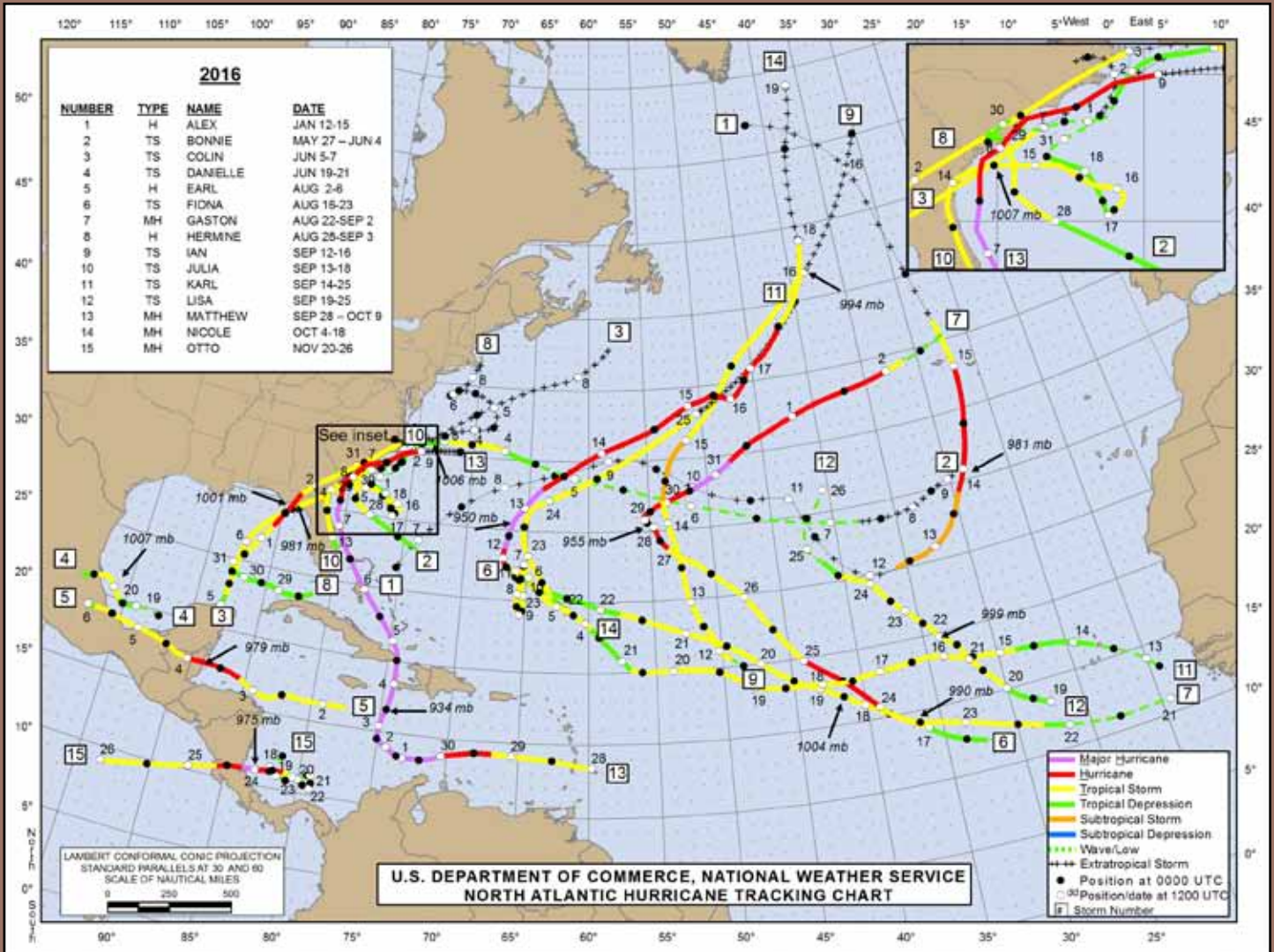


# INTENSIFYING STORMS AND COASTAL HOMES



**NARRAGANSETT BAY**  
**WATERSHED**  
**COUNTS**  
ECONOMY • ENVIRONMENT • EQUITY  
**2017**



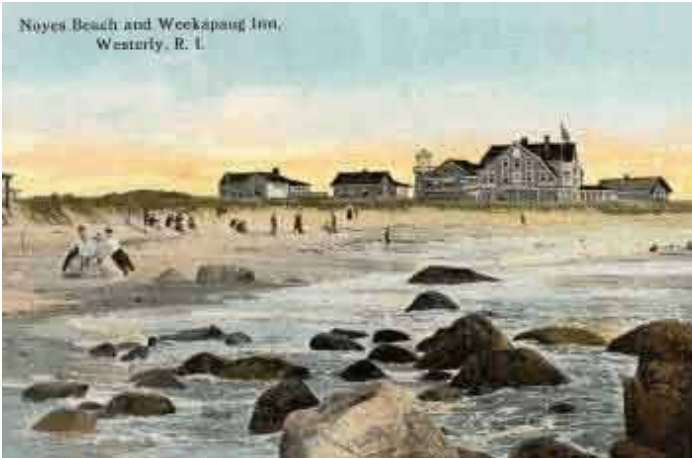


*Tropical storms are getting more intense.*

- 4% more intense per 1.8 °F (1 °C) warming of the underlying Atlantic Ocean.
- 12% increase in precipitation associated with tropical storms per 1.8 °F (1 °C) that the Atlantic warms.
- Storms will become more intense; may be fewer.
- These more intense storms will sit on higher seas, further amplifying their impact.



# Intensifying Storms and Coastal Homes



By the seashore is where I want to be,  
Enveloped by the sweet symphony,  
The rush of the surf, the whisper of the wind,  
All in one place congregate.

With the vast unknown set before me,  
The rising sun high in the sky,  
and a warm blanket of sand, side by side.  
The welcoming hiss and spray of the sea,  
All wondrous to me.

—*Shores of an Unknown World*, Misael Lopez  
(abridged by Watershed Counts)

From Narragansett to Little Compton, Rhode Island is known for its iconic coastal communities. While summer tourists revel in fried clams at Aunt Carrie's, ooh and aah at a tour of the Breakers, and bodysurf at Misquamicut Beach, Rhode Island's residents know that the best part of these coastal communities is that they're home.

## Living the dream on Rhode Island's coast

Rhode Island's 21 coastal communities include year-round homes as well as seasonal properties for summer tourists and winter rentals for college students. Coastal properties range from sizeable Newport "cottages" of Gilded Age fame to one-room cottages at Roy Carpenter's Beach to RV parks overlooking Salt Pond to generational homes in Oakland Beach.

Over 65% of Rhode Island's roughly one million residents live in coastal communities, however, this number does not take into account the seasonal coastal population. For instance, Block Island has 1054 year-round residents, but the island's summer population swells to 15,000 to 20,000, including day-trippers and seasonal residents.

Coastal properties are valued for their scenic views and ocean access, but increasingly these seaside havens are at risk from intensifying hazards associated with climate change. By 2100, an estimated 7000 people living in over 3000 housing units within the state's coastal communities may experience flooding based on a 7-foot sea level rise projection.



RI State Archives

## Dollars and sense: RI's residential coastal property

In dollars and cents, some of the state's most valuable residential property is located in coastal areas vulnerable to damage by intensification of storms and flooding. But it's not just the individual property owner who stands to lose—cities and towns rely heavily on property taxes from these valuable coastal homes—taxes that pay for schools, roads, and other essential services. For example, Charlestown's waterfront homes make up a hefty proportion of the town's tax base. The town's 22-acre southern half, which includes homes on the barrier beach and near the salt ponds, is assessed at \$1.56 billion, compared to \$814 million for the 35-acre northern half.

Nationwide, waterfront homes are valued at more than double the rest of homes throughout the country. In Rhode Island, coastal home values vary from \$89,000 for a cottage in Galilee to \$19 million for a mansion on Newport's Ocean Avenue. It has been estimated that a 6-foot sea level rise by 2100 would put 4853 Rhode Island homes, valued at \$2.9 billion, underwater.

Rhode Island's coastal communities have deep social and cultural value. Many families have visited the same coastal town or stayed in the same beach house for generations. For year-round residents, the coast is their front yard. For both groups, the emotional bond between person and place is powerful. While you can't put a price tag on memories, this bond increases the value of coastal homes.



## *Coastal storms pulled no punches*

Rhode Island's coast is no stranger to big storms. The Hurricane of 1938 generated sustained winds up to 120 mph and a storm surge of 12 to 15 feet, damaging boats, destroying homes, and taking lives in communities from Westerly to Providence. The funnel shape of Narragansett Bay intensified flooding in the upper bay, allowing the storm surge to inundate downtown Providence with almost 20 feet of water. In 1954, Hurricane Carol generated sustained winds up to 100 mph and a storm surge of 14.4 feet in Providence, and resulted in \$90 million in property damage statewide. These storms spurred the state to build the Fox Point Hurricane Protection Barrier.

### *Holding back the flood*

The Fox Point Hurricane Protection Barrier was completed in 1966 at a cost of \$15 million. Built in response to the storms of '38 and '54, it was designed with flood gates and pumps to protect downtown Providence's commercial and residential areas from storm-driven flooding up to 22 feet above low water. The barrier has served the capital city well, protecting it during storms including Hurricane Bob in 1991 and Superstorm Sandy in 2012.

However, a major future storm surge could overtop the barrier, causing damage to surrounding areas.

Some Rhode Islanders only associate hurricanes with historic photos, but 2012's Superstorm Sandy is still fresh in our minds. Sandy was a weak storm by comparison to '38 and '54, but even Sandy drove a 6-foot storm surge into Providence and a 3 to 5 foot surge into the south coast communities of Narragansett and Westerly. Misquamicut—one of the hardest-hit

areas in the state—was damaged by flooding, piles of displaced storm-driven sand, and significant beach erosion. As a result, the Federal Emergency Management Agency provided relief of \$35.8 million to Rhode Island residents through federal flood insurance, and an additional \$103 million in private insurance claims were filed. While Sandy was damaging and costly, it is worth remembering that both the '38 and '54 storms far exceeded Sandy in storm surge height, wind speed, overall strength, and area impacted.

### *Building for the future of coastal property*

Climate change is increasing the vulnerability of coastal residences through its effects on storm surge, coastal erosion, and sea level rise. This likely means costly damage and can put residents at risk. In addition to the cost of damage and social disruption to cities, towns, and the state, there are also significant risks to first responders.

Climate change is expected to produce more intense coastal storms. Their powerful storm surge will cause more coastal erosion. Over time such storms will damage or destroy natural and human-made barriers, undermining shoreline protection provided by salt marshes or sea walls.

The combination of intense storms and storm surge is only exacerbated by sea level rise. Think of a basketball court—raise the floor and you shorten the distance between the floor and the basket, making it easier for players to slam-dunk the ball. Similarly, rising seas shorten the distance between sea level and coastal structures that could be “dunked” during a storm event. Today, we see the occasional flooding of some coastal roads, driveways, and parking lots after a storm or at high tide. As sea level continues to rise, these areas may experience daily flooding. While storm surge events are temporary, sea level rise is ongoing and will bring waters ever closer to homes and roads.



## *Rolling the dice on 100-year storms*

A storm surge is not just a really high tide. It is the rise of water over and above predicted tides due to storm conditions.

A 100-year storm is one that is likely to occur once every hundred years. This does not mean that a storm this size will happen once every hundred years, but it means that each year there is a 1% chance of experiencing a storm of this size. When you flip a coin, you have a 50% chance of getting heads or tails. However, that doesn't mean you won't get 50 heads in a row. Probability begins anew with every flip, just like probability of a 100-year storm starts fresh with every hurricane.



## *Hitting a wall can be a headache*

For millennia, humans have used walls for protection and fortification. Seawalls, along with jetties, bulkheads, revetments, breakwaters, and groins, are types of structural shoreline hardening, or “armoring,” intended to protect adjacent property from coastal erosion and storm surge. An estimated 30% of the Narragansett Bay coastline has shoreline protection structures. Up until the late 1900s, armoring was the preferred method of shoreline protection. So why not keep building walls?

Seawalls are not only costly, but they also alter the natural features important to people and wildlife. These structures interfere with natural processes by increasing erosion of adjacent properties. They limit natural sediment transport along the shoreline, resulting in habitat loss for shorebirds, horseshoe crabs, and other species. Seawalls can also cause additional erosion directly in front of the structures themselves, thereby reducing beach width and limiting public access and recreation opportunities.

Plus, seawalls are vulnerable to the same coastal hazards as the properties they are designed to protect—overtopping by rising seas and storm surges, undermining by coastal erosion, and degrading through frequent exposure to intense storms. Seawalls also require maintenance and retrofitting to accommodate rising seas and new storm surge projections. Increasingly, coastal managers and scientists are recommending alternatives to protect people and property from the encroaching sea given the urgency of climate change. Hardened shoreline techniques are being eclipsed by non-structural methods, nature-based tools, and other strategies to reduce the potential consequences of storms and flooding.

Rhode Island's Coastal Resource Management Council (CRMC) prohibits new shoreline protection structures along conservation areas, areas with habitat or scenic value, as well as “areas particularly unsuitable for structures due to their exposure to severe wave action, flooding, and erosion.” They also require a permit for any alteration or maintenance of an existing shoreline protection structure.



## *Fight or flight for shoreline protection*

Climate change is here and Rhode Islanders are beginning to adapt, either by choice or necessity. The choices are: protect the property, prepare to accommodate, or relocate.



Shoreline protection strategies aim to reduce the chance that property will be flooded or eroded. Nature-based protection strategies such as dune building or habitat restoration are recommended as alternatives to shoreline hardening or seawalls. A newer method of installing biodegradable coconut fiber logs and planting saltmarsh grasses to protect the shoreline from erosion was successfully used in 2010 to protect almost 800 feet of shoreline surrounding a home in South Kingstown.

Coastal property owners can accommodate climate change by elevating homes or flood-proofing buildings. There are currently elevated beach homes in Rhode Island—but even these will need to be built higher to accommodate rising seas.

Property owners can also relocate out of the projected path of harm's way. Sometimes described as managed retreat, this strategy gradually moves coastal residents away from vulnerable areas. Relocation doesn't have to mean abandoning the coast—it

can simply mean living farther away from the water's edge, but these decisions are tied to economic and social realities. While relocation may sound extreme, it has already happened in Rhode Island. In 2013, following a rigorous permitting process, the last of Matunuck's three iconic Browning Cottages was relocated 35 feet inland on the same lot and elevated onto concrete pilings.





## *Staying ahead of shoreline change*

CRMC is developing the forward-looking Shoreline Change Special Area Management Plan—or Beach SAMP—to help coastal property owners prepare for changing conditions. Working with URI's Coastal Resources Center (CRC) and Rhode Island Sea Grant (RISG), CRMC is developing a suite of tools and studies that directly address storm surge, coastal erosion, and sea level rise. The Beach SAMP looks ahead, projecting and planning for future hazards. When finished, the plan will include guidance for coastal property owners and decision-makers on how to assess and prepare for climate change risks.

At the local level, Rhode Island's cities and towns are preparing as well. North Kingstown recently partnered with URI, CRC, and RISG to map and assess the town's vulnerability to projected sea level rise. From this collaboration, North Kingstown developed a climate change adaptation element of its comprehensive community plan that will help town decision-makers and residents prepare for rising seas.

## *Flooding in 2100 at a glance:*

7 feet of sea level rise plus a 100-year storm surge equals:

- 27,431 or 12% of coastal residences flooded
- 3930 or 64% of homes in Barrington flooded
- 5422 or 18% of homes in Warwick flooded
- 3082 or 19% of coastal commercial structures (e.g. businesses) flooded
- 566 or 14% of coastal public service structures (e.g. police stations) flooded

RI Coastal Resources Management Council and the University of Rhode Island STORMTOOLS (<http://www.beachsamp.org/stormtools/>); Boothroyd, Hollis, Oakley and Henderson, 2016 ([http://www.crmc.ri.gov/maps/maps\\_shorechange.html](http://www.crmc.ri.gov/maps/maps_shorechange.html))



## *Explore your options*

Change is coming to Rhode Island's coast and property owners must prepare by knowing their risk and planning for the future. As shorelines shift, innovation and foresight will help coastal residents continue to embrace their connection to the sea.



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**Selected Resources:**

Socioeconomics of Sea Level Rise, Rhode Island Statewide Planning Program. [http://www.planning.ri.gov/documents/sea\\_level/socio/Technical%20Paper%20168.pdf](http://www.planning.ri.gov/documents/sea_level/socio/Technical%20Paper%20168.pdf)

Reducing Coastal Risk on the East and Gulf Coasts, National Research Council, The National Academies of Sciences. doi:<https://doi.org/10.17226/18811>.

Rhode Island Shoreline Change Special Area Management Plan, Rhode Island Coastal Resources Management Council, URI Coastal Resources Center & Rhode Island Sea Grant.

Rhode Island Coastal Property Guide 2014: a product of the Rhode Island Shoreline Change Special Area Management Plan, Rhode Island Coastal Resources Management Council, URI Coastal Resources Center & Rhode Island Sea Grant. <http://www.beachsamp.org/relatedprojects/coastalpropertyguide/>

Metro Bay Special Area Management Plan, Rhode Island Coastal Resources Management Council. [http://www.crmc.ri.gov/samp\\_mb.html](http://www.crmc.ri.gov/samp_mb.html)

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