
# Coastal Vulnerability Assessment
# Brigantine City, NJ

May 2017

PARTNERS

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# Contents

# I. Project Introduction

As stated in the 2011 NJDEP document New Jersey's Coastal Vulnerability Assessment and Mapping Protocol, vulnerability is defined as "the degree of exposure and inability of a human or natural system to cope with the effects of a natural hazard, including changing variability and extremes in weather and climate."

This report aims to assess vulnerabilities to enable communities in the planning for future exposures and develop strategies for mitigating long-term risk, making communities more resilient. To do so, this report assesses community vulnerability to sea level rise projected for the year 2050 along with a category 1 hurricane storm surge.

## Figure 1: Range of Sea Level Rise Estimates (Miller et.al)

| | Sea-level rise (feet) | | |
|---|---|---|---|
| | Global | Bedrock | Shore |
| **2030 central** | **0.5** | **0.7** | **0.8** |
| 2030 low | 0.3 | 0.5 | 0.6 |
| 2030 high | 0.7 | 1.0 | 1.1 |
| 2030 higher | 0.9 | 1.2 | 1.4 |
| **2050 central** | **0.8** | **1.3** | **1.5** |
| 2050 low | 0.5 | 0.9 | 1.1 |
| 2050 high | 1.3 | 1.8 | 1.9 |
| 2050 higher | 1.6 | 2.1 | 2.3 |
| **2100 central** | **2.5** | **3.1** | **3.5** |
| 2100 low | 1.4 | 2.2 | 2.5 |
| 2100 high | 4.0 | 4.6 | 4.9 |
| 2100 higher | 4.6 | 5.5 | 5.9 |
| 2100 collapse | 8.7 | 9.7 | 10.1 |

Figure 1 illustrates the sea level rise range of estimates for 2030, 2050, and 2100. This publication calls for a central projection of 1.5 feet of sea level rise along the shore in 2050 and is the projection used in this report.

### Figure 2: Tide Gage Data (Miller et.al)

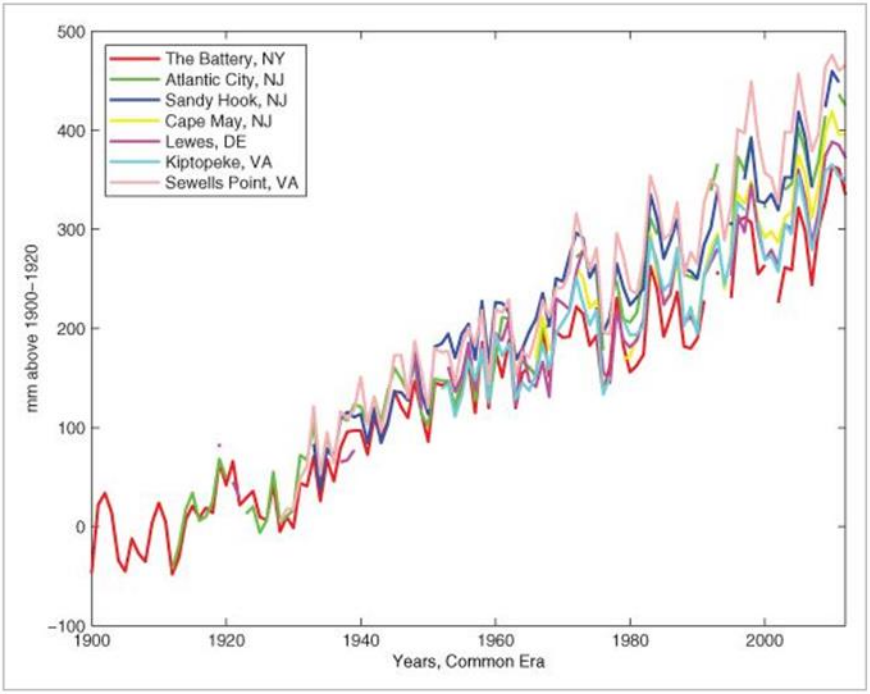



Figure 2 illustrates tide gage data taken along the Eastern seaboard from 1900 to past the year 2000. Miller et.al. attribute a higher rate of rise in the coastal plains to coastal subsidence and groundwater withdrawal and compaction.

Category 1 storm surge data was mapped using the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) data developed by the National Weather Service/NOAA to estimate storm surge heights resulting from historical, hypothetical, or predicted hurricanes, taking into account the atmospheric pressure, size, forward speed, and track data of storms.
According to the National Hurricane Center, Category 1 storm characteristics include:

- Sustained winds of 74-95 mph
- Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters.
- Large branches of trees will snap and shallow rooted trees may be toppled.
- Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.

## II. Community Profile

Brigantine City's is an island city with its boundary defined by the Somers Bay, Steelman Bay, Eagle Bay, Absecon Inlet, and the Atlantic Ocean. In total, the City has just above 6 sq. mi. of land. (Refer to Map #1)

According to the 2010 US Census, the population of Brigantine City was 9,450, making it the 9th most populated of 23 municipalities in Atlantic County. The City has a median household income of $62,212 and median age of 48.4 years. The racial makeup of the City is 87.33% white and 2.91% Black or African American.

Part of the Edward B. Forsyth national Wildlife Refuge is located on the northern end of the island and serves as crucial habitat to various species of endangered and threatened species.

### Image 1: Superstorm Sandy Breaching the Brigantine Boardwalk (Brigantinenow.com)

Data modeled by FEMA shows storm surge from Superstorm Sandy inundated much of the City with the exception of the vegetated area between the southern beach and developed area (Refer to Map 2).

FEMA has designated the vast majority of land in Brigantine City as Zone AE (Refer to Map 3). These areas are subject to inundation by the 1% annual-chance flood event, Base Flood Elevations (BFEs) are shown, and mandatory flood insurance purchase requirements and floodplain management standards apply. Additionally, land immediately adjacent to the water is designated as Zone VE, or coastal areas with a 1% or greater chance of flooding and an additional hazard associated with storm waves. These areas have a 26% chance of flooding over the life of a 30 year mortgage. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones

### Image 2: Beach Replenishment in Brigantine (USACE)

The US Army Corp. of Engineers completed a beach replenishment project designed to reduce damage from coastal storms in February 2013.

According to a zoning map obtained from ARC GIS Online created with data from the Atlantic County Department of Planning and Regional Development, the majority of the waterfront is zoned as Conservation and Wetlands, with residential and small commercial areas located inland. (Refer to Map #4)

# III. Municipal Coastal Vulnerability Assessment Methodology

The process for completing a CVA is generally done in three steps:

1. Identify Community Assets
2. Establish Vulnerabilities and Consequences
3. Recommendations

### *CVA Step 1: Identifying Community Assets*

When a CVA is completed, community assets from four general areas are indexed in a matrix and then used to support the development of asset mapping, identification of depth inundations, community-led findings, and eventual recommendations. These four asset areas include:

- **Community Resources**: Schools, shelters, storm-related retail, major employers, churches, food banks, etc.
- **Critical Infrastructure and Facilities**: Government operations, utilities, evacuation routes, emergency response
- **Natural and Ecosystem Resources**: Beaches, bayfronts, wetlands/critical habitat, parks
- **Vulnerable Sites and Populations**: Identifiable clusters of senior citizens, low income populations, limited English proficient populations, mobile home parks, contaminated/otherwise hazardous materials/sites

## Table 1. Community Assets

| Asset # | Name | Asset Category | Function |
|---|---|---|---|
| 1 | Absecon State Wildlife Management Area | Natural Areas/Ecological Assets | State Land |
| 2 | Ace Hardware | Community Resources | Storm-Related Retail |
| 3 | ACME Market | Community Resources | Supermarket |
| 4 | Bayside Marina | Community Resources | Marina |
| 5 | Bob's Marine | Community Resources | Marina/Gas Station |
| 5 | Brigantine Auto and Marine | Critical Facilities | Gas Station |
| 7 | Brigantine Beach Patrol | Community Resources | Municipal Operations |
| 8 | Brigantine Bible Church | Community Resources | Church |
| 9 | Brigantine Branch Atl Co Library | Community Resources | Municipal Operations |
| 10 | Brigantine Elementary School | Critical Facilities | School |
| 11 | Brigantine Elks Lodge | Community Resources | Elks Lodge |
| 12 | Brigantine Fire Dept | Critical Facilities | Fire |
| 13 | Brigantine Lighthouse | Community Resources | Local Attraction |
| 14 | Brigantine North Middle School | Critical Facilities | School |

| | | | |
|---|---|---|---|
| 15 | Brigantine Police | Critical Facilities | Police |
| 16 | Brigantine Public Works | Critical Facilities | Municipal Operations |
| 17 | Brigantine Sewer Lift/pump station | Critical Facilities | Utility |
| 18 | Community Presbyterian Church | Community Resources | Church |
| 19 | Deebold Boat Yard | Community Resources | Marina |
| 20 | Fish Finder Marine | Community Resources | Marina |
| 21 | Haneman Park | Natural Areas/Ecological Assets | Park |
| 22 | Harbor Beach substation | Critical Facilities | Utility |
| 23 | Jolly Roger Marina | Community Resources | Marina |
| 24 | Marine Mammal Stranding Center | Critical Facilities | Ecological |
| 25 | North Brigantine State Natural Area | Natural Areas/Ecological Assets | State Land |
| 26 | North Point Marina | Community Resources | Marina |
| 27 | Pump Station | Critical Facilities | Utility |
| 28 | Pump Station | Critical Facilities | Utility |
| 29 | Pump Station | Critical Facilities | Utility |
| 30 | Pump Station | Critical Facilities | Utility |
| 31 | Shark Park | Natural Areas/Ecological Assets | Park |
| 32 | Shell | Critical Facilities | Gas Station |
| 33 | St Thomas Apostle Church | Community Resources | Church |
| 34 | The Links at Brigantine Beach | Community Resources | Golf Course |
| 35 | US Post Office | Critical Facilities | Municipal Operations |
| | County Road 638 | Critical Facilities | Evacuation Route |
| | State Highway 87 | Critical Facilities | Evacuation Route |

# IV.Findings and Recommendations

## CVA Step 2: Establish vulnerability and consequences matrix

After identifying the assets, depth projections were mapped and listed using the chosen project scenario: combined data provided by the New Jersey Department of Protection for the storm surge from a category 1 storm coupled with sea level rise projected for the year 2050. (Refer to Map #5) *Note: projected depths are based on sea level.

Vulnerability was rated at a range from *N/A* to *High* based on the projected inundation depth and the level of development seen on the site using Google Maps. Consequences were rated

from *N/A* to *High* based on a desktop review of how flooding of the site may impact the City socially, economically, environmentally, etc.

Table 2 displays the potential vulnerability and consequences ratings.

### Table 2: Coastal Vulnerability Assessment Matrix

| Asset # | Name | Projected Depth (Ft.) | Vulnerability Rating | Consequences Rating |
|---|---|---|---|---|
| 1 | Absecon State Wildlife Management Area | 6-9 | High | Low |
| 2 | Ace Hardware | 2-3 | Moderate | Moderate |
| 3 | ACME Market | 0-4 | Low/Moderate | Moderate/High |
| 4 | Bayside Marina | 1-4 | Low/Moderate | Low |
| 5 | Bob's Marine | 3-4 | Moderate | Low |
| 6 | Brigantine Auto and Marine | 3-5 | Moderate | Low |
| 7 | Brigantine Beach Patrol | 0-2 | Low | Low |
| 8 | Brigantine Bible Church | 2-5 | High | Moderate |
| 9 | Brigantine Branch Atl Co Library | 1-2 | Low | Low |
| 10 | Brigantine Elementary School | 0-3 | Low/Moderate | Moderate |
| 11 | Brigantine Elks Lodge | 3-4 | Moderate | Moderate |
| 12 | Brigantine Fire Dept | 0-2 | Low | Low |
| 13 | Brigantine Lighthouse | 2-3 | Moderate | Low |
| 14 | Brigantine North Middle School | 2-4 | Moderate/High | Moderate/High |
| 15 | Brigantine Police | 0-2 | Low/Moderate | Moderate |
| 16 | Brigantine Public Works | 0-4 | Low/Moderate | Moderate |
| 17 | Brigantine Sewer Lift/pump station | 1-3 | Moderate | Moderate |
| 18 | Community Presbyterian Church | 0-1 | Low | Low |
| 19 | Deebold Boat Yard | 3-5 | Low/Moderate | Low |
| 20 | Fish Finder Marine | 2-4 | Moderate | Low |
| 21 | Haneman Park | 2-3 | Low | Low |
| 22 | Harbor Beach substation | 1-3 | Low | Low |
| 23 | Jolly Roger Marina | 2-4 | Moderate | Low |

| | | | | |
|---|---|---|---|---|
| 24 | Marine Mammal Stranding Center | 1-3 | Low | Low |
| 25 | North Brigantine State Natural Area | 6-8 | High | Low |
| 26 | North Point Marina | 4-5 | Moderate | Moderate |
| 27 | Pump Station | 3-4 | Moderate/High | High |
| 28 | Pump Station | 0-1 | Low | Low |
| 29 | Pump Station | 4-5 | Moderate/High | High |
| 30 | Pump Station | 0-1 | Low | Low |
| 31 | Shark Park | 0-2 | Low | Low |
| 32 | Shell | 1-3 | Low | Moderate |
| 33 | St Thomas Apostle Church | 0-1 | Low | Low |
| 34 | The Links at Brigantine Beach | 3-6 | Low | Low |
| 35 | US Post Office | 0-3 | Low/Moderate | Moderate |
| | County Road 638 | 0-2 | Low | Moderate/High |
| | State Highway 87 | 1-4 | Low/Moderate | High |

It is the purpose of this matrix to serve as a reference or starting point for City officials to begin planning for flood mitigation in and around sites and assets that are critical to the City.

## NFIP and the CRS

Brigantine participates in both the National Flood Insurance Program (NFIP) and Community Ratings System (CRS) and is currently a Class 5 Community, resulting in a 25% premium reduction for properties in the Special Flood Hazard Area.

According to the Atlantic County Hazard Mitigation Plan, approximately 400 homes were identified as substantially damaged post-Sandy, with about half of those being raised. The plan also stated that the City does not plan on pursing residential buyouts.

### *CVA Step 3: Recommendations*

Post Sandy, Brigantine installed stormwater pump stations, created a watershed management plan, constructed 4 living shoreline projects, and made stormwater improvements at various locations around town. Taking into account what the City has already focused on, complimentary recommendations for the City to take into consideration are listed below:

- *Utilize green infrastructure to mitigate flood risks*

The 2016 Master Plan Reexamination Report states that where there are opportunities for redevelopment, the subgrade will not be able to accommodate stormwater storage or

infiltration. Therefore, on-site green infrastructure techniques should be used to mitigate flood risks. This includes techniques such as stormwater wetlands and tree trenches.

- Resource: GI Options to Reduce Flooding (NOAA)

➢ *Adopt a Shoreline Management Plan*

A Plan could be used to log past erosion control measures, their performance, and support recommendations for future restoration projects. It could also set the tone for future land use and zoning decisions taking into account future sea level rise projections, this could include if and how well the tidal marsh is keeping up with the rate of sea level rise.

- Resource: Gloucester County Shoreline Management Plan (Virginia Institute of Tech.)

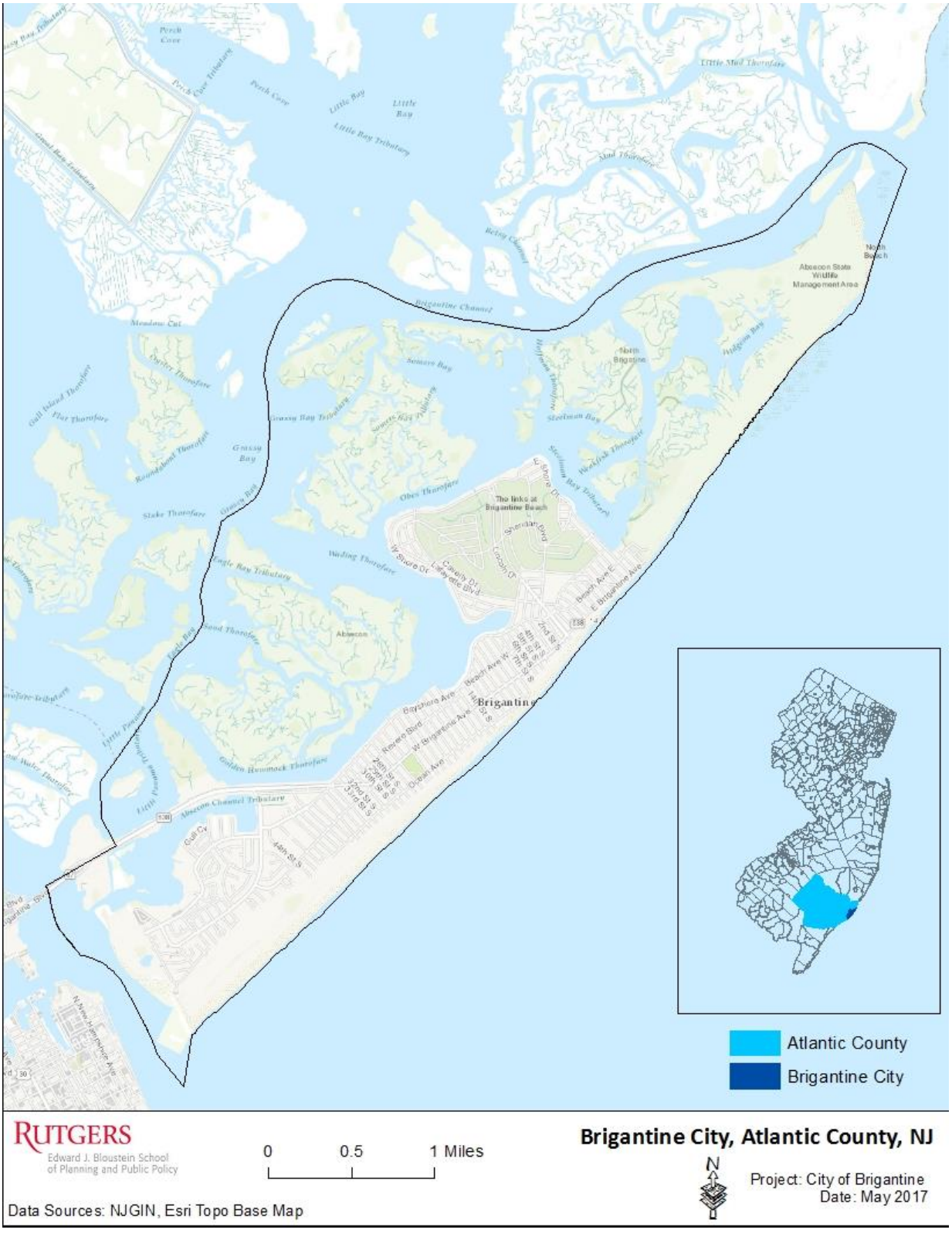
➢ *Conduct a Shoreline Change Analysis*

An Analysis could be done as part of the Shoreline Management Plan. A GIS Shoreline Change Analysis along the Bay Shore and ocean would illustrate how the shore line has eroded over the years and may continue to change into the future. This data will be useful in projecting needed beach replenishment projects or opportunities for living shorelines. It may also assist municipal officials in planning future areas for development as well as conservation.

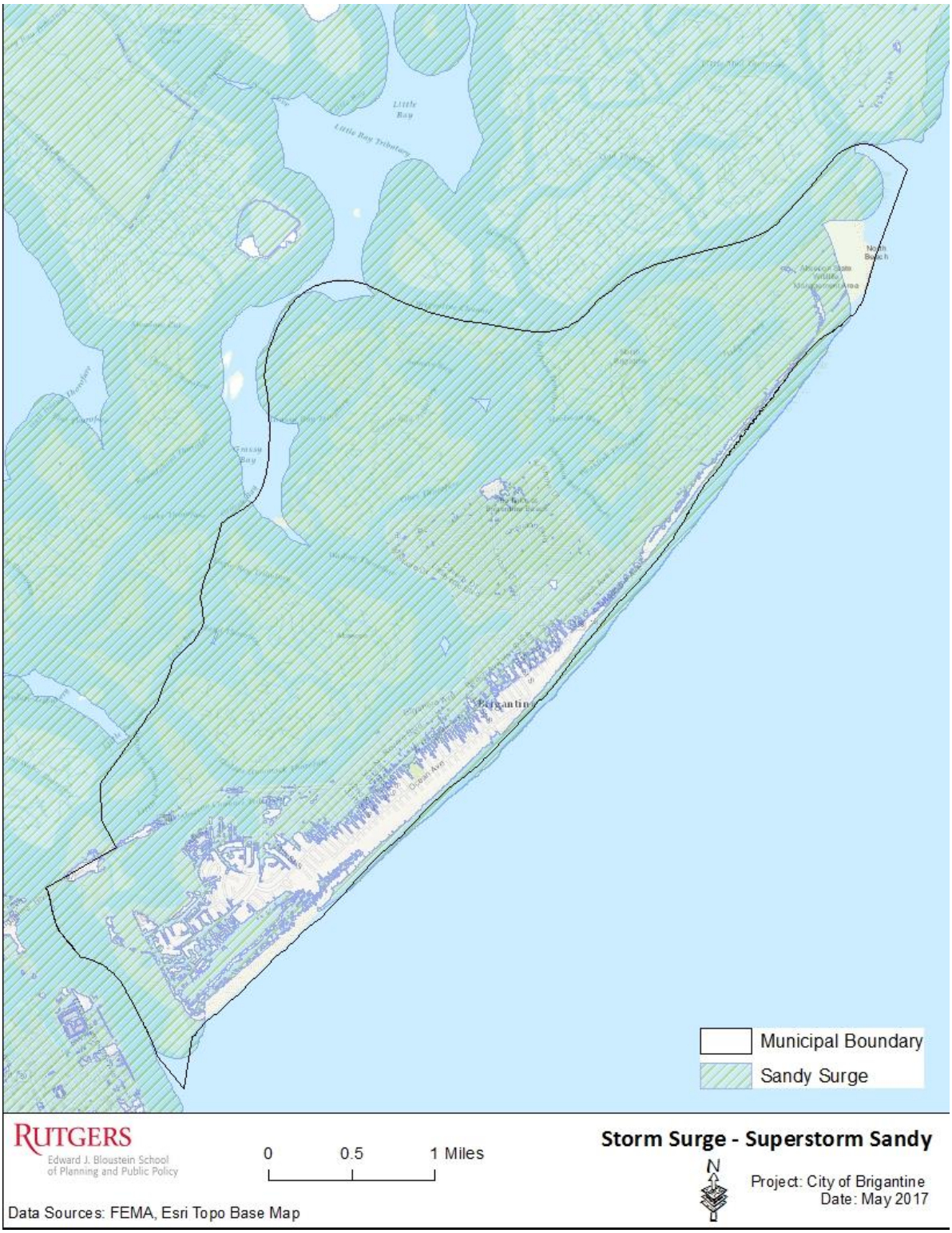
- Resource: NOAA's Shoreline Change Analysis

# Appendices

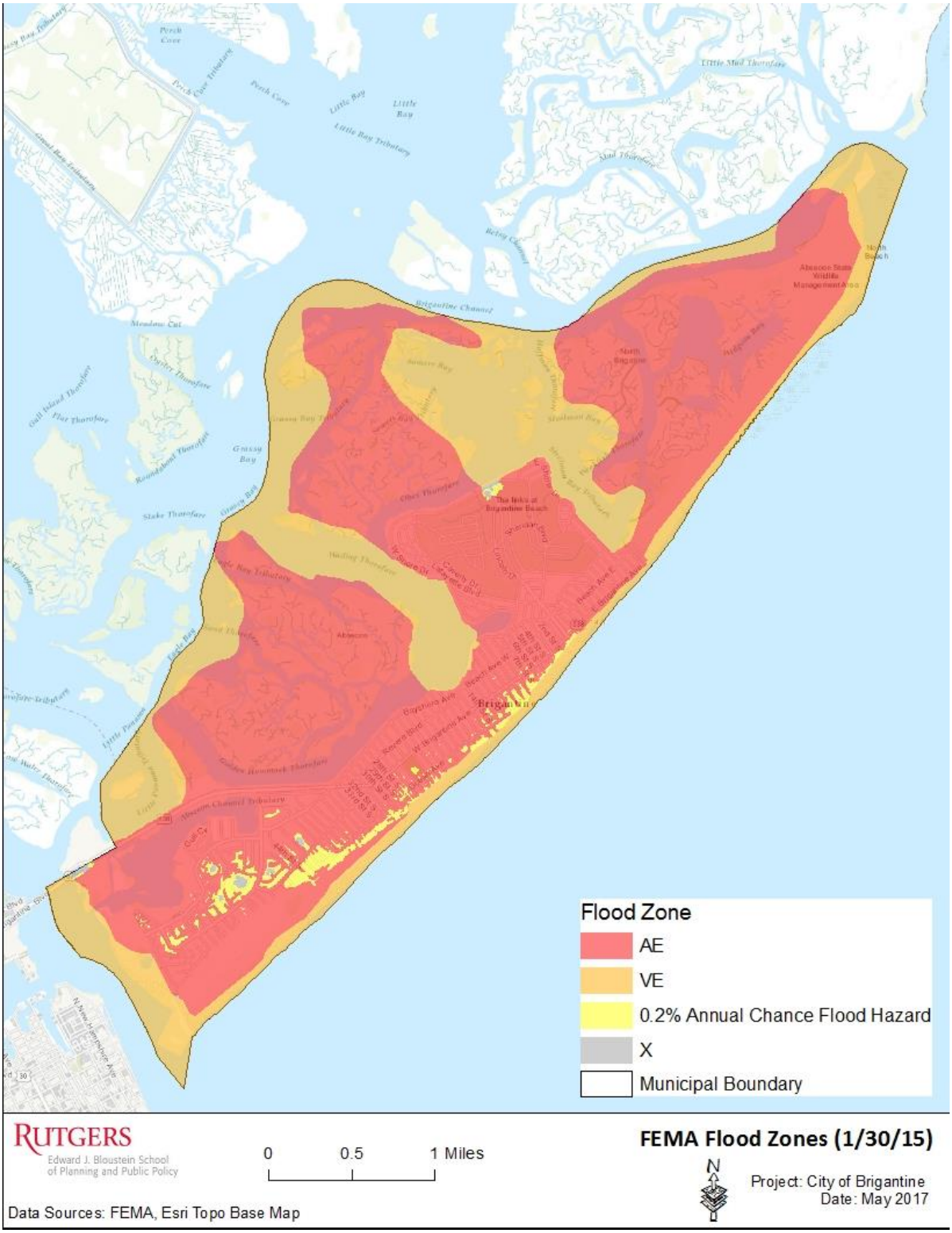
## Map 1: Brigantine City, Atlantic County – NJ



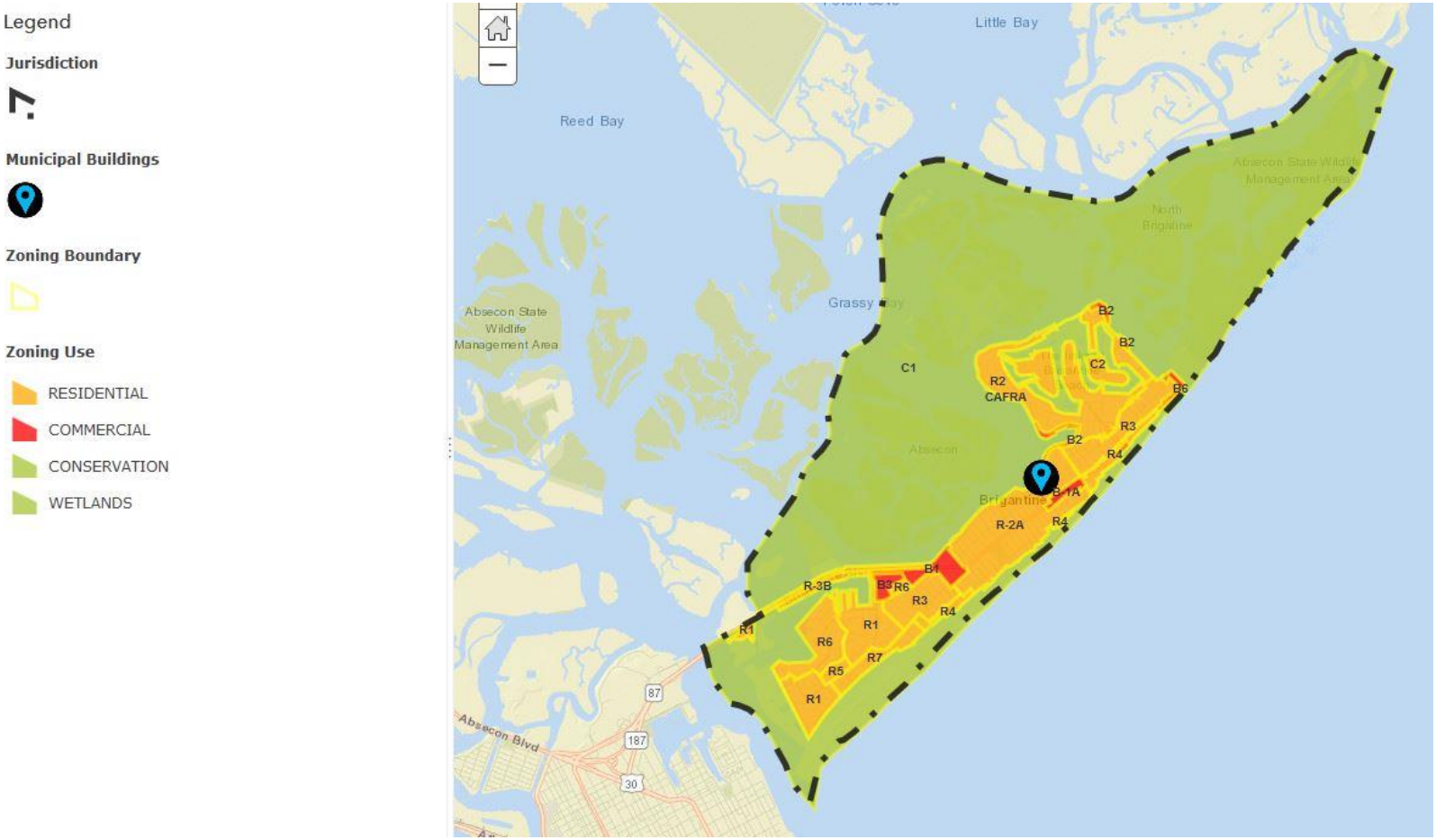
## Map 2: Superstorm Sandy Surge Extent



## Map 3: FEMA Flood Zones



## Map 4: Zoning (Source: Arc GIS online, Atlantic County)



## Map 5: Vulnerable Assets