

April, 2022

New Jersey, USA

# Future Flood Risk: Historic Sites in NJ



*Photo: Ellis Island/Michael Warren (NJ Spotlight News)*

Image credit: Rob Olivera

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# INTRODUCTION

**Climate Central**, a science research and communications organization, used its proprietary Portfolio Analysis Tool (PAT) to determine the current and future flood risk to six locations in New Jersey that hold historic and cultural significance. These locations include Ellis Island, once the nation's busiest immigrant inspection station, as well as lighthouses, a concert hall, and a restaurant.

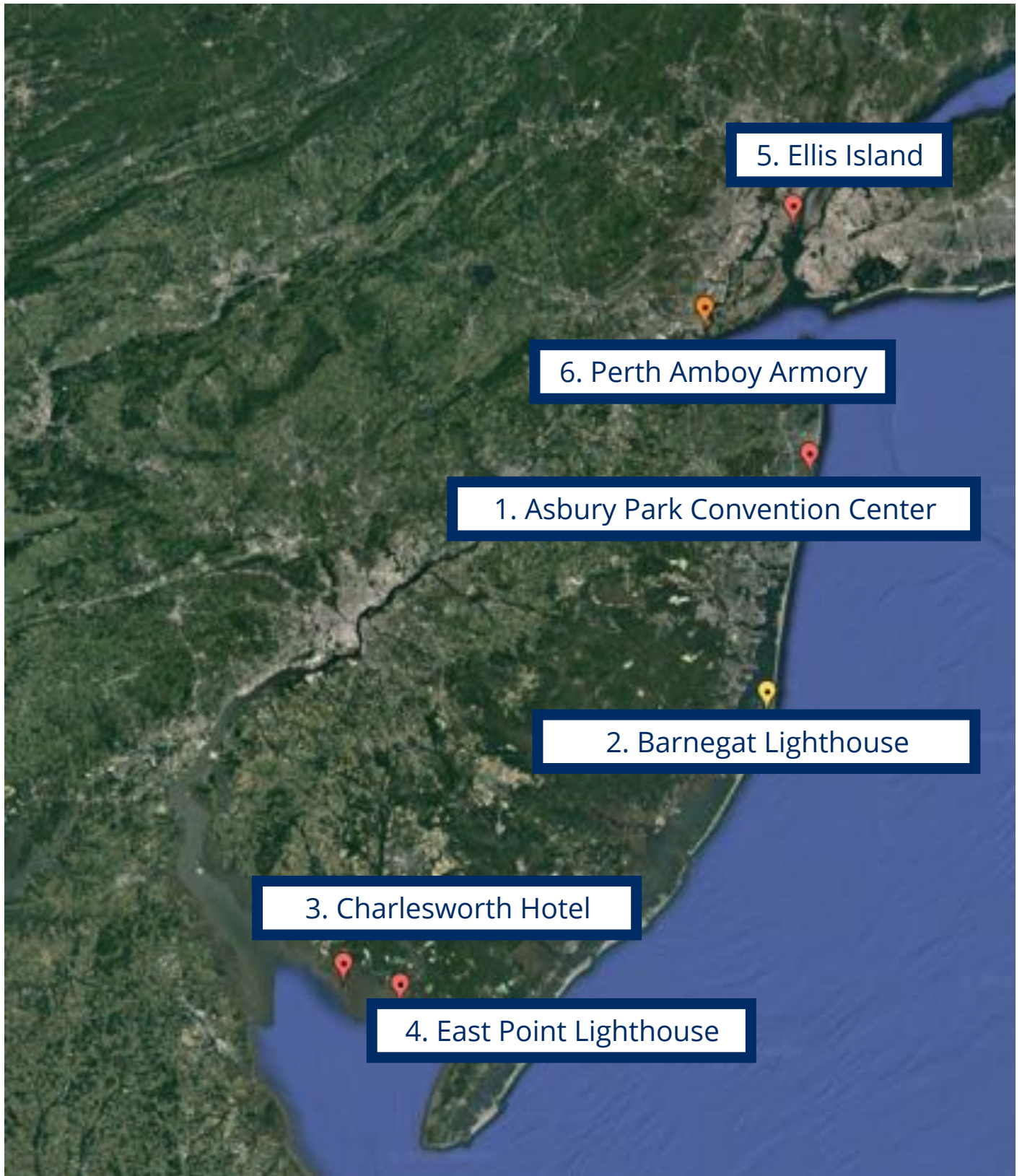
Coastal flooding already poses significant risks to the locations studied. As rising pollution levels increase temperatures, the risk of flooding at these historic sites will increase dramatically as seas rise. All were found to face frequent flood risks by 2050, or worse. The list of sites analyzed for this report was developed through a feature story collaboration between Climate Central's Partnership Journalism program and NJ Spotlight News—their joint coverage [can be found here](#).



*South Jersey is shown with areas below a water level 3 feet above the local high tide line marked in blue. This water level, which could occur through combinations of sea level rise, tide, and storm surge, has a 52% chance of occurring in 2030, rising to a 96% chance in 2050.*

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# SITES CONSIDERED





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# OUR FINDINGS

Using coordinates for the six selected landmarks and our proprietary [Portfolio Analysis Tool](#), Climate Central assessed the coastal flood risk to six historic sites in New Jersey. We found that all of the sites investigated are currently experiencing at least occasional flood risk, with four of the sites already experiencing chronic flood risk—defined as experiencing one or more flood risk events per year. By 2040, all sites are expected to be exposed to at least frequent flood risk and by 2060 all sites are projected to experience at least annual flood risk events. A flood risk event occurs when nearby coastal water levels exceed the elevation of a location and there is an unobstructed pathway for the water to reach that site.

These findings assume heat-trapping emissions continue unchecked (the RCP 8.5 scenario). Results for lower emissions scenarios are similar through 2050, as there is not a significant difference in projected sea level rise between different emissions scenarios until the second half of the century due to the lag between emissions, warming, and sea level rise.

This report summarizes our findings, with detailed data available upon request.

## THIS REPORT DEFINES FLOOD RISK BY ANNUAL CHANCE OF OCCURRENCE, NOT FLOOD DEPTH:

### OCCASIONAL FLOOD RISK



At least 0.01 expected flood risk events per year, corresponding to approximately a 1% annual chance of a flood risk event. This is the level commonly used to establish flood hazard zones. One can statistically expect a 26% chance of a 100-year flood during a 30-year period.

### FREQUENT FLOOD RISK



At least 0.1 expected flood risk event per year. This is approximately a 10% annual chance of a flood risk event.

### CHRONIC FLOOD RISK



At least 1 expected flood risk event per year, or approximately a 99%+ annual chance of a flood risk event.

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# 1. ASBURY PARK CONVENTION HALL



*The land beneath elevated sections of the Asbury Park Convention Hall is projected to experience occasional to chronic flood risk by 2050. Yellow pins represent occasional flood risk; orange represents frequent risk; red represents chronic risk.*

Built nearly a century ago, the Asbury Park Convention Center is a 3,600-person capacity music venue that has hosted performances by some of the world's most famous acts—including New Jersey native Bruce Springsteen. It is currently closed to performances due to safety and maintenance issues. Much of the facility is built on stilts over the beach. While these areas beneath the structure are increasingly susceptible to flooding, the boardwalk entrance is on higher and safer ground.

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## 2. BARNEGAT LIGHTHOUSE



*Parts of the exterior of the Barnegat Lighthouse are projected to experience frequent flood risk by 2050, represented by orange pins.*

Barnegat Lighthouse is a popular tourist destination at the northern tip of Long Beach Island. Now surrounded by state parkland, it has been operating since 1859 and was added to the National Register of Historic Places in 1971. State and federal agencies including the Army Corps of Engineers have already spent millions of dollars protecting it from storms and floods, though more would be needed as seas continue to rise.

Barnegat Lighthouse is currently projected to experience occasional flood risk, increasing to frequent flood risk by 2040. By 2060, the historic lighthouse is expected to experience chronic flood risk. Without further intervention, Barnegat Lighthouse is projected to be exposed to flooding nine times a year on average by the end of the century.

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### 3. CHARLESWORTH HOTEL



*By 2050 the entire Charlesworth Hotel site is projected to experience chronic flood risk, represented by red pins.*

The Charlesworth Hotel and Restaurant is a popular business in Fortescue that was damaged by Hurricane Sandy, but survived and reopened in part following cleanup efforts by volunteers. The entire beachfront site is already expected to be at risk of flooding at least once a year on average, though the building itself is elevated for protection against routine flood hazards.



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## 4. East Point Lighthouse



*By 2050 all points surrounding the East Point Lighthouse site are projected to experience chronic flood risk, represented by red pins.*

East Point Lighthouse on the Delaware Bay was added to the National Register of Historic Places, restored, protected against erosion and switched back on during the past quarter of a decade. Its vulnerabilities to climate change receive less attention and less funding than some higher-profile cultural sites along New Jersey's shorelines.

Presently, the north corner of East Point Lighthouse is at chronic risk of coastal flooding, while the rest of the lighthouse is at occasional or frequent flood risk. By 2050, the entirety of the lighthouse's footprint will experience chronic coastal flood risk. By the end of the century, the lighthouse could experience near-monthly flood risk events.



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## 5. ELLIS ISLAND



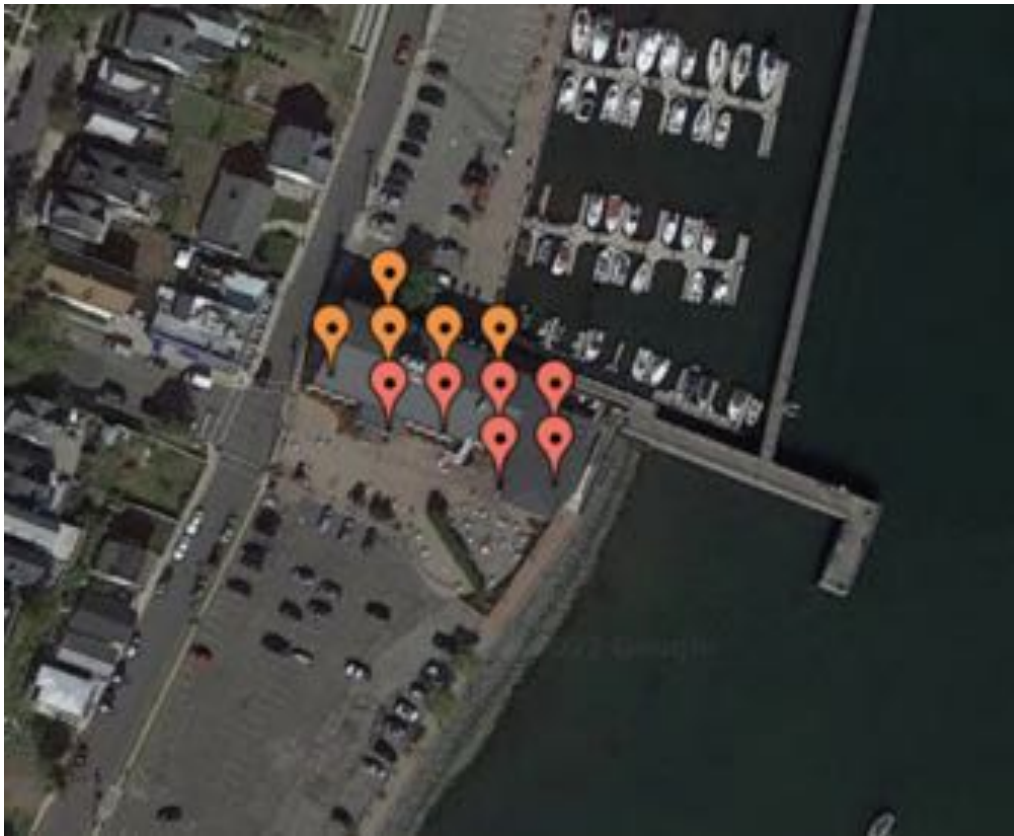
*Parts of Ellis Island are projected to experience occasional to chronic flood risks by 2030 (left), with risks increasing by 2050 (right). Yellow pins represent occasional flood risk; orange represents frequent risk; red represents chronic risk.*

More than 12 million migrants, mostly from Europe, dealt with federal customs officials on Ellis Island until their office shuttered in 1954. Straddling New Jersey and New York in New York Harbor, the island and its buildings fell into disrepair following being protected for their historical value, rehabilitated and reopened as a popular tourism destination in 1990. The buildings were heavily damaged by Superstorm Sandy and the National Park Service is spending \$50 million to protect the island and its historical structures and artefacts from flooding and other hazards.

While parts of Ellis island are already plagued with chronic flood risk, the majority of the island is currently experiencing only occasional flood risk. However by 2040, the entire island will experience at least frequent flood risk and by 2080 the entire island will be exposed to flooding more than once a year.

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## 6. PERTH AMBOY ARMORY



*Perth Amboy Armory is projected to experience frequent to chronic flood risk in 2050. Orange pins represent frequent flood risk; red pins represent chronic risk.*

Home to naval ammunition during the first and second world wars, this historic building now houses an upscale restaurant and banquet hall.

The Perth Amboy Armory is already experiencing frequent flood risk. By 2040, parts of the site will be at chronic risk of coastal flooding. And the entire site will be at risk of chronic flooding by 2080.

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# METHODOLOGY

In this analysis, Climate Central's freely available [Coastal Risk Screening Tool](#) and proprietary [Portfolio Analysis Tool \(PAT\)](#) were used to estimate future coastal flood threats to culturally and historically significant sites in New Jersey.

Using leading peer-reviewed science, the Coastal Risk Screening Tool allows users to explore coastal flood risk and sea level rise projections by year, water level, temperature increase, and more through interactive maps. See the *Details and Limitations* section of the tool for detailed methodology.

The Portfolio Analysis Tool combines sea level rise science with local flood history data to compute the number of statistically-expected future coastal flood risk events at specific locations each decadal year, from 2020 through 2100. A flood risk event is defined as the occurrence of nearby coastal water levels exceeding the elevation of the ground at a specific inland location (defined by latitude and longitude coordinates), with an unobstructed pathway for the water to reach that location. Not all such events will cause flooding at the location, but each event poses a risk.

Ground elevation is determined from a NOAA database of LiDAR-derived elevation data. Elevations of structures above the ground are not known or evaluated.

Local flood history comes from the nearest NOAA tide station with at least 30 years' history of hourly water level data. Tide stations that have not experienced a hurricane in their recorded history may not adequately represent the risk of a future hurricane. Precipitation or riverine flooding is not considered, but coastal high water impedes runoff and increases the risk of freshwater flooding inland.

Projected sea level rise is derived from a sea level rise [model](#) (Kopp et al. 2014). Inputs to the model include an assumption that carbon emissions continue unchecked (RCP 8.5).

The Portfolio Analysis Tool estimates the expected number of flood risk events each year and reports the results in decadal increments starting in 2020 through 2100. Our analysis is based on the statistically expected number of future flood risk events during the course of a year.

This report presents statistical expectations, not forecasts or predictions, and should be used for scoping and general planning purposes only. Climate Central accepts no responsibility for any damage to property, death or bodily injury, or other loss arising in any way from the use of this report for any purpose.



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# ABOUT CLIMATE CENTRAL

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Climate Central's Program on Sea Level Rise strives to provide accurate, clear, and granular information about sea level rise and coastal flood hazards both locally and globally, today and tomorrow. Anchored in rigorous primary research, our work distinguishes itself by its user-friendly maps and tools, extensive datasets, and high-quality visual presentation. The program dedicates its efforts to helping citizens, communities, businesses, organizations, and governments at every level to understand the consequences of different carbon pathways and to navigate the shifting waters of our warming world.

You can search or navigate [our interactive tools](#) to see maps of areas below different amounts of sea level rise and flooding, down to neighborhood scale, matched with area timelines of risk. Our tool also provides statistics of population, homes, and land affected by city, county, and state, plus links to factsheets, data downloads, action plans, embeddable widgets, and more.

If you are interested in a customized analysis using Climate Central's proprietary Portfolio Analysis Tool (PAT), contact us at [portfolio@climatecentral.org](mailto:portfolio@climatecentral.org).