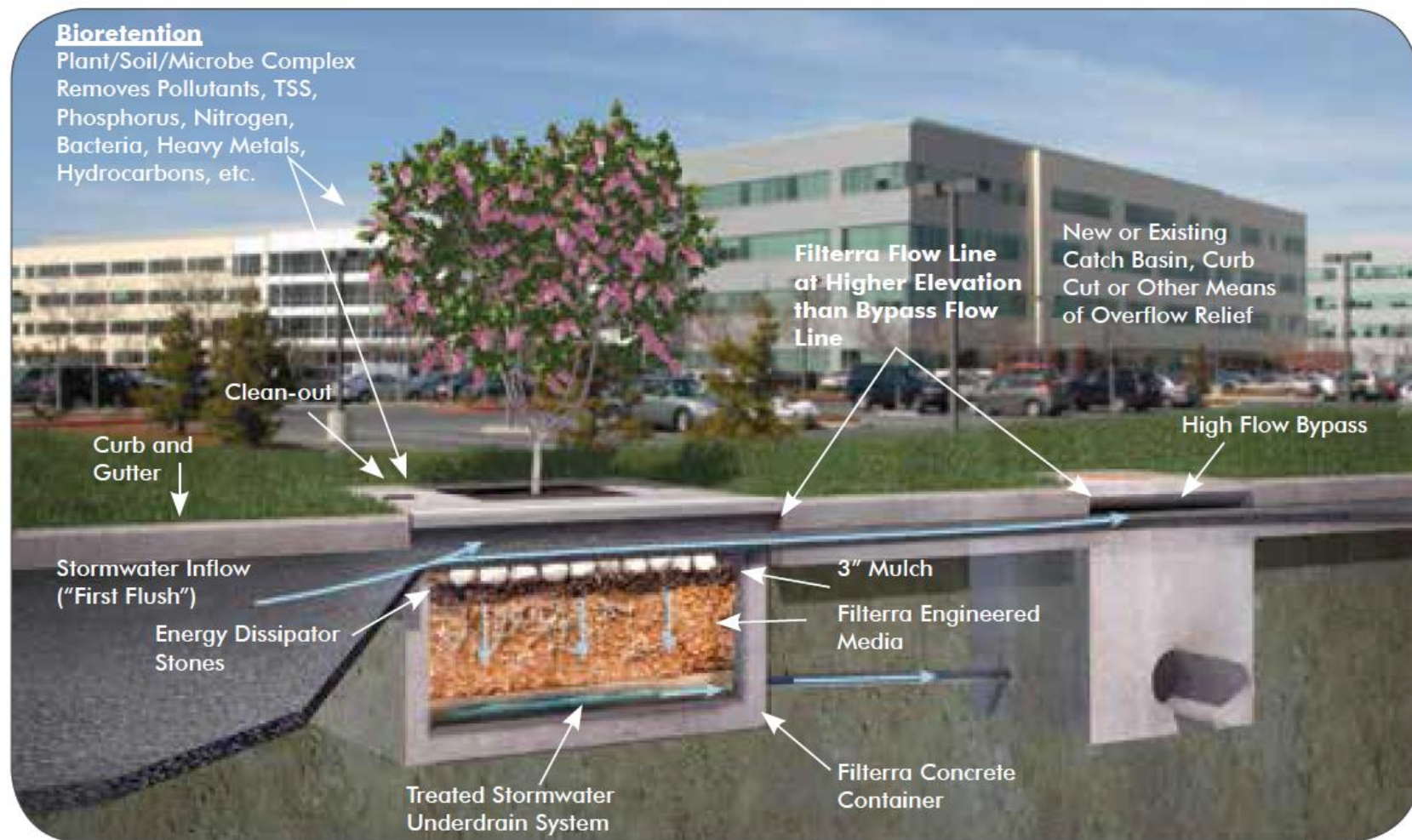
**An innovative, ecosystem-based approach to land development and stormwater management**



# Porous Asphalt and Permeable Pavers



# Street Trees & Tree Box Filters







Rain Garden in a median strip of a townhouse project. Please note the depressed curb and grate inlet structure

# Stormwater Detention & Retention





# Culvert Widening to Improve Saltmarsh Habitat





# Assessment of Tidal Restrictions from Undersized Culverts





# Seawall Repair





# Living Shorelines



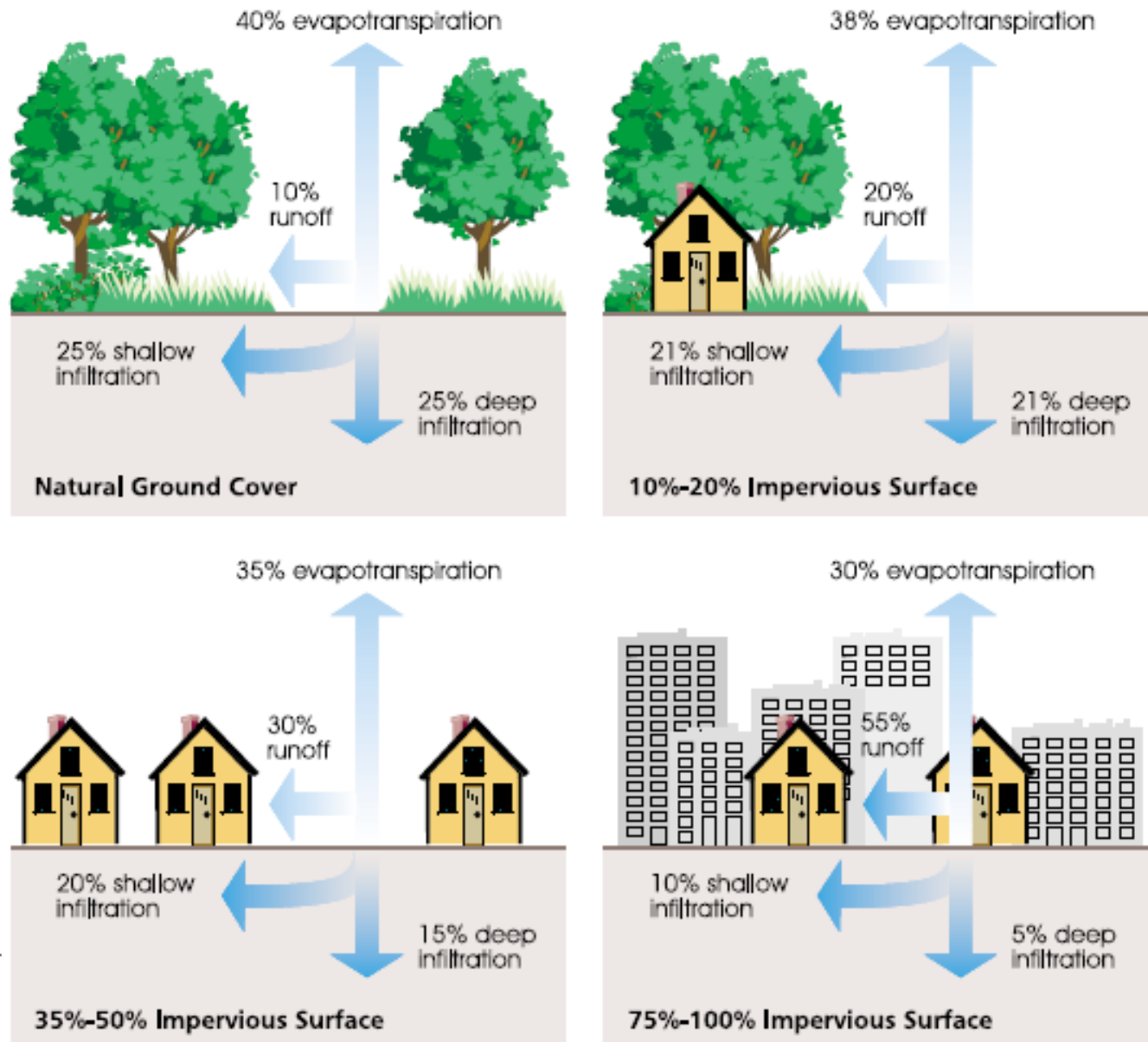


# Cloudburst Streets



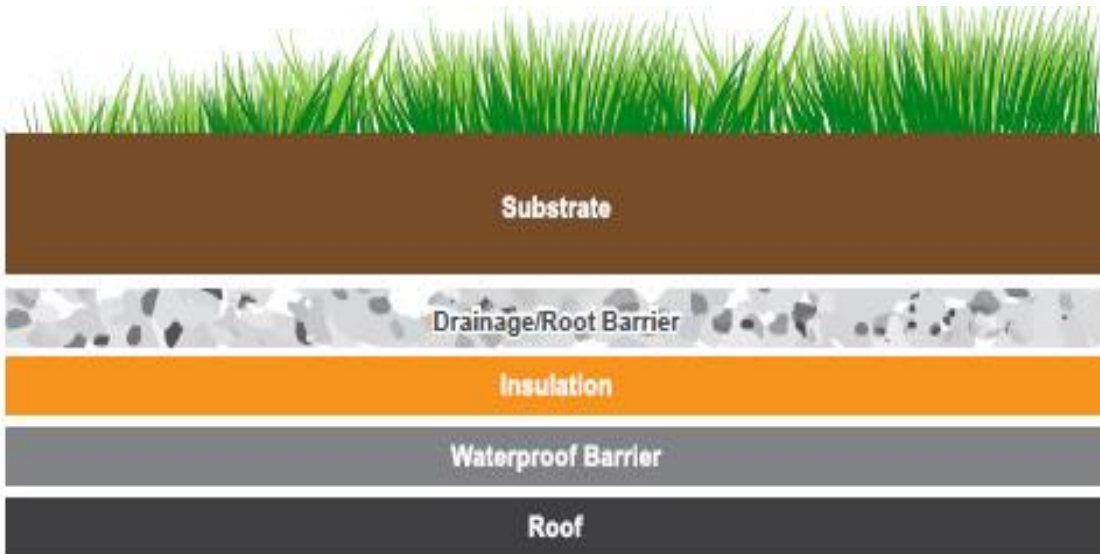
MATTHEËUSGADE - CLOUDBURST STREET

# Reduce Impervious Areas

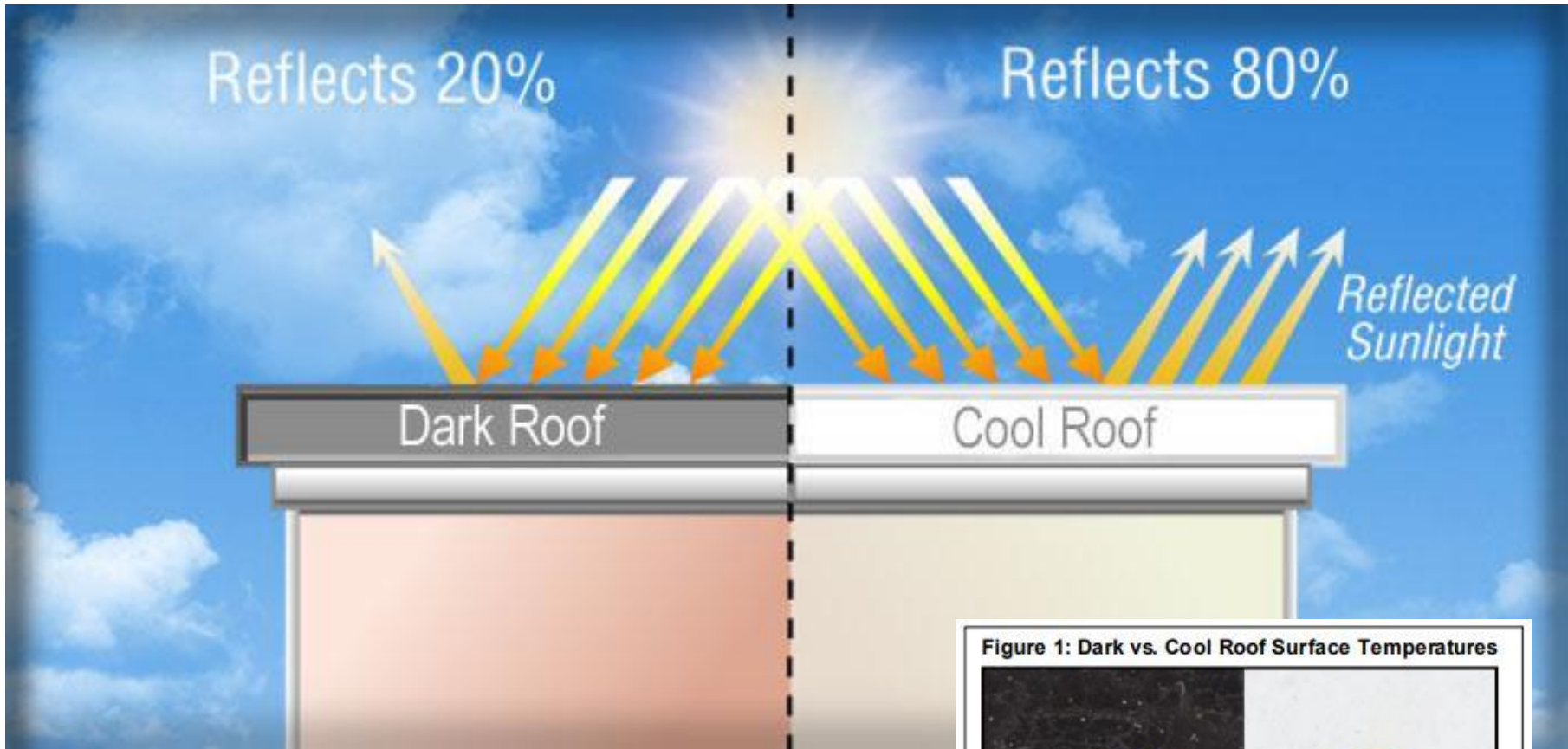




# Green Roofs



# Cool Roofs



Source: Heat Island Group at Lawrence Berkeley National Laboratory

**Figure 1: Dark vs. Cool Roof Surface Temperatures**



A dark roof (left) becomes much hotter than a cool white roof (right) on a sunny afternoon.

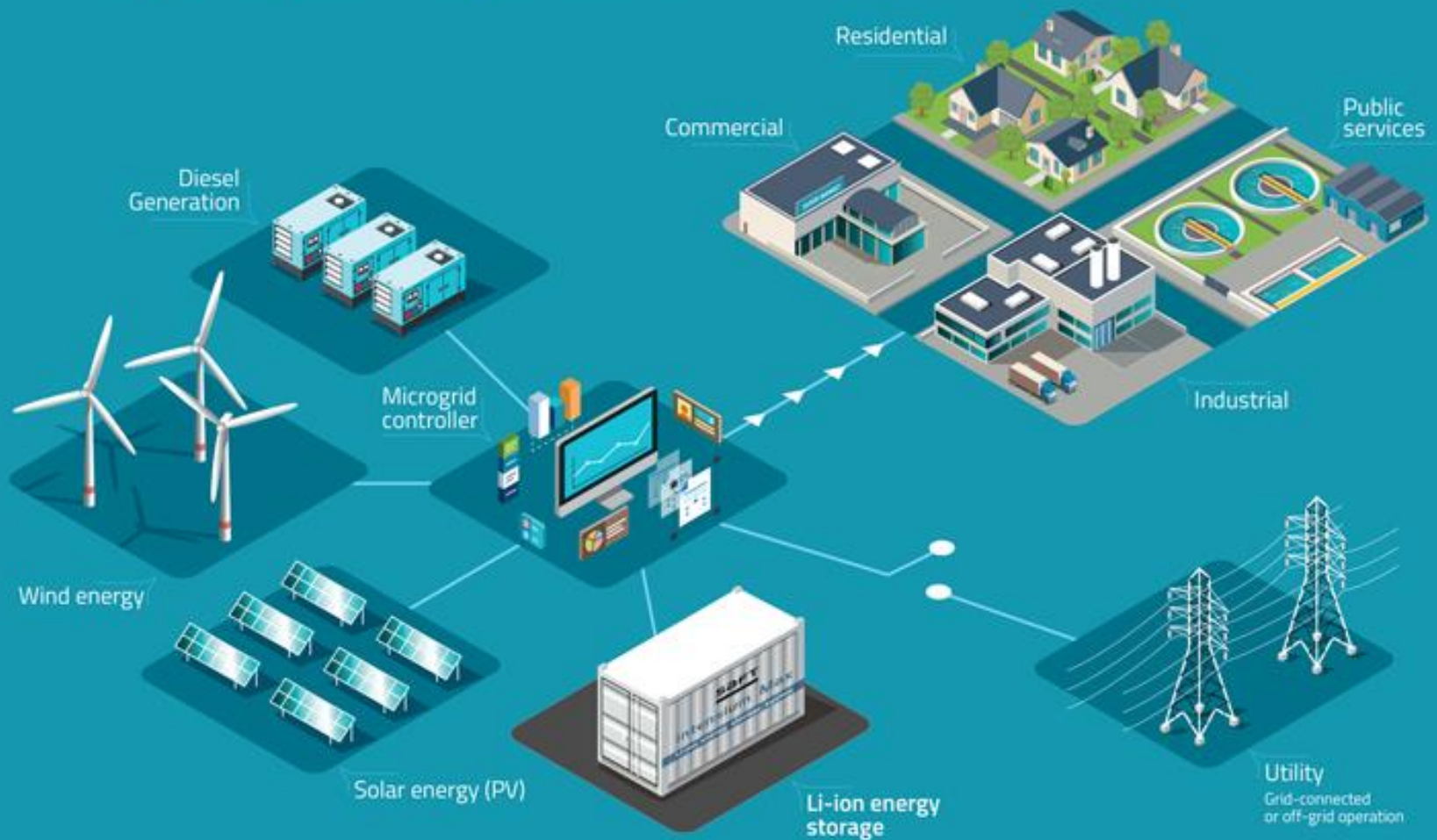


# Cooling Centers



# Renewable Micro-Grids

Li-ion energy storage takes microgrids to the next level





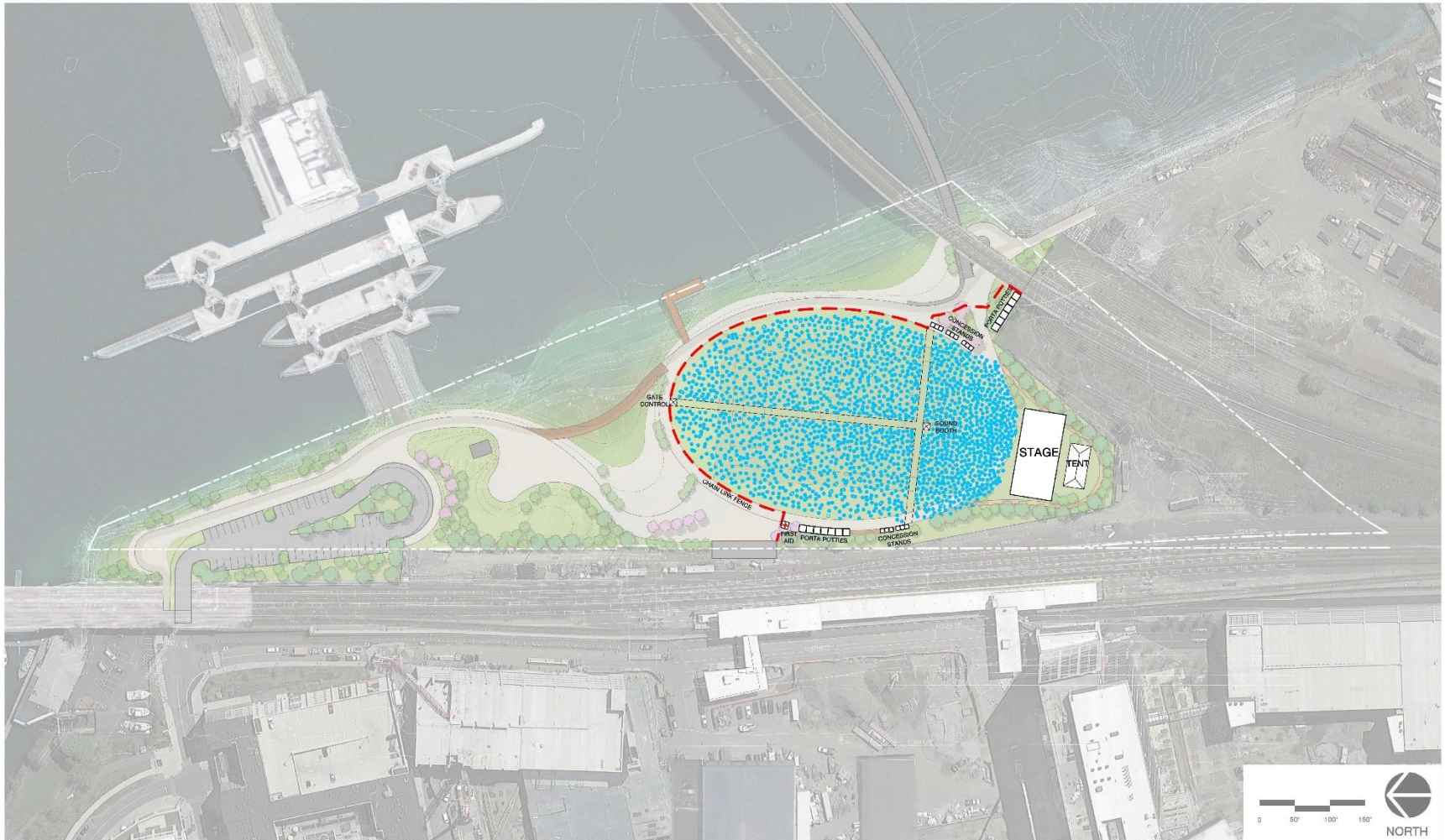
# Regional Resiliency Efforts

(Examples include transportation & water supply)



# Landscape Design to Accommodate Water

## Draw Seven Park, Somerville – Existing Conditions



CONCEPT #1 - CROWD DIAGRAM

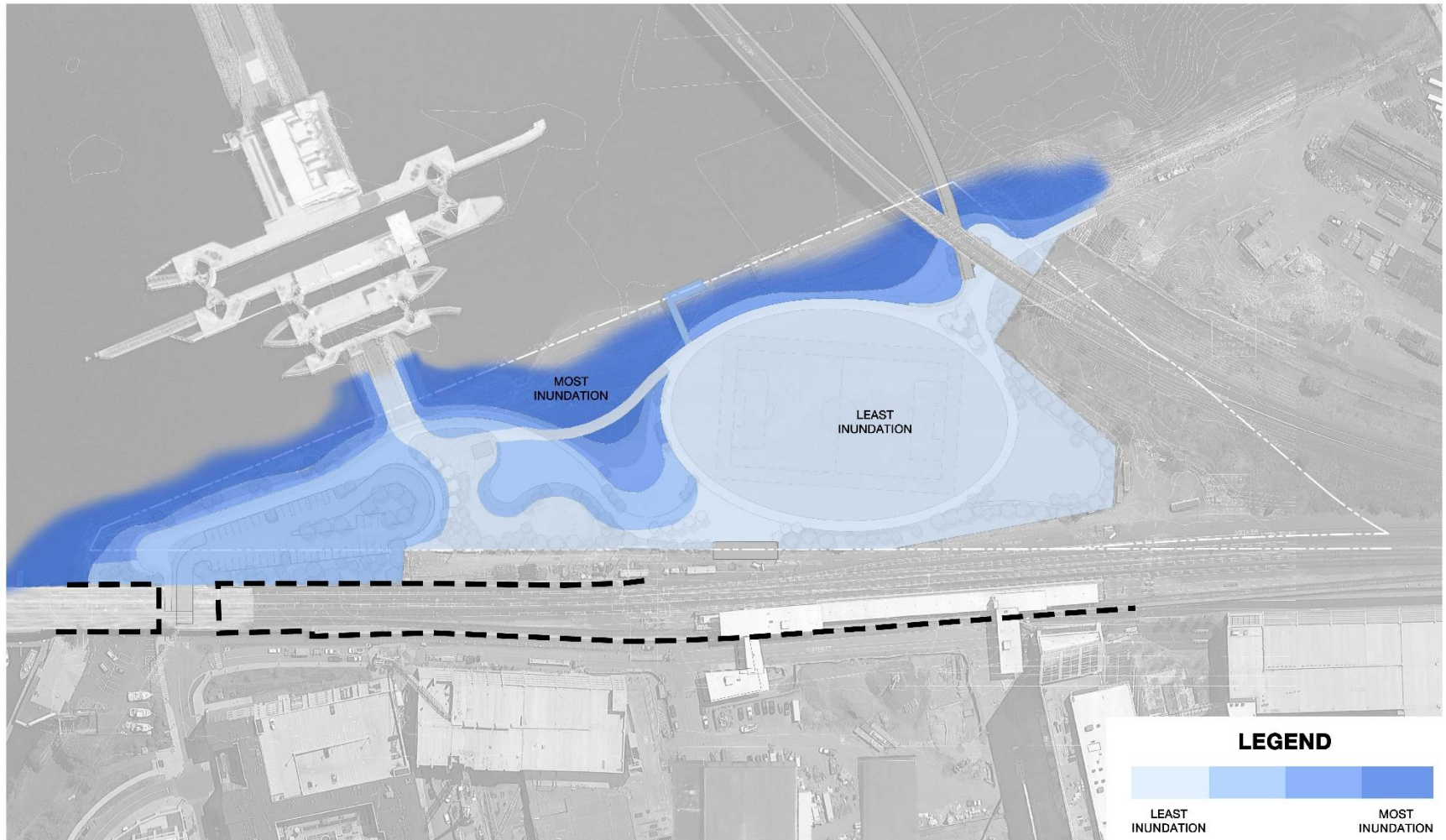
### DRAW SEVEN PARK

February 2018



# Landscape Design to Accommodate Water

## Draw Seven Park, Somerville – Flooded Conditions

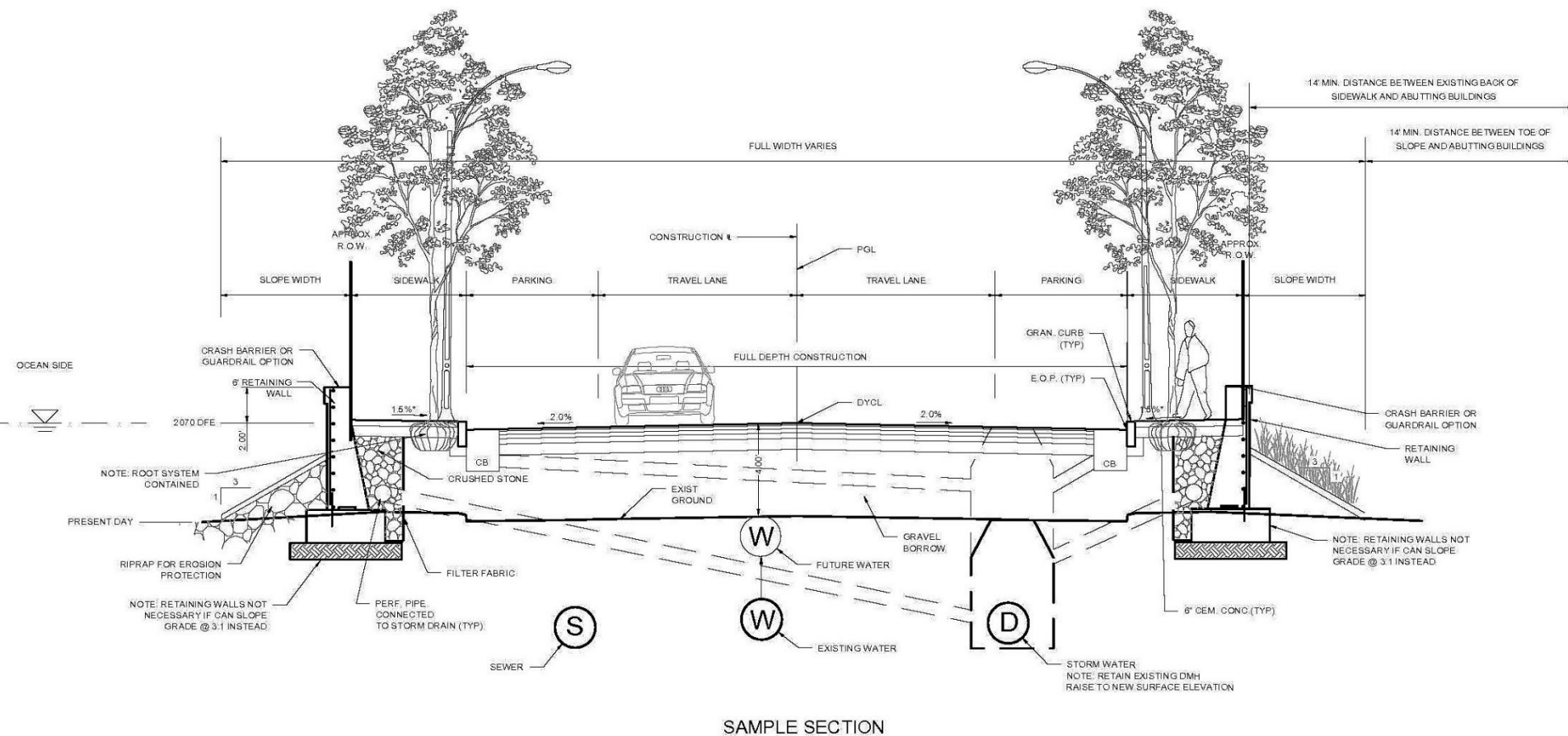


CONCEPT #1 - INUNDATION DIAGRAM

### DRAW SEVEN PARK

February 2018

# Raised Roadways





# Retrofitted Floodproof Doorways



# Re-evaluate Local Regulations & Policies

## BROOKLINE MUNICIPAL VULNERABILITY PREPAREDNESS (MVP) ACTION PROJECT

town of brookline, massachusetts



Weston & Sampson will audit the Town of Brookline's stormwater, floodplains, zoning bylaws, public way design guidelines, wetlands bylaws, and Department of Public Works' Site Plan Review Checklist to identify opportunities to mandate higher standards for climate resiliency and to identify any conflicts these standards might have with State policy. Our approach is centered around the promotion of nature-based solutions and strategies such as green infrastructure, low impact development (LID), open space protection, and floodplain protection. The project is funded by a Municipal Vulnerability Preparedness Action Grant from the Massachusetts Executive Office of Energy & Environmental Affairs.

Weston & Sampson will identify opportunities for incorporating standards into the Town of Brookline's bylaws and other planning instruments to increase the town's resilience against the effects of climate change, including increased temperatures as well as increased precipitation frequency/intensity and associated flooding. Implementation of this project will help to reduce risk of climate change impacts to public infrastructure, private property, natural resources, and human safety and welfare. The project's specific recommendations for bylaw amendments as well as sustainability standards for site plan review will be targeted at new and renovated projects across all building sectors: residential, multifamily and affordable housing, commercial, and institutions.

Weston & Sampson's deliverables, identified as priority action items in the town's "Climate Vulnerability Assessment," will include: recommendations for new or amended town bylaws and regulations mandating LID measures, LID Best Management Practices - narrative and Site Plan Review checklist - that targets owners and developers of new and renovated residential, multifamily, and commercial properties, and assists in educating them of the overall benefits to the environment and the value in protecting their properties from climate change impacts. The standards and checklists will serve as imperative components of the "Site Plan Review" ordinance that the town will be adopting and are intended to limit storm and flood damage, mitigate stormwater runoff, reduce impervious surfaces, and improve ecosystem resiliency.

- convene a core team of leaders from departments, boards, and commissions
- review existing By-laws
- conduct literature review of examples from other municipalities
- develop and evaluate alternatives
- develop draft recommendations; workshop them with town's Boards, Commissions, and Departments.
- develop final recommendations and assist with preparation of package to town meeting
- conduct community outreach

### client contact

Maria Morelli  
Senior Planner,  
Climate Action/Land Use  
Town of Brookline  
Department of Planning &  
Community Development  
mmorelli@brooklinema.gov  
617-730-2670



A photograph of a street scene on a foggy day. The street is wet and has patches of snow. On the left, there is a construction site with a wooden fence and a sign that reads "Black Diamond Project". A "DO NOT ENTER" sign is visible on the left side of the street. On the right, there are buildings, including a two-story building with a red awning and a sign that reads "Carmelo Pizza & Pasta". Below the awning, there are signs for "CHICKEN FINGERS" and "ITALIAN SAUSAGE". A set of stairs leads up to the second floor of the building. The text "15-Minute Break!" is overlaid in the center of the image.

# 15-Minute Break!

A yellow John Deere 544J front loader is shown in the process of dumping a large pile of sand onto a wet, muddy street. The loader is positioned in front of a building with a brick and wood-paneled facade and a balcony. In the background, other commercial buildings and a utility pole are visible under an overcast sky.

# Define Community Actions





# Identify Priority Actions







# Wrap-up & Closing Remarks

# thank you

[westonandsampson.com](http://westonandsampson.com)







## APPENDIX C

### Participant Matrices

Table 1

Table 2

Table 3

Table 4

Table 5

Final Matrix, Page 1

Final Matrix, Page 2





TABLE #2

| Community Resilience Building Risk Matrix                                                             |                                  |                           |                           |                                                                                                                    |                                                                                                                                            | www.CommunityResilienceBuilding.org                  |                                                                             |                       |                                                |  |
|-------------------------------------------------------------------------------------------------------|----------------------------------|---------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------|------------------------------------------------|--|
| H-M-L priority for action over the Short or Long term (and Ongoing)<br>V = Vulnerability S = Strength |                                  |                           |                           | Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |                                                                                                                                            |                                                      |                                                                             |                       |                                                |  |
|                                                                                                       |                                  |                           |                           | SLR, COASTAL STORM SURGE, EROSION                                                                                  | EXTREME PRECIPITATION (LOTS OF RAIN AND DROUGHT)                                                                                           | EXTREME STORMS - WIND, ICE, NOR'EASTERS              | EXTREME TEMPERATURES                                                        | Priority<br>H - M - L | Time<br>Short Long Ongoing                     |  |
| Features                                                                                              | Location                         | Ownership                 | V or S                    |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             |                       |                                                |  |
| Infrastructural                                                                                       |                                  |                           |                           |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             |                       |                                                |  |
| ROADS (STATE, LOCAL, ETC. BEACH ROAD, ROUTE 1A, FERRY ROAD)                                           | TOWN                             | STATE, LOCAL, PRIVATE     | V                         | RAISED ROADS, ALTERNATIVE TRANSPORTATION OPTIONS                                                                   | ALTERNATIVE TRANSPORTATION OPTIONS, INFRASTRUCTURE UPDATES                                                                                 | MAINTENANCE, ROAD/STORM SERVICES (PLOWING, SAND)     | SALT + SAND (ROAD TREATMENT) AND MAINTENANCE                                | H                     | O-MAINTENANCE, L-RAISED ROADS, S-STUDIES       |  |
| UTILITIES                                                                                             | TOWN                             | PRIVATE, TOWN, STATE      | V                         | STUDIES (GPS), \$, MAINTENANCE, QUICK RESPONSE FROM UTILITY COMPANIES                                              | MAINTENANCE, \$, ALTERNATIVE TECHNOLOGY (RAIN COLLECTION), ALTERNATIVE PRODUCTS (MICROGRID), UPDATING EXISTING (PUT UTILITIES UNDERGROUND) | MAINTENANCE, \$                                      | MAINTENANCE, \$                                                             | H                     | S-RESPONSE, O-MAINTENANCE, L-PLAN              |  |
| BUILDINGS, INCLUDING THE BEACH ENTERTAINMENT CENTER                                                   | TOWN                             | MUNICIPAL, STATE, PRIVATE | V/S (ONE SHELTER)         | RETREAT, ELEVATE, INCREASE PERMEABILITY, INCREASE DUNES, SAND MINING                                               | RETAIN WATER (BLUE ROOFS, RAIN BARRELS), RETROFIT BUILDINGS, WATER CAPTURE                                                                 | FLOOD SHIELDS, GENERATORS, ALTERNATIVE POWER SOURCES | SHADE, COOLING CENTERS, TREES                                               | H                     | S                                              |  |
| STATE RESERVATION                                                                                     | BEACH CAMPGROUND                 | STATE, LOCAL, PRIVATE     | V/S (DESTINATION AT-RISK) | NOURISHMENT, BEACH MANAGEMENT, EDUCATION, BIODIVERSITY, DEDICATED BEACH ACCESS, UPLAND FACILITY                    | WATER QUALITY MONITORING, OUTREACH, NOTIFICATION                                                                                           | MAINTENANCE                                          | MAINTENANCE, SHADE, COOLING CENTERS, VISITORS DURING STORMS ARE A LIABILITY | H                     | O                                              |  |
| BRIDGES, TIDE GATES                                                                                   | TOWN                             | STATE + MUNICIPAL         | V/S                       | STUDIES, MAINTENANCE, ALTERNATIVE ROUTES, REPLACEMENT                                                              | TIDE GATES: O&M PLAN                                                                                                                       | O&M PLAN                                             | FREEZING: O&M FOR TIDE GATES                                                | H                     | L-STUDY OPPORTUNITIES TO CHANGE INFRASTRUCTURE |  |
| COMMUNICATION                                                                                         | TOWN                             | TOWN, PRIVATE             | V/S (WIFI + FIBER)        | EMERGENCY RESPONSE, CLEAR MESSAGE, STUDIES (GPS), MAINTENANCE                                                      | UPDATING TECHNOLOGY                                                                                                                        |                                                      |                                                                             | H                     | S                                              |  |
| Societal                                                                                              |                                  |                           |                           |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             |                       |                                                |  |
| ELDERLY POPULATIONS                                                                                   | TOWN                             | PRIVATE, MUNICIPAL, STATE | V/S (LOCAL KNOWLEDGE)     | EVACUATION PLAN AND INFRASTRUCTURE, NOTIFICATION, SHELTERS, \$                                                     | ALTERNATIVE WATER SOURCES                                                                                                                  | ROAD ACCESS TO BEACH                                 | SHADE, TREE PLANTING                                                        | H                     | O                                              |  |
| LOW INCOME COMMUNITIES                                                                                | TOWN                             | PRIVATE, MUNICIPAL, STATE | V                         |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             | H                     |                                                |  |
| TRANSIENT POPULATIONS (RENTERS, HOMELESS, LIVING IN A CAMPGROUND OR MOTEL)                            | TOWN                             | PRIVATE                   | V                         |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             | H                     |                                                |  |
| TOURISM                                                                                               | TOWN                             | STATE, LOCAL, PRIVATE     | S                         |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             | H/M                   |                                                |  |
| MUNICIPAL SERVICES (FIRE, POLICE)                                                                     | TOWN                             | MUNICIPAL                 | S                         | PROTECT THE BUILDINGS, STAFFING, TRAINING, EQUIPMENT, GENERATORS, COMMUNICATION                                    |                                                                                                                                            |                                                      |                                                                             | H                     |                                                |  |
| CHILDREN                                                                                              | TOWN                             | N/A                       | S/V (THEY'RE THE FUTURE)  | PLAN, NOTIFY, SHELTERS                                                                                             |                                                                                                                                            |                                                      |                                                                             | H                     |                                                |  |
| Environmental                                                                                         |                                  |                           |                           |                                                                                                                    |                                                                                                                                            |                                                      |                                                                             |                       |                                                |  |
| BEACH, MARSH, OCEAN                                                                                   | EASTERN SIDE                     | STATE, TOWN, PRIVATE      | S/V                       | PRESERVATION, BOULDERS/SEAWALL, \$ FOR NOURISHMENT, MANAGEMENT PLAN                                                | BIODIVERSITY, DROUGHT-RESISTANT PLANTS, MONITOR FIRE RISK                                                                                  | NOURISHMENT, PROTECT THE DUNES (1ST LINE OF DEFENSE) | BIODIVERSITY                                                                | H                     | O/L                                            |  |
| RIVER                                                                                                 | TOWN, SOUTHERN BORDER            | MUNICIPAL, PRIVATE        | S/V                       | POTENTIAL ADDITIONAL SEAWALL, NOURISHMENT, RETREAT                                                                 | WATER CONSERVATION, EDUCATION, NOTIFICATION, OUTREACH, DREDGING                                                                            | N/A                                                  | MONITORING AND NOTIFICATION                                                 | L/H                   | S/L (EVACUATION ROUTE)                         |  |
| FOREST                                                                                                | TOWN                             | PRIVATE, MUNICIPAL, STATE | S/V                       | N/A                                                                                                                | ALTERNATIVE WATER SOURCE, MAINTAIN TRAILS, OUTREACH                                                                                        | TRAINING, MAINTENANCE                                | RISK, NOTIFICATION, EQUIPMENT                                               | M                     | L                                              |  |
| WATER (AQUIFER, WELLS)                                                                                | TOWN (WESTERN SIDE FOR AQUIFERS) | MUNICIPAL, PRIVATE        | S/V                       | N/A                                                                                                                | ALTERNATIVE SOURCES, PLANNING, SURVEYING, \$, MONITOR IMPERVIOUS                                                                           | GENERATORS, MAINTENANCE, EMERGENCY PREPAREDNESS      |                                                                             | H                     | O/L                                            |  |
| FARMLAND                                                                                              | WESTERN SIDE                     | PRIVATE                   | S/V                       | N/A                                                                                                                | ALTERNATIVE IRRIGATION                                                                                                                     | PROTECTING INFRASTRUCTURE                            |                                                                             | M/H                   | L                                              |  |
| UPLAND WETLANDS (BVW)                                                                                 | TOWN                             | PRIVATE                   | S/V                       | N/A                                                                                                                | ENFORCEMENT, LOCAL REGULATIONS, EDUCATION                                                                                                  |                                                      |                                                                             | H                     | O                                              |  |



TABLE #3

| Community Resilience Building Risk Matrix                                                                 |                   |               |        | www.CommunityResilienceBuilding.org                                                                                |                                                      |                                              |                                                   |                       |                               |
|-----------------------------------------------------------------------------------------------------------|-------------------|---------------|--------|--------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------|---------------------------------------------------|-----------------------|-------------------------------|
|                                                                                                           |                   |               |        | Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |                                                      |                                              |                                                   |                       |                               |
| H - M - L priority for action over the Short or Long term (and Ongoing)<br>V = Vulnerability S = Strength |                   |               |        | SLR, Coastal Surge,<br>Erosion                                                                                     | Extreme Precip,<br>Drought                           | Extreme Storms                               | Temp                                              | Priority<br>H - M - L | Time<br>Short Long<br>Ongoing |
| Features                                                                                                  | Location          | Ownership     | V or S |                                                                                                                    |                                                      |                                              |                                                   |                       |                               |
| <b>Infrastructural</b>                                                                                    |                   |               |        |                                                                                                                    |                                                      |                                              |                                                   |                       |                               |
| Beach Road + other at-risk roads ●●                                                                       | Townwide          | State + town  | V      | Study to evaluate at-risk roads + evacuation routes ●                                                              |                                                      | Raise roads ●●                               |                                                   | H                     | L                             |
| Evacuation Routes ●●                                                                                      | Flood-prone Areas | "             | V      | Plan + model, set priorities                                                                                       | Plan/model/study areas, set priorities, em. response | Model/study, set priorities for em. response |                                                   | H                     | O                             |
| Wastewater Infrastructure (and on-site systems) ●                                                         | Townwide          | Town, private | V      | Expand/upgrade sewer, find funding                                                                                 |                                                      | Plan for resiliency (flooding plant)         |                                                   | H                     | L                             |
| Wells ●●                                                                                                  | TW                | "             | V      | Upgrade for saltwater intrusion                                                                                    | Find new sources                                     | ●                                            | Same as drought                                   | M                     | O                             |
| Shelter ●                                                                                                 | Center            | Town, private | V      |                                                                                                                    |                                                      | Need generator, increase capacity,           | Generator                                         | H                     | S                             |
| Power Supply/Infrastructure                                                                               | TW                | Private       | V      | Protect utilities from erosion                                                                                     |                                                      | Explore redundancy ●                         | Explore alternative sources                       | M                     | L                             |
| <b>Societal</b>                                                                                           |                   |               |        |                                                                                                                    |                                                      |                                              |                                                   |                       |                               |
| Commercial Economic Vulnerability                                                                         | TW                | Private       | V      | Education/funding for resiliency                                                                                   |                                                      |                                              |                                                   | M                     | S/L                           |
| Shelter Accessibility                                                                                     | TW                |               | V      | Emergency transport, Communication system, Planning                                                                | → ●                                                  |                                              |                                                   | H                     | O                             |
| Transient/Homeless Population                                                                             | TW                |               | V      | " →                                                                                                                |                                                      |                                              |                                                   | H                     | O                             |
| Elderly/Low-Income Population ●                                                                           | TW                |               | V      | " →                                                                                                                |                                                      |                                              |                                                   | H                     | O                             |
| Agriculture                                                                                               | TW                | Private       | V      | Preservation, tax subsidies                                                                                        | Adaptation planning techniques                       |                                              | Adaptation planning techniques                    | M                     | O                             |
| Public Health (vector + microbe) ●                                                                        | TW                |               | V      | Education                                                                                                          | Mosquito Control                                     | Warning system for sewer overflows           | Mosquito control                                  | H                     | O                             |
| <b>Environmental</b>                                                                                      |                   |               |        |                                                                                                                    |                                                      |                                              |                                                   |                       |                               |
| Invasive Species (degradation of natural areas) ●●                                                        | TW                |               | V      | Restoration ● → ●                                                                                                  |                                                      | Identify + elim. restrictions                |                                                   | H                     | O                             |
| Loss of Salt Marsh ●●                                                                                     | TW                |               | V      | Restoration                                                                                                        |                                                      | Id + eliminate restrictions                  |                                                   | H                     | O                             |
| Saltwater Intrusion                                                                                       | TW                |               | V      | Study + monitor                                                                                                    |                                                      |                                              |                                                   | L                     | L                             |
| Loss of Beach ●                                                                                           | Coastal           | State         | V      | Regular beach nourishment + vegetation. Grants for house raising/buoyancy ●●                                       | Diversity of vegetation (dune) ●                     | Education/outreach                           | Public/private partnership to restore beach/dunes | H                     | S                             |
| Aquifer                                                                                                   | TW                |               | V      | Expand sewer → ●                                                                                                   |                                                      |                                              | Promote water conservation                        | H                     | L                             |
| Overwash ●                                                                                                | Coastal           | State + town  | V      | Protection for existing infrastructure ●                                                                           |                                                      | Coordinate Response                          |                                                   | H                     | S                             |





TABLE #5

| Community Resilience Building Risk Matrix                                                             |              |                                 |        | www.CommunityResilienceBuilding.org                                                                                |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
|-------------------------------------------------------------------------------------------------------|--------------|---------------------------------|--------|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-----------------------|----------------------------|
|                                                                                                       |              |                                 |        | Top Priority Hazards (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.) |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| H-M-L priority for action over the Short or Long term (and Ongoing)<br>V = Vulnerability S = Strength |              |                                 |        | Extreme Temperatures                                                                                               | Extreme Storm Events                                                                                                                                                                                                                                                  | Storm Surge / Erosion / Flooding (Coastal Surge)                                                         | Extreme Precipitation                                                                                 | Priority<br>H - M - L | Time<br>Short Long Ongoing |
| Features                                                                                              | Location     | Ownership                       | V or S |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| <b>Infrastructural</b>                                                                                |              |                                 |        |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| Well Water ●●●                                                                                        | inland       | town                            | V      |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          | Drought: investigate new areas for more wells in new aquifer, renegotiate price for interconnections. |                       |                            |
| Water Tanks                                                                                           | town-wide    | "                               | V      |                                                                                                                    | Wind: increase tree maintenance around trunk                                                                                                                                                                                                                          |                                                                                                          |                                                                                                       | M                     |                            |
| Underground Utilities ●                                                                               | "            | town, gas/telephone are private | V      | Obtain + maintain redundant generators, to continue to use pumpstations. Replace eroding pipes in coastal areas.   |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       | H                     | O/S                        |
| Roadways/Public Safety Access ●●●                                                                     | "            | "                               | V      |                                                                                                                    | Beach Road, Bridge Road, Ferry Road, NEB, Liberty Street, 1st, March. Investigate flooding solutions + present findings to state. Investigate feasibility of raising town-owned roads. Invest in boats/train water search + rescue/have access to high water vehicles |                                                                                                          |                                                                                                       | H                     | L                          |
| Municipal Buildings                                                                                   | "            | "                               | V      | Continue HMGP Application process                                                                                  |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       | S                          |
| Residential/Commercial                                                                                | "            | Private                         | V      |                                                                                                                    | Stay active in CRS + require compliance with ordinance                                                                                                                                                                                                                |                                                                                                          |                                                                                                       |                       |                            |
| <b>Societal</b>                                                                                       |              |                                 |        |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| Senior Housing / Asst. Living ●                                                                       | inland       | Private                         | V      | increase communication, increase evacuation potential/plan, ensure power is maintained                             |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       | H                     |                            |
| Elementary Students                                                                                   | "            | Triton                          | V/S    |                                                                                                                    | create evacuation plan in conjunction with town's current HMP, fortification or evacuation                                                                                                                                                                            |                                                                                                          |                                                                                                       | H                     |                            |
| Boys + Girls Club                                                                                     | "            | Private                         | V/S    |                                                                                                                    | "                                                                                                                                                                                                                                                                     |                                                                                                          |                                                                                                       | H                     |                            |
| Farm animals / pet daycare / feline                                                                   | "            | Private                         | V      |                                                                                                                    | increase shelter space to accommodate a room for pets                                                                                                                                                                                                                 |                                                                                                          |                                                                                                       | L                     |                            |
| Shelter / COA ●●                                                                                      | "            | Town                            | V/S    | Obtain + maintain a generator. Currently used as a cooling station                                                 | Create mass evacuation plan, increase accessibility + resources                                                                                                                                                                                                       |                                                                                                          |                                                                                                       | H                     |                            |
| Low + Moderate Income Housing                                                                         | "            | Private, YWCA                   | V      |                                                                                                                    | Create evacuation plan in conjunction w/ HMP                                                                                                                                                                                                                          |                                                                                                          |                                                                                                       | H                     |                            |
| <b>Environmental</b>                                                                                  |              |                                 |        |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| Beach/Shoreline ●                                                                                     | shoreline    | state                           | V/S    |                                                                                                                    |                                                                                                                                                                                                                                                                       | beach nourishment to replenish eroding dunes                                                             |                                                                                                       |                       |                            |
| Aquifer                                                                                               | inland       | town                            | V      |                                                                                                                    |                                                                                                                                                                                                                                                                       | Investigate zoning to prevent development around aquifer. Collaborate w/ Seabrook to drain less from it. |                                                                                                       |                       |                            |
| Trails / Parks ●                                                                                      | town-wide    | state/town                      | V/S    |                                                                                                                    |                                                                                                                                                                                                                                                                       | experiment with different water levels to see impacts of flooding gate                                   |                                                                                                       |                       |                            |
| Agriculture                                                                                           | inland       | private                         | V      | Continue Agricultural Commission engagements. Create educational program on shortened season.                      |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| Forest / Trees                                                                                        | inland       | private/town                    | V/S    |                                                                                                                    |                                                                                                                                                                                                                                                                       |                                                                                                          |                                                                                                       |                       |                            |
| River                                                                                                 | inland/beach | state/town                      | V      |                                                                                                                    |                                                                                                                                                                                                                                                                       | contract with river clean up groups (Clean River Project)                                                |                                                                                                       |                       |                            |



**Top Priority Hazards** (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

[illegible]



## Community Resilience Building Risk Matrix



**Top Priority Hazards** (tornado, floods, wildfire, hurricanes, earthquake, drought, sea level rise, heat wave, etc.)

[illegible]

APPENDIX D

Annotated Maps from Participants









FIGURE 1

TOWN OF SALISBURY

HAZARDS AND RESOURCES

OCTOBER 2018 SCALE: NOTED

Weston & Sampson





FIGURE 1

TOWN OF SALISBURY

HAZARDS AND RESOURCES

OCTOBER 2018

SCALE: NOTED

Weston & Sampson



**APPENDIX E**

**Core Team Meeting Notes**

Meeting September 5, 2018  
Meeting September 26, 2018  
Meeting: November 29, 2018



Town of Salisbury  
Municipal Vulnerability Preparedness (MVP) Planning Grant Project  
Core Team Meeting Notes  
Wednesday, September 5, 2018  
10:00 am – 11:30 am

**Attendance**

Salisbury

Neil Harrington, Town Manager  
Lisa Pearson, Project Manager and Planning  
Lisa DeMeo, Public Works  
Michelle Rowden, Conservation  
Scott Vandewalle, Building  
Robert Cook, Emergency Management  
Scott Carrigan, Fire

Weston & Sampson

Chris Perkins, Principal in Charge  
Kathy Baskin, Project Manager

**Discussion**

MVP Program Overview (Kathy)

- Year 1: MVP Planning Grant Process
  - 70+ municipalities in 2017-2018
  - 80+ municipalities in 2018-2019
  - Municipal and stakeholder driven process
  - 8-hour Community Resiliency Building Workshop to identify strengths, vulnerabilities and strategies
  - Development of Risk Matrix to identify Key Actions
- Year 2 and beyond: MVP Action or CZM Resiliency Grant
  - Implementation of Key Actions
  - MVP program ties into other funding programs; MVP certified communities receive extra points awarded on other EEA grant/loan applications
  - Discussed CZM Coastal Resiliency Grant application and other funding sources
  - Ferry Road does not have a sufficient Benefit Cost Ratio to qualify for FEMA funds
  - Senior Center needs up to date shelter code

Core Team Role (Kathy)

- Core Team defines goals and develops schedule
- Organizes implementation of the Community Resilience Building Workshop
- Determines how information and decisions from Workshop will be used
- Reviews recommendations and prioritizes Action Items

Define Project Goals

- Items to consider when developing goals:

- Need to increase the level of understanding of people who are affected by coastal surge that other areas of town are also of concern (Ferry Road/March Road, Ring's Island area) (Michelle)
- Impacts of climate change are not limited to flooding and erosion, but also include precipitation and temperature (droughts and high temperatures affect framers and local wells and contribute to wildfire risk)
- Flooding is directly related to the physical characteristics of the town (ocean and marsh); infrastructure was constructed without consideration of vulnerability from flooding (Neil)
- This situation affects the Town's ability to access people who do not have power; residents are at risk, road access is limited,
- Along Beach Road, can get 4 to 6 feet of flooding twice yearly; need to keep emergency apparatus on the beach.
- Ferry Road and Ring's Island become isolated during flooding.

#### Community Resilience Building Workshop

- Components of the Workshop are:
  - Provide an overview of climate projections
  - Use of large map depicting key resources, assets and infrastructure
  - Discussion of strengths and vulnerabilities
  - Prioritization of key actions
  - Use of the Risk Matrix to organize ideas

#### Data Needs and Sources

- Reports and materials previously identified by Weston & Sampson
  - Merrimack Valley Region Multi-Hazard Mitigation Plan Update (2016)
  - Great Marsh Coastal Adaptation Plan (2017)
  - Salisbury Master Plan (2008)
  - Town of Salisbury- 2012/2013 Community Development Strategy (<https://www.salisburyma.gov/sites/salisburyma/files/file/file/caccommunitydevelopmentstrategy.pdf>)
  - Salisbury Master Plan Volume 1: Existing Conditions and Trends, February 2008 ([https://www.salisburyma.gov/sites/salisburyma/files/file/file/pbmasterplan\\_volume1existing.pdf](https://www.salisburyma.gov/sites/salisburyma/files/file/file/pbmasterplan_volume1existing.pdf))
  - Salisbury Master Plan Volume 2: Implementation Plan, October 2008 ([https://www.salisburyma.gov/sites/salisburyma/files/file/file/pbmasterplan\\_volume2implementation.pdf](https://www.salisburyma.gov/sites/salisburyma/files/file/file/pbmasterplan_volume2implementation.pdf))
- Additional reports and materials
  - Emergency operation plan (Bob to provide)
  - DCR's Salisbury Beach Management Plan (2008) (<https://www.mass.gov/files/documents/2016/08/pf/salb-mgt-plan-final-sept-2008-text-only.pdf>)
  - Town of Salisbury Harbor Plan – Phase 1 ([https://scholarworks.umb.edu/uhi\\_pubs/8/](https://scholarworks.umb.edu/uhi_pubs/8/))
  - Open Space Plan (recently updated)
  - Draft Tree Management Plan
  - Water System Master Plan (10 years old)



### List of Workshop Attendees

- Lisa Pearson has developed a preliminary list of invitees for the Workshop
- List will be screened and narrowed; Lisa will assign contact information to the invitees

#### ***Municipal Staff***

Neil Harrington  
Lisa DeMeo  
Tom Fowler  
Scott Carrigan  
Scott Vandewalle  
Bob Cook  
Michelle Rowden  
Lisa Pearson  
Bart  
Jack  
Liz Pettis

Citizens for Change  
Marist Center  
Sheriff's office  
Merrimack Valley Planning Council  
Politicians offices (if they are interested)  
Rings Island Water  
Rings island taxpayers (Jerry)  
Coastal Trails  
PTA  
Storm Surge  
CZM  
DCR  
Realtors

#### ***Volunteers***

Selectmen  
Planning Board  
Board of Health  
Conservation Commission  
ZBA  
Agricultural Board  
Kristine Harrison

Local Engineers/Architects  
Nuke plant?  
MEMA  
Eric Hutchins, NOAA  
Eric Durluth, US Fish & Wildlife Service  
Ed Reiner (EPA)  
Georgeann (DER)  
US Army Corps of Engineers  
MRBA

#### ***Local Builders***

Steve Paquette  
Ben Leggairs  
Dan Gelinis

Parker River Watershed Association  
Kristen Grubs (Ipswich River)  
Seabrook Water  
DOT

#### ***Outside groups***

Pettengill House  
Boys and Girls Club  
Assisted Living  
Housing Authority  
Beach Betterment  
Chamber  
Beach Partnership

Rocky Morrison (Clean Rivers Project)  
Blue ocean society  
Greg Moore (UNH)  
Merrimack River Watershed Council  
YWCA  
Housing Authority  
Amesbury Emergency Management (Amesbury  
Fire Chief)

### Stakeholder Survey

- Weston & Sampson will prepare and administer a survey to solicit more in-depth input from stakeholders prior to Workshop

### Schedule

- All day Workshop on a weekday from 8:00 am to 4:00 pm
- Tentatively set for October 10, 2018
- If that does not work with the Police Chief and Town Manager, Kathy Will send out Doodle Poll

***Salisbury Action Items:***

- Determine date of Workshop
- Finalize list of invitees; send invitation and track RSVPs (W&S could send and track RSVPs, if desired)
- Provide information/data sources:
  - Emergency operation plan (Bob to provide)
  - Town of Salisbury Harbor Plan – if there are other phases besides Phase 1
  - Open Space Plan (updated)
  - Draft Tree Management Plan
  - Water System Master Plan

***W&S Action Items:***

- Send project goal ideas to Lisa
- Prepare survey questions for SurveyMonkey-type survey to Workshop invitees
- Draft invitation to Workshop invitees
- Review list of additional information, request those reports/sources that are not available online

Next Meeting September 26, 2018 at 10:00 am



Town of Salisbury  
Municipal Vulnerability Preparedness Planning Grant Project  
Wednesday, September 5, 2018, 10:00 am – 12:00 pm  
Core Team Meeting Sign-In Sheet

| Name             | Affiliation      | Email Address                                     |
|------------------|------------------|---------------------------------------------------|
| Kathy Baskin     | Weston + Sampson | baskink@wseinc.com                                |
| Michelle Rowden  | Conservation     | Conservation@ <del>governor</del> salisburyma.gov |
| Lisa Pearson     | Planning         | Lpearson@salisburyma.gov                          |
| Scott Vandewalle | Building         | bldginsp@salisburyma.gov                          |
| Neil Harrington  | Town Manager     | nharrington@salisburyma.gov                       |
| Robert Cook      | EMD              | sema@salisburyma.gov                              |
| Scott Carrigan   | Fire Chief       | scarrigan@salisburyma.gov                         |
| CHRIS PERKINS    | WESTON & SAMPSON | perkinsc@wseinc.com                               |
| LISA DEMEO       | DPW              | ldemco@salisburyma.gov                            |
|                  |                  |                                                   |
|                  |                  |                                                   |
|                  |                  |                                                   |
|                  |                  |                                                   |

Town of Salisbury  
Municipal Vulnerability Preparedness (MVP) Planning Grant Project  
Core Team Meeting Notes  
Wednesday, September 26, 2018  
10:00 am – 11:30 am

**Attendance**

Salisbury

Neil Harrington, Town Manager  
Lisa Pearson, Project Manager and Planning  
Lisa DeMeo, Public Works  
Michelle Rowden, Conservation  
Scott Vandewalle, Building  
Robert Cook, Emergency Management

Weston & Sampson

Kathy Baskin, Project Manager

**Discussion**

Workshop

The Community Resilience Building Workshop is scheduled for October 10, 2018 from 8:30 am to 4:30 pm in the Selectmen's room at Salisbury Town Hall.

Workshop Participants

Lisa Pearson and her staff have sent out invitations to the Workshop. The Core Team discussed the list and verified that specific people or entities were invited (such as the Harbor Master).

Lisa and Kathy will coordinate next week on the list of Invitees and RSVPs. The group discussed sending an email confirmation with date, time, location, and other logistics to those who have accepted the invitation. We could also send the online survey to participants. Outreach to participants prior to the CRB Workshop will depend on whether there is available time to allow for meaningful input between their RSVPs and the Workshop date. We will want to make table assignments to those

**Salisbury Action Item:** Call invitees who have not responded, finalize list of participants, email survey, and make table assignments.

**W&S Action Item:** Follow up with Salisbury on RSVPs, coordinate on table assignments

Workshop Materials

- Draft Agenda: Kathy reviewed the general schedule of the workshop describing the sequence of events.
  - Draft Powerpoint: The Core Team reviewed the draft workshop presentation which includes existing hazards, existing climate change, climate change projections, features that will be vulnerable or offer strength to the community under climate change, and types of actions that can be taken to alleviate impacts. Comments included:
  - We want to be sure that the presentation is lively and engages the participants so they don't get sleepy or distracted.



- It is important to educate people about climate change impacts; unfortunately, a big storm can be the best educator.
- Michelle gave an example of a 2015 Nor'easter during which a neighborhood was hit hard. Two houses had been connected by a wall that directed the water in a way to caused scour around the foundations. This went on until the water punched through the wall. The homeowners were educated and now understand that the wall contributed greatly to the damage of 4 to 5 homes.
- Bob mentioned that the cooling center was used this summer.
- Bob and Lisa DeMeo offered to give anecdotes about impacts/threat to people, buildings, and infrastructure.
- Lisa DeMeo offered to send relevant photos to Weston & Sampson from Town for CRB Slide Show
- Draft GIS Map for Discussion: The Core Team reviewed the large GIS map of the assets and vulnerabilities. Suggestions included:
  - Make colors less similar (light blue and aqua, for example) so they do not blend together, making areas hard to distinguish
  - Use hatching
  - Make font size of labels larger
  - Separate out information into two maps
  - Kathy asked for locations of mobile home parks and low-income housing areas

**W&S Action Item:** Finalize Workshop materials based on Core Team input

**Salisbury Action Item:** Help to fill mapping gaps related to community assets, vulnerabilities

#### Workshop Staffing

- Weston & Sampson will provide five table facilitators for the Workshop
- The Town of Salisbury will identify five table scribes/note-takers for Workshop from Town

**Salisbury Action Item:** Identify five table note-takers

#### Other

- Lunch: Lisa and Kathy developed a list of food and beverages for morning and afternoon snacks and lunch.
- Room Logistics
  - Kathy would like to tour the meeting space in advance to note locations of electrical outlets, locate tables and chairs, and decide on room configuration.
  - Weston & Sampson will bring laptops and projector. There is a screen in the room.
- The group discussed possible outreach to the local press by Town officials. Lisa P will look into this.

## TOWN OF Salisbury

[illegible]





Town of Salisbury  
Municipal Vulnerability Preparedness Planning Grant Project  
Core Team Meeting  
Wednesday, November 29, 2018  
10:00 am – 10:45 am

**Attendance**

Salisbury

Neil Harrington, Town Manager  
Lisa Pearson, Project Manager and Planning  
Lisa DeMeo, Public Works  
Scott Carrigan, Fire

Weston & Sampson

Kathy Baskin, Project Manager

**Discussion**

Review Draft Municipal Vulnerability Report and Priority Actions

- The Team reviewed a draft list of the Draft MVP Report's recommended Actions, which were developed during the October 10, 2018 Workshop
- The Team proposed revisions to the language, to remove redundant Actions and to ensure that the Actions represented the intent of Workshop participants
- Actions were reorganized slightly, to differentiate between Priority Actions and Other Actions.
- Weston & Sampson will make the suggested changes and send the revision to Lisa Pearson for distribution.
- The Core Team will provide comments on the draft report.
- The draft report will be made available to the public for public comment period associated with the Listening Session.

Public Listening Session

- The Core Team selected Monday, December 10, 2018 from 6:30 pm - 7:30 pm for the date and time of the Public Listening Session.
- The Town will post the draft report on its website and will provide a public comment period.

Proposed Listening Session Format

- Weston & Sampson reviewed a draft agenda for the Listening Session.
- The agenda will be revised to reflect the date and time selected for the meeting.



## Listening Session Guidance

Each community must complete at least one public listening session with the whole community invited and should have a clearly articulated list of priority next steps and actions and how to implement these.

General guidelines for (-60 min) MVP public listening sessions include:

- Schedule and post listening session using best practices or requirements for posting public meetings in the municipality
- Ensure listening session is open to the public in a central, easily accessible location in the municipality (city/town hall, public library, community center, etc.)
- Ensure that the core team is present and ideally elected officials
- Provide a speaker(s) to present an overview of the Summary of Findings Report
  - Speaker(s) should be from the core team members and/or elected official(s)
  - Service provider for the respective municipality should not be the principal speaker(s)
  - Speaker(s) to review purpose, intent, objectives, and outcomes of workshop process
- Provide a question and answer period for members of the concerned public
  - Core team member(s) and/or service provider(s) respectfully listen and record responses from public
  - Provide clarification about Findings
- Provide opportunity for members of the concerned public to contribute in writing further input at the listening session
- Provide web link to Summary of Findings report at the listening session

Acceptable alternative formats include:

- A public listening session can take place at a selectmen meeting only if they are open and promoted for public attendance, with similar allotment of time (-60 min) for the MVP listening session portion





Town of Salisbury  
Municipal Vulnerability Preparedness Planning Grant Project  
Public Listening Session  
Wednesday, September 26, 2018  
6:30 pm – 8:00 pm

Agenda

1. **Introductions** – Neil Harrington, Town Manager and Lisa Pearson, Project Manager and Planning Director
2. **MVP Program Overview** – Kathy Baskin, Weston & Sampson
3. **Summary of Findings Report and Priority Actions** – Kathy Baskin, Weston & Sampson and Lisa Pearson, Project Manager and Planning Director
4. **Questions and Answers** – All
5. **Conclusions** – Neil Harrington, Town Manager and Lisa Pearson, Project Manager and Planning Director



## TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

After listing vulnerabilities, hazards, and possible actions, participants ranked their recommendations from high to low priority. A summary of findings from the final group matrix is included below.

### 6.1 Highest Priority

- Protecting roads is a high priority item. Strategies could include designing alternative modes of transportation; training and emergency management planning; raising roads and protecting Beach Road, Ferry Road, and Route 1A. There should also be regular maintenance programs and work to improve drainage and reduce surface flooding.
- Providing and preparing shelters. This will require emergency transportation options, communication, planning, reliable power, adequate staffing and equipment, evacuation routes, and the materials and facilities needed to sustain evacuated residents.
- Protecting the beachfront. Strategies could include education and advocacy, maintaining dunes, a seawall, regular beach nourishment, and diversifying plant species.
- Protecting the Marsh by implementing strategies that eliminate restrictions, studying options for buffer protection and resilience, increasing biodiversity, and planting drought-resistant species.
- Protecting critical municipal facilities and services by implementing strategies that provide backup power to Town Hall, protecting other municipal buildings, and providing adequate staffing, and training.
- Protecting the State Reservation through beach nourishment, studies, O&M, tide gates, water quality monitoring, and shade.
- Protecting wells by seeking new water sources and protecting current water sources.

### 6.2 Moderate Priority

- Protecting businesses, like at the Salisbury Beach Center, by maintaining and creating dunes.
- Educating children to prepare the next generation to tackle climate change.
- Evaluating and studying the addition of tide gates.
- Proacting underground utilities like gas, water, and sewers through redundancy and back-up power.

### 6.3 Lower Priority

- Reliable power sources, including backup power and equitable access to facilities with power.
- Protecting buildings, including the Beach Entertainment Center. This could involve strategies including retreat, elevation, seawalls, dunes, sand mining, and increased permeable surfaces.
- Improved communication before, during, and after extreme events.
- Disaster management specific to tourism, including a tailored evacuation and notification plan, and protecting related infrastructure.
- Protecting aquifers and expanding sewers in critical areas.
- Preventing exposed utilities.