



Great Egg Harbor Watershed Association





Sea Level Rise in the Great Egg Harbor Watershed

River Administrator "Watershed" Fred Akers will discuss sea level rise, online tools available to better understand the future of sea level rise, and what some people are doing to try and reduce the future extent of sea level rise.

NJ Flood Mapper

Jacques Cousteau National Estuarine Research Reserve (JCNERR)
Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA)

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OVERVIEW

IS SEA LEVEL RISING?

HOW DOES SEA LEVEL RISE AND STORM SURGE INTERACT?

WHY IS THE SEA LEVEL RISING?

HOW DO TIDAL CYCLES AFFECT COASTAL FLOODING?

CLIMATE CHANGE AND FLOODING

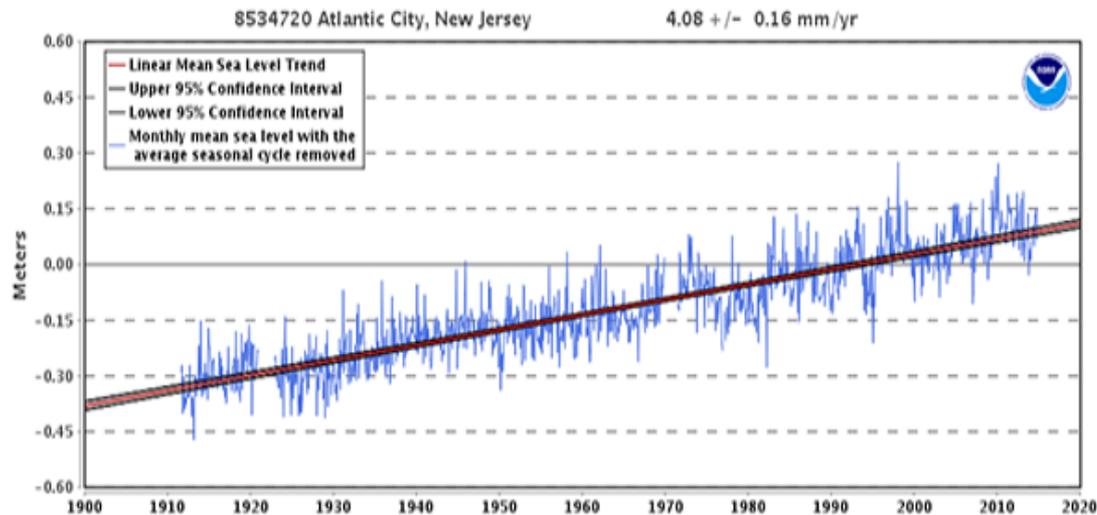
HOW CAN NJ FLOOD MAPPER BE USED FOR LONG RANGE PLANNING?

NOW WHAT DOES MY COMMUNITY DO?

CITED SOURCES

IS SEA LEVEL RISING?

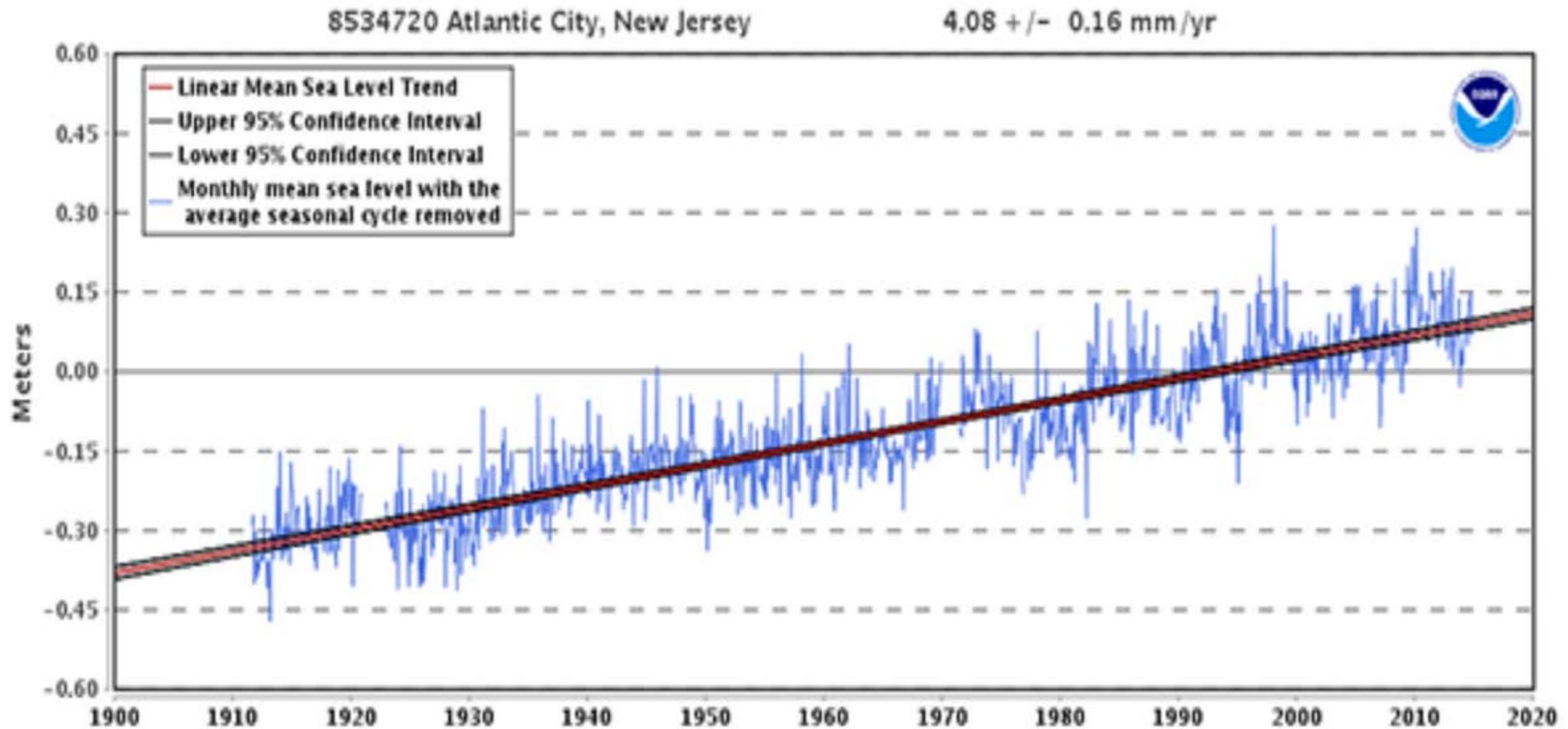
Yes, sea level rise (SLR) is a physical reality that is impacting the New Jersey and the entire Mid-Atlantic coastline. The historical rate of sea level rise along the New Jersey coast over the past half century was 3-4 mm/yr (or 0.12 - 0.16 in/yr).



The mean sea level trend is 4.08 mm/year (0.16 in/yr), which is equivalent to a change of 1.34 feet in 100 years.

Graphic Credit: NOAA

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WHY IS SEA LEVEL RISING?

Global sea level and the Earth's climate are closely linked.

The Earth's climate has warmed about 1.8°F during the last 100 years.

The two major causes of global sea level rise are thermal expansion of the oceans (water expands as it warms) and the loss of land-based ice due to increased melting.

Along the Mid-Atlantic Coast, coastal lands are subsiding further exacerbating sea level rise. In addition, oceanographic effects due to shifting of the Gulf Stream will potentially affect sea level in this region.

Global sea level is projected to rise during the 21st century at a greater rate than during 1961 to 2003.

Thermal expansion is currently contributing about half of the average rise, but land ice will lose mass increasingly rapidly as the century progresses.

It is uncertain how much of the current land ice located in the Antarctic and Greenland ice sheets may melt. Other factors include changes in ocean dynamics, glacial isostatic adjustment and sediment compaction.

Future rates of sea level rise are expected to increase beyond what the New Jersey coast experienced over the past hundred years.

Estimates of SLR for New Jersey vary depending upon methods used by different scientists.

In August 2013, a panel of sea level rise experts from Rutgers University, the National Oceanic and Atmospheric Administration, and the U.S. Global Climate Change Research Program was convened to assist in developing consensus values for Year 2050 and 2100 SLR scenarios using best available scientific information.

Additional refinements have occurred since August 2013 as the scientists have continued with their research and publications.

Due to the uncertainty in projecting sea level rise out into the future, Low, High and Higher scenarios were developed (Table 1).

The probabilistic framework of Kopp et al. (2014) provides guidance in interpreting the odds of these different sea-level rise projections (Table 2).

The NJFloodMapper is designed to visualize sea level rise within this range of heights. For more information on the development of the consensus SLR projections please refer to the full report available at www.njadapt.org.

Table 1. Consensus sea-level rise projections (in feet) for the New Jersey. The baseline is year 2000 sea level.

Year	Low	High	Higher
2050	1.0 ft	2.0 ft	2.5 ft
2100	2.5 ft	5.0 ft	7.0 ft

Table 2. Sea level rise projections underlying the consensus values. Note: All values are feet above baseline year 2000 sea level.

2050 Projection	Low	High	Higher
NOAA Average*	1.0 ft	1.5 ft	2.5 ft
Miller/Kopp (M/K) (2013)**	1.1 ft	1.9 ft	2.2 ft
Mean of NOAA and M/K	1.0 ft	1.7 ft	2.4 ft
Consensus Values***	1.0 ft	2.0 ft	2.5 ft
Consensus Values: % Chance of SLR exceeding this value ****	85%	8%	0.5%
2100 Projection	Low	High	Higher
NOAA Average*	2.3 ft	4.5 ft	7.5 ft
Miller/Kopp (M/K) (2013)**	2.5 ft	4.9 ft	5.8 ft
Mean of NOAA and M/K	2.4 ft	4.7 ft	6.7 ft
Consensus Values***	2.5 ft	5.0 ft	7.0 ft
Consensus Values: % Chance of SLR exceeding this value ****	80%	10%	0.8%

* NOAA Intermediate Low projections included under Low category, NOAA Intermediate High included under High category and NOAA High values included as Higher category in Table. SLR Values are in feet and are provided by the NOAA/USACE calculator rounded to the nearest 0.5 ft

** Miller/Kopp Low projections, rounded to nearest 0.1 ft

*** Rounded up to nearest 0.5 ft

**** Percentile projections based on Kopp et al., 2014

HOW DOES SEA LEVEL RISE AND STORM SURGE INTERACT?

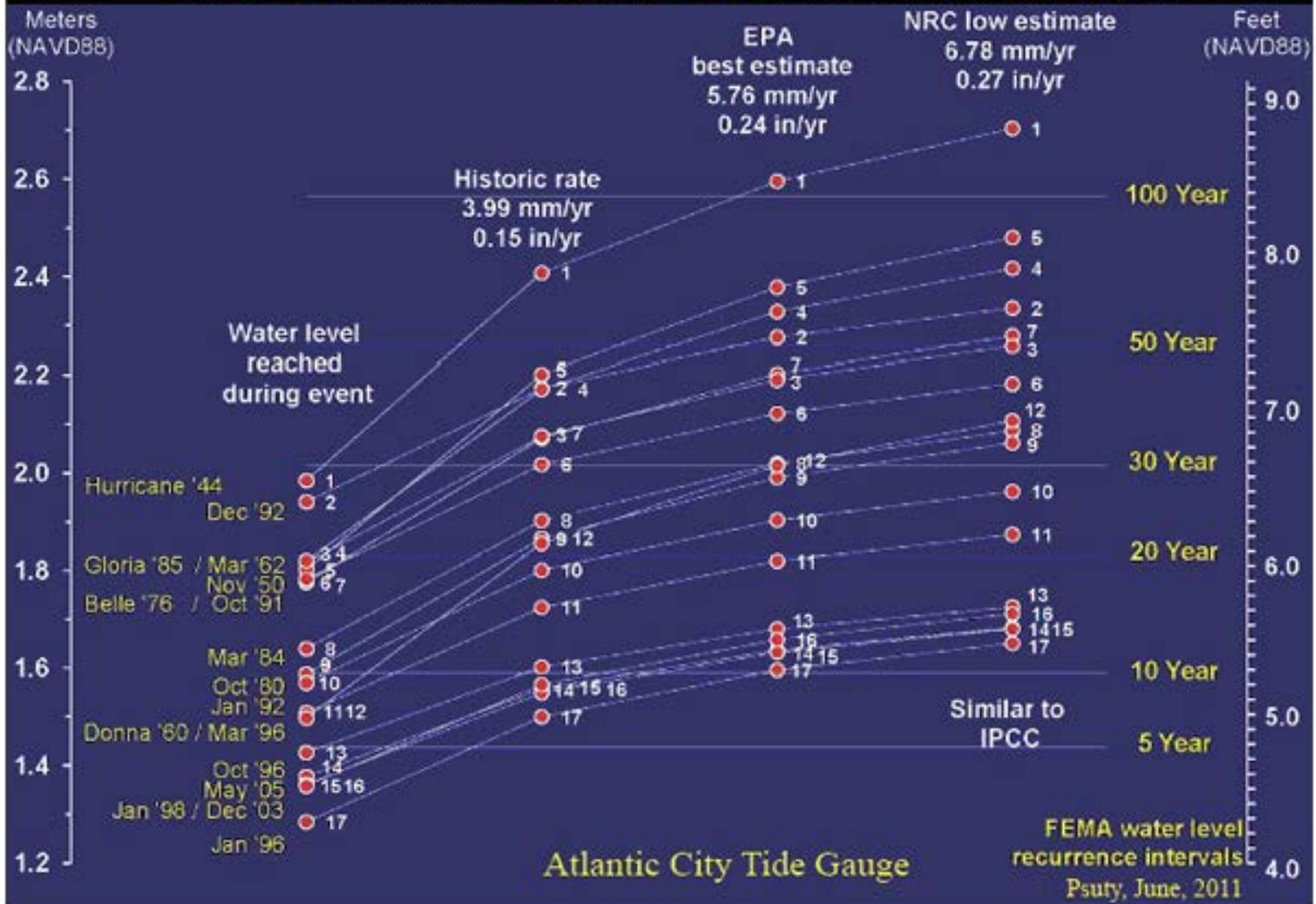
Sea level rise increases the vulnerability of coastal areas to flooding during storms for several reasons.

First, a given storm surge from a hurricane or northeaster builds on top of a higher base of water.

Considering only this effect, it is estimated that development along the coast would experience a 36-58 percent increase in annual damages for a 1-foot rise in sea level, and a 102-200 percent increase for a 3-foot rise.

Second, greater shoreline erosion also increases vulnerability to storms, by removing the beaches and dunes that would otherwise buffer coastal property from storm waves.

Increased Risk – Estimated water levels for 2050



The following graphic displays historical storm water levels measured at Atlantic City projected to the year 2050 using three sea-level-rise scenarios: 1) applying historic rate; 2) applying Environmental Protection Agency (EPA) best estimate rate; and 3) applying National Research Council low estimate rate (similar to the IPCC estimate). For example, the December '92 storm (ranked 2nd in terms of severity) had storm water levels of approximately 6.4 ft above NAVD88. That same storm in 2050 would have water levels from 7.2 to 7.6 ft (depending on the SLR scenario). The 1944 hurricane, which was rated as a 1-in-30 year storm, when projected to 2050 would be equivalent to a 1-in-100 yr storm in severity under EPA and NRC estimated sea level rise.

HOW DO TIDAL CYCLES AFFECT COASTAL FLOODING?

The NJFloodMapper uses mean Higher High Water (MHHW) as a baseline for sea level. MHHW is the average of the higher high water height recorded each tidal day. Each month at the time of the new and full moon, especially strong tides (called spring tides) occur resulting in higher highs and lower low waters. A king tide is an especially high tide that occurs when the gravitational pull of the sun and moon reinforce one another. This extra-high tide happens twice a year at the times when the moon is closest to the earth. King tides can be 2-3 feet above normal MHHW and further exacerbate coastal flooding.



Cedar Run Dock Road in Little Egg Harbor Bay flooding during the October 2011 king tide. Photo Credit: Leslee Ganss To learn more about king tides and see pictures go to <http://bbp.ocean.edu/pages/357.asp> .

CLIMATE CHANGE AND FLOODING

Increased temperatures are predicted to lead to increasing rainfall intensity during severe storms.

Additionally, warmer ocean temperatures could [increase the intensity of tropical storms](#) and hurricanes which, in turn, could increase flood and wind damages.

Factors such as [rising sea levels](#), [disappearing wetlands](#), and increased coastal development threaten to intensify the damage caused by hurricanes and tropical storms.

Increasing rainfall intensity during severe storms is also predicted to lead to increased flooding of interior rivers and streams.

What was once considered a 100 year flood (i.e. occurring once every 100 years or 1% chance of occurring in any given year) are now occurring with much higher frequency.

Factors such as increased impervious surface and floodplain development lead to even more intense flooding and vulnerable human populations.

HOW CAN NJ FLOOD MAPPER BE USED FOR LONG RANGE PLANNING?

Many government officials and planners agree that the year 2050 represents a reasonable planning horizon.

Scientists' best estimates are for an additional 1 to 2.5 feet of sea level rise by 2050.

Given that king tides often exceed 2 feet above MHHW, shallow or nuisance coastal flooding might be expected at elevations from 3 to 4 ft higher than at present.

Higher sea levels associated with possible storm surge (on top of expected SLR) can be visualized using the NJFloodMapper tool.

However, caution is warranted in that extremely severe storms may potentially have surge levels higher than the 6 foot SLR mapped here.

As SuperStorm Sandy has demonstrated, storm surge topped 6 feet in many back-bay areas and was higher along the barrier islands and in Raritan Bay.

NOW WHAT DOES MY COMMUNITY DO?

Now that you know a bit more about how your community may be affected by sea level rise and flooding, you may be wondering, What can we do about it?

One place to start would be to incorporate your knowledge of your community's risk and vulnerability into your local planning documents.

Documents like your Master Plan, Hazard Mitigation Plan, Stormwater Management Plan, etc. are the ideal places to identify your risks and plan for them.

The Getting to Resilience online community evaluation

www.prepareyourcommunitynj.org is the perfect place to start learning how best to take your knowledge of risk and put it into action on the local planning level.

Through this evaluation you will learn how incorporating this knowledge into local planning can be worth valuable points through FEMA's Community Rating System and Sustainable Jersey.

Flooding is a risk that many communities need to be aware of and learn how to prepare for.

This is especially true for coastal communities.

NOW WHAT DOES MY COMMUNITY DO?

Learn more about the latest in coastal community flood mapping and preparedness information at <http://www.region2coastal.com/>



Your source for the latest information about flood risk in coastal New York and New Jersey.

I want to:

- look up flood risk information by address.
- learn about the coastal flood study.
- protect my property from flooding.

WELCOME

The Federal Emergency Management Agency's (FEMA's) Region II office has prepared a coastal flood study to update Flood Insurance Rate Maps (FIRMs) for communities in coastal New Jersey and New York. The flood hazards shown on the FIRM are used to determine flood insurance rates and requirements and where floodplain development regulations apply. The updated maps will help communities plan for and reduce the risk from flooding in the future. Start taking steps now to keep your communities and families safe from flood risk:

LATEST NEWS

November 12, 2015, 04:35 pm
[November is Critical Infrastructure Security and Resilience Month](#)

November 10, 2015, 04:35 pm
[NJDEP Flood Hazard Risk Reduction and Resiliency Grant](#)

NOW WHAT DOES MY COMMUNITY DO?

Click on [this document \(PDF\)](#) to learn more about how other communities are trying to act now to prepare and adapt for hazardous conditions.

- **Innovative floodplain ordinance passed in Saco, ME**

"If you lived in southern Maine and there's a big enough winter or spring storm, then the odds are good that there will be footage on your television station of Camp Ellis and the beating its taking," explains Saco City Planner Bob Hamblen.

The repeated loss of homes to wave action and beach erosion in this neighborhood of Saco has made Camp Ellis a poster child of storm damage within the state.

"If there were going to be a Maine community most in need of taking action to prepare for future storms, it would be Saco," Hamblen asserts. "Because of all the damage, the planning board, city staff, and council are all very mindful of what happens on the coast during a storm."



- **Boston Plans for the Near-term Risk of Rising Tides**

While many cities around the country grapple with drought and excessive heat this year, city planners in Boston have something else on their minds: the prospect of rising water.

In this coastal metropolis, scientists and computer models predict that climate change could eventually lead to dramatic increases in sea level around the city. Coupled with a storm surge at high tide, parts of the city could easily end up under water.

The area that's home to Boston's Faneuil Hall, the city's first public market, is one of them. The land the hall was built on was once waterfront property, but by the late 1800s, the growing city needed more room. So the marshes and mudflats along the wharf were filled in — and the city expanded.



- **Sea level rise accounted for at Deer Island wastewater treatment plant**

Synopsis: Even in 1989, scientists and engineers considered sea level rise in decision-making for big investments

Imagine a sewage treatment plant large enough to remove human, household, and commercial pollutants from 43 greater Boston communities.

It's called the Deer Island Wastewater Treatment plant, and it's the second largest treatment plant in the country. It was constructed in the Boston Harbor back in 1968, and sits on a peninsula jutting into the ocean.



- **City of New Castle, Delaware Coastal Resiliency Action Plan**

- As part of their statewide Sea Level Rise Adaptation Initiative, the Delaware Coastal Programs Office of the Division of Soil and Water Conservation in the Delaware Department of Natural Resources and Environmental Control (DNREC) is helping the City of New Castle conduct a vulnerability assessment and develop a coastal resiliency action plan to prepare for and adapt to sea level rise and other projected climate change impacts. This pilot implementation project will examine the physical, social, economic, and environmental vulnerabilities of the City of New Castle's coast in order to identify issues of concern, collect relevant information, and develop adaptation strategies.



Sea Level Rise Confidence Marsh
Vulnerability Flooding Facilities

Sea Level Rise ?

▼ | | | | | Current MHHW

Legend

- Water Depth
- Low-lying Areas
- Visualization Location

Overview

Use the slider bar above to see how various levels of sea level rise will impact this area.

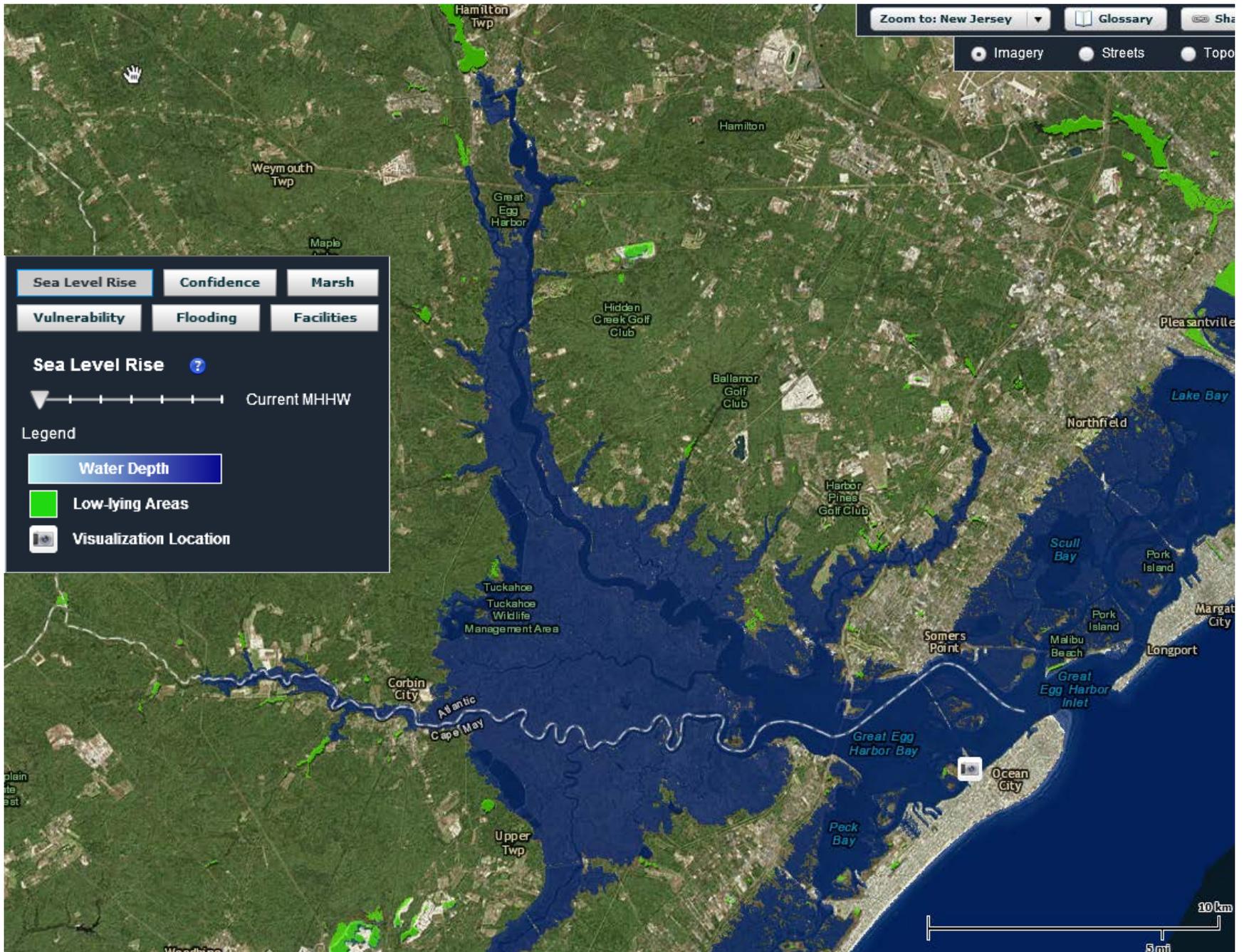
Levels represent inundation at high tide. Areas that are hydrologically connected are shown in shades of blue (darker blue = greater depth).

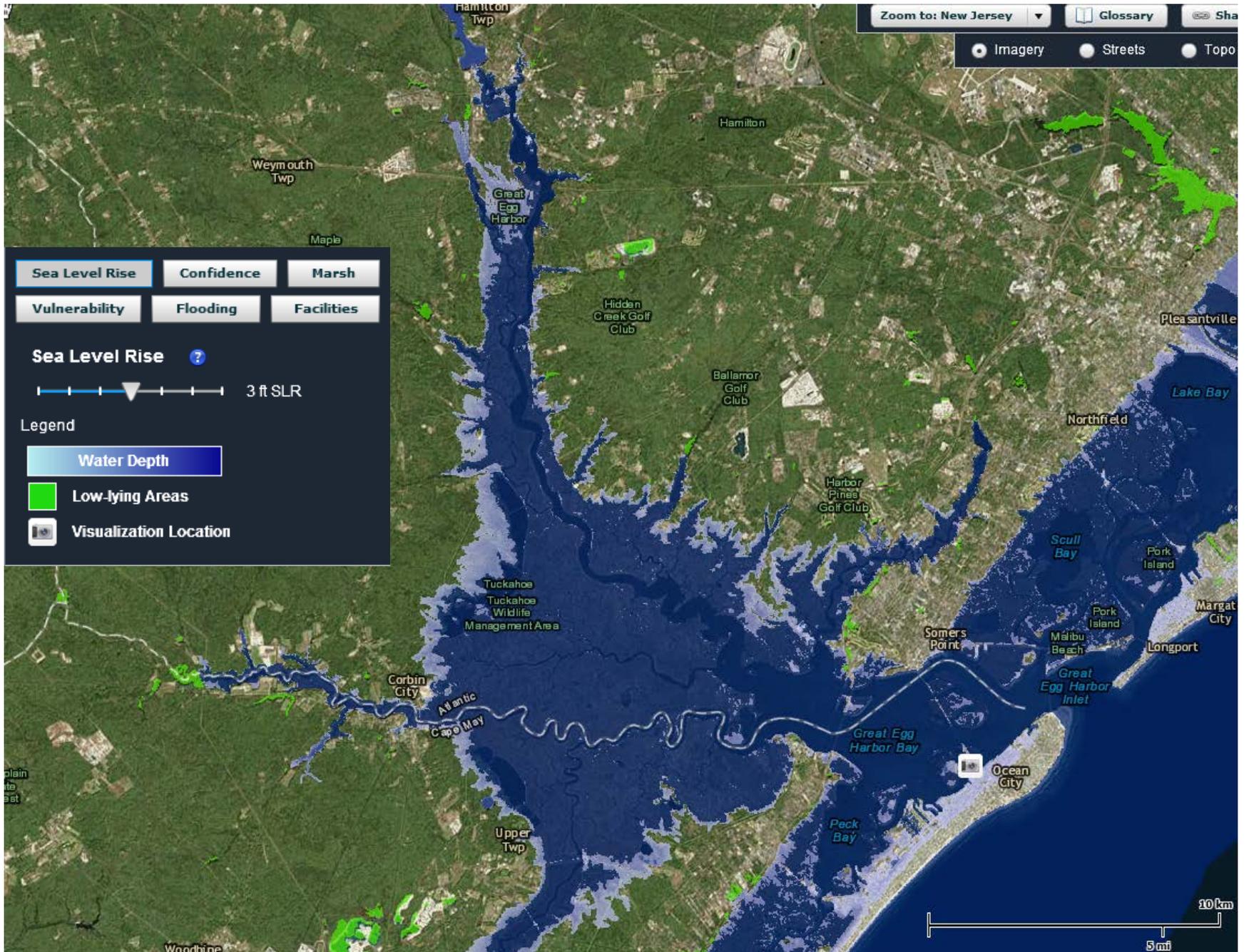
Low-lying areas, displayed in green, are hydrologically "unconnected" areas that may flood. They are determined solely by how well the elevation data captures the area's hydraulics. A more detailed analysis of these areas is required to determine the susceptibility to flooding.

Data. The data in the map do not consider natural processes such as erosion or marsh migration that will be affected by future sea level rise.

Confidence. There is not 100% confidence in the elevation data and/or mapping process. It is important not to focus on the exact extent of inundation, but rather to examine the level of confidence that the extent of inundation is accurate.

Hydrology. The data may not completely capture the area's hydrology, such as canals, ditches, and stormwater infrastructure.





Zoom to: New Jersey

Glossary

Share

Imagery

Streets

Topo

Sea Level Rise

Confidence

Marsh

Vulnerability

Flooding

Facilities

Sea Level Rise



3 ft SLR

Legend

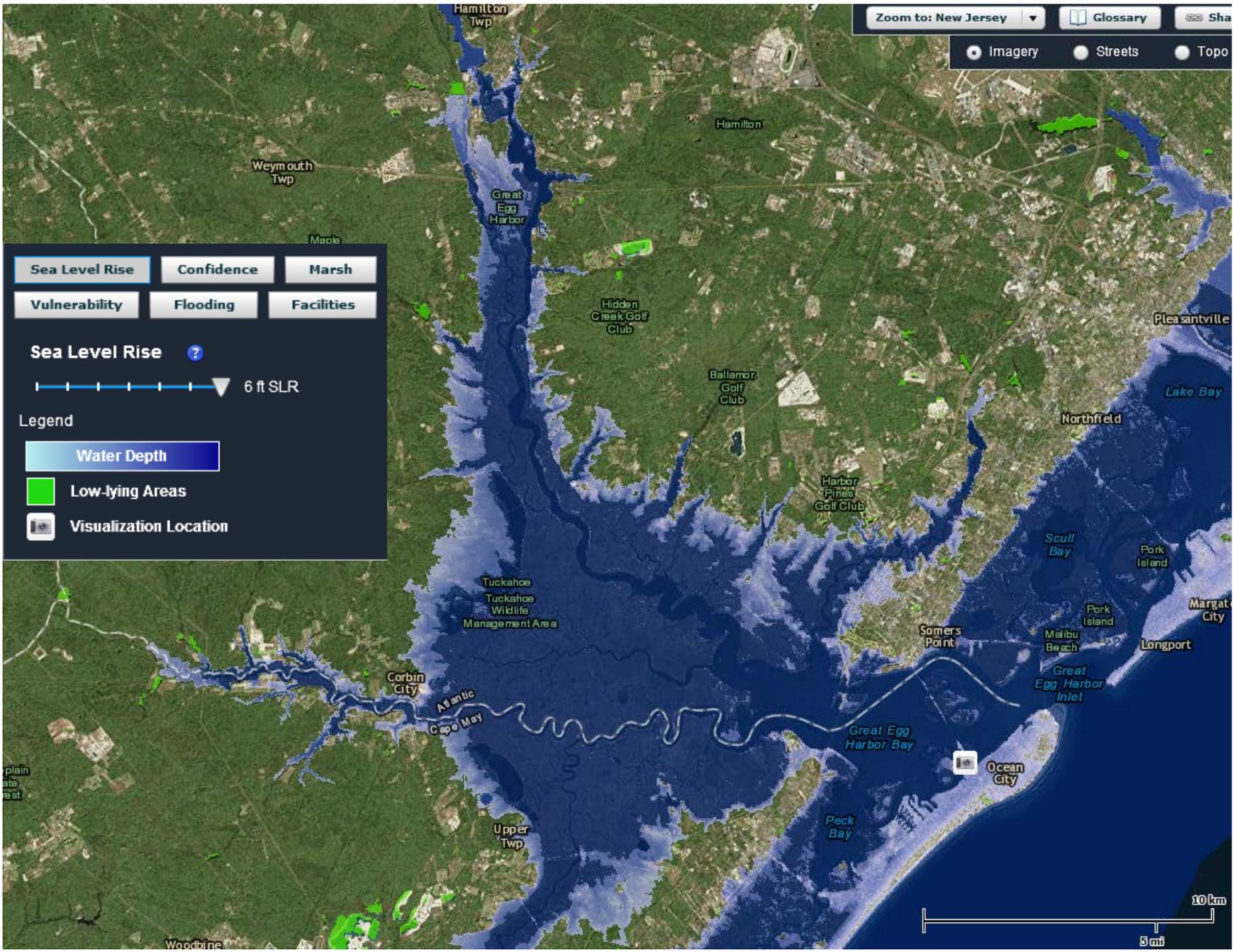
Water Depth

Low-lying Areas

Visualization Location

10 km

5 mi



Zoom to: New Jersey

Glossary

Share

Imagery Streets Topo

Sea Level Rise Confidence Marsh

Vulnerability Flooding Facilities

Sea Level Rise ?



Legend

Water Depth

Low-lying Areas

Visualization Location

10 km

5 mi

Zoom to: New Jersey

Glossary

Imagery

Streets

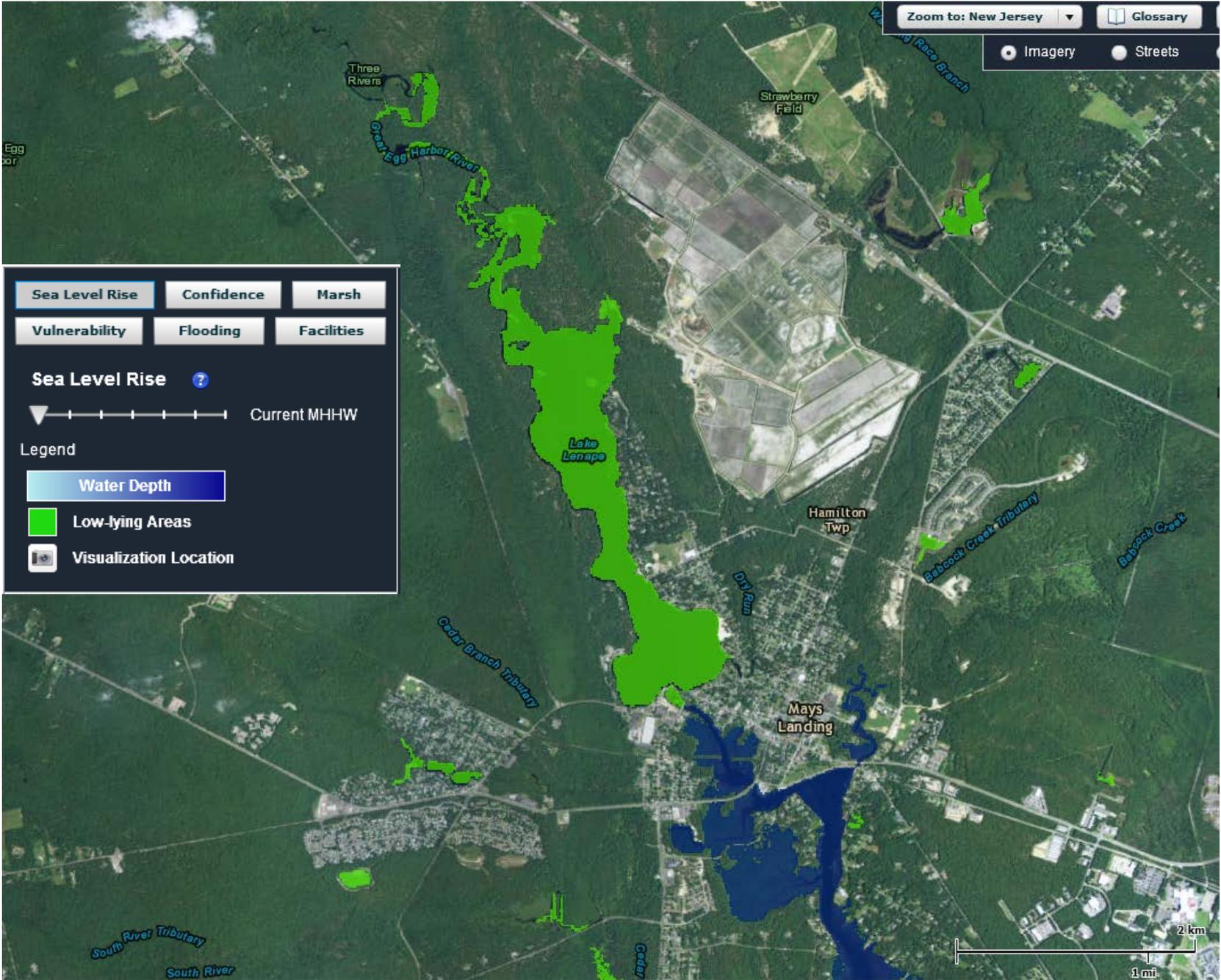
Sea Level Rise Confidence Marsh
 Vulnerability Flooding Facilities

Sea Level Rise ?

▼ ———— Current MHHW

Legend

- Water Depth
- Low-lying Areas
- Visualization Location



Zoom to: New Jersey

Glossary

Imagery

Streets

Sea Level Rise

Confidence

Marsh

Vulnerability

Flooding

Facilities

Sea Level Rise ?

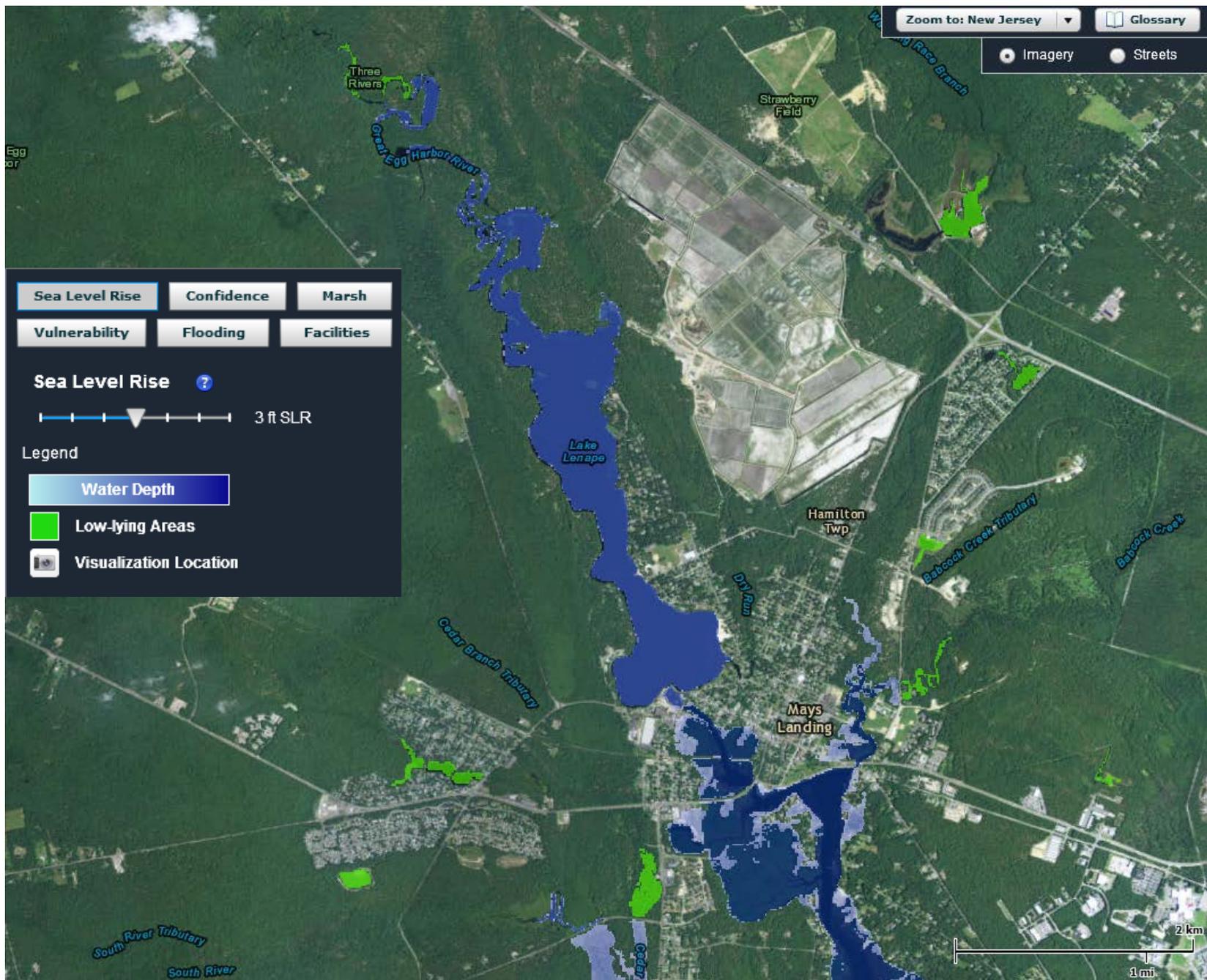
3 ft SLR

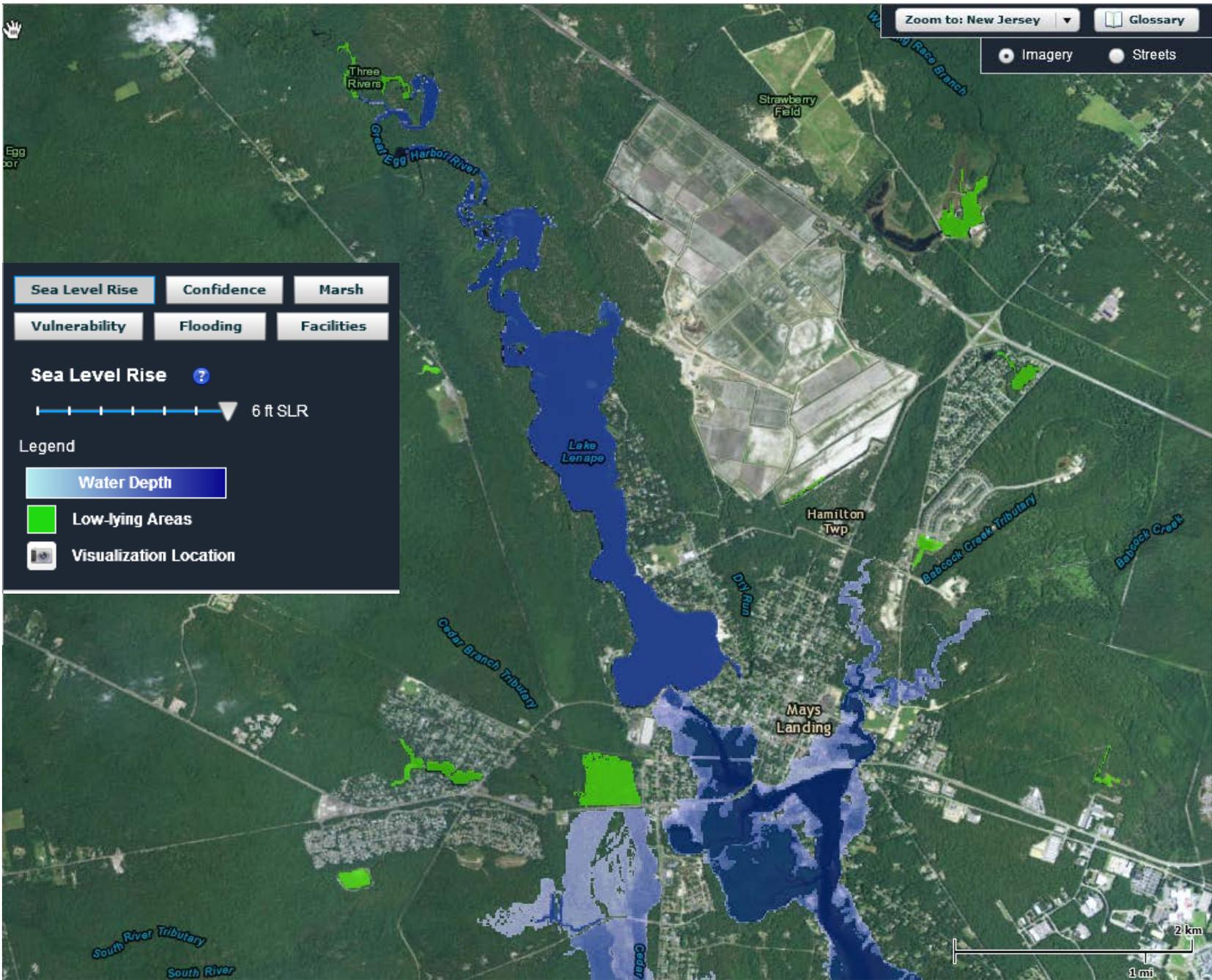
Legend

Water Depth

Low-lying Areas

Visualization Location



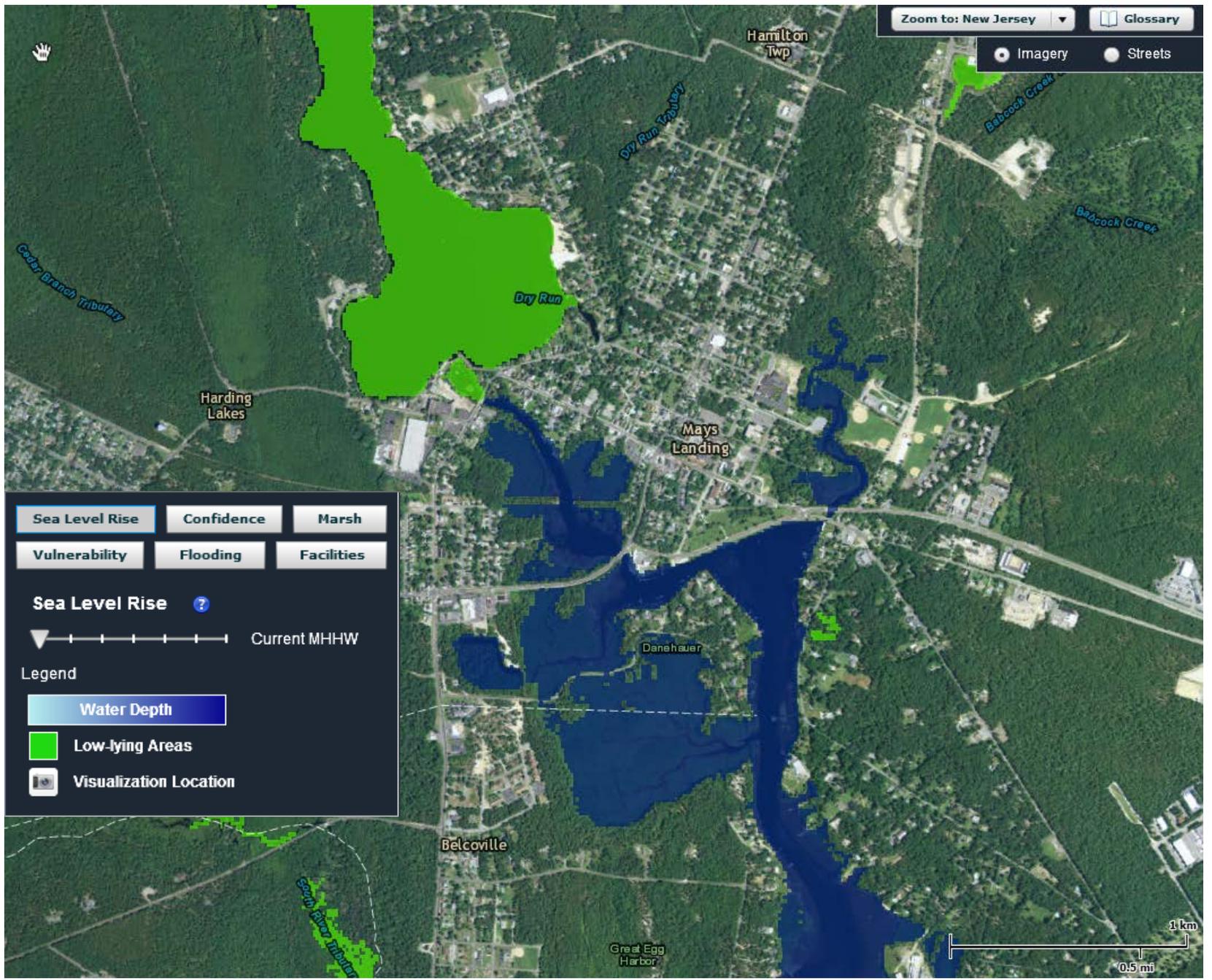


Zoom to: New Jersey

Glossary

Imagery

Streets



Sea Level Rise	Confidence	Marsh
Vulnerability	Flooding	Facilities

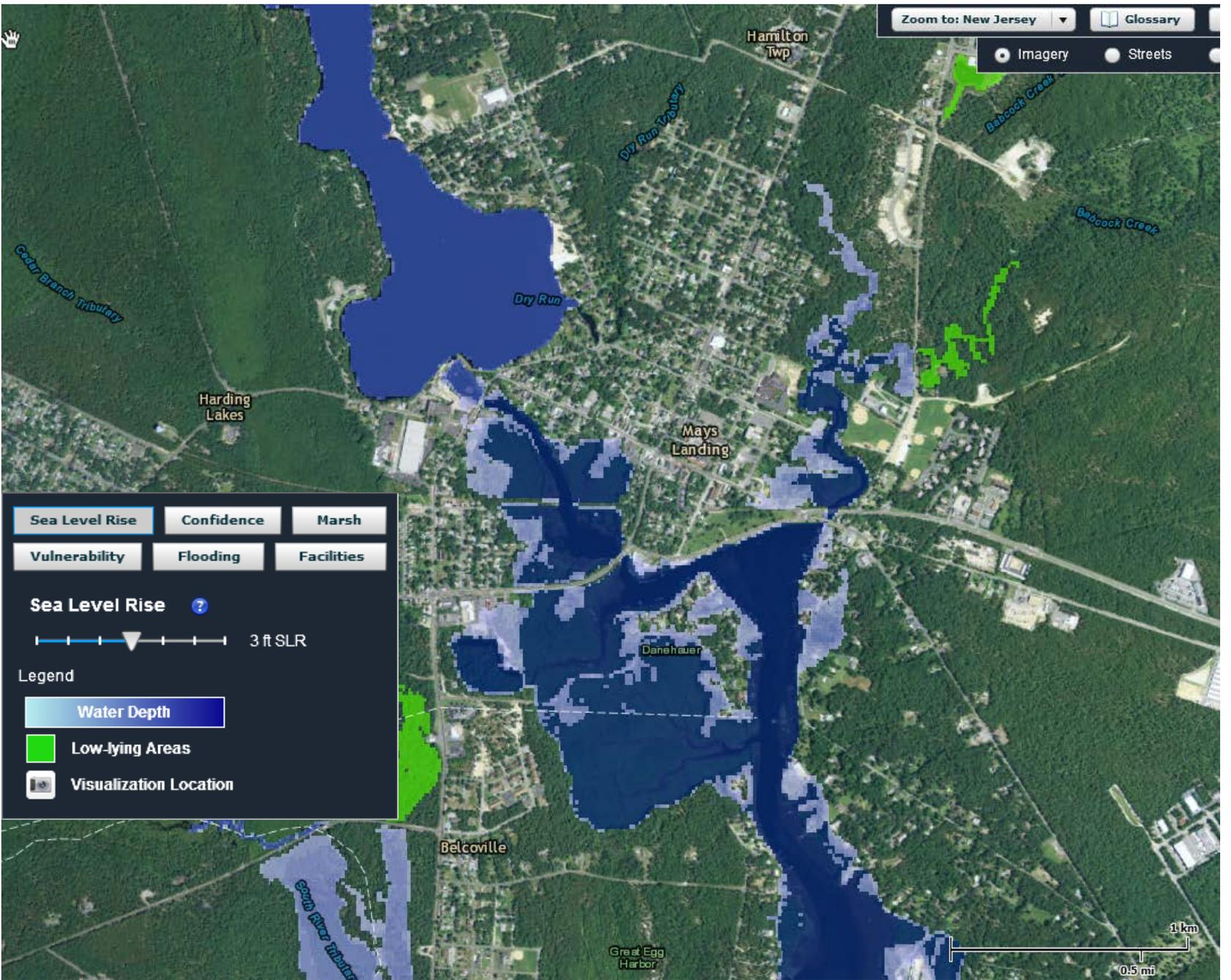
Sea Level Rise ?

▼ ———— Current MHHW

Legend

	Water Depth
	Low-lying Areas
	Visualization Location



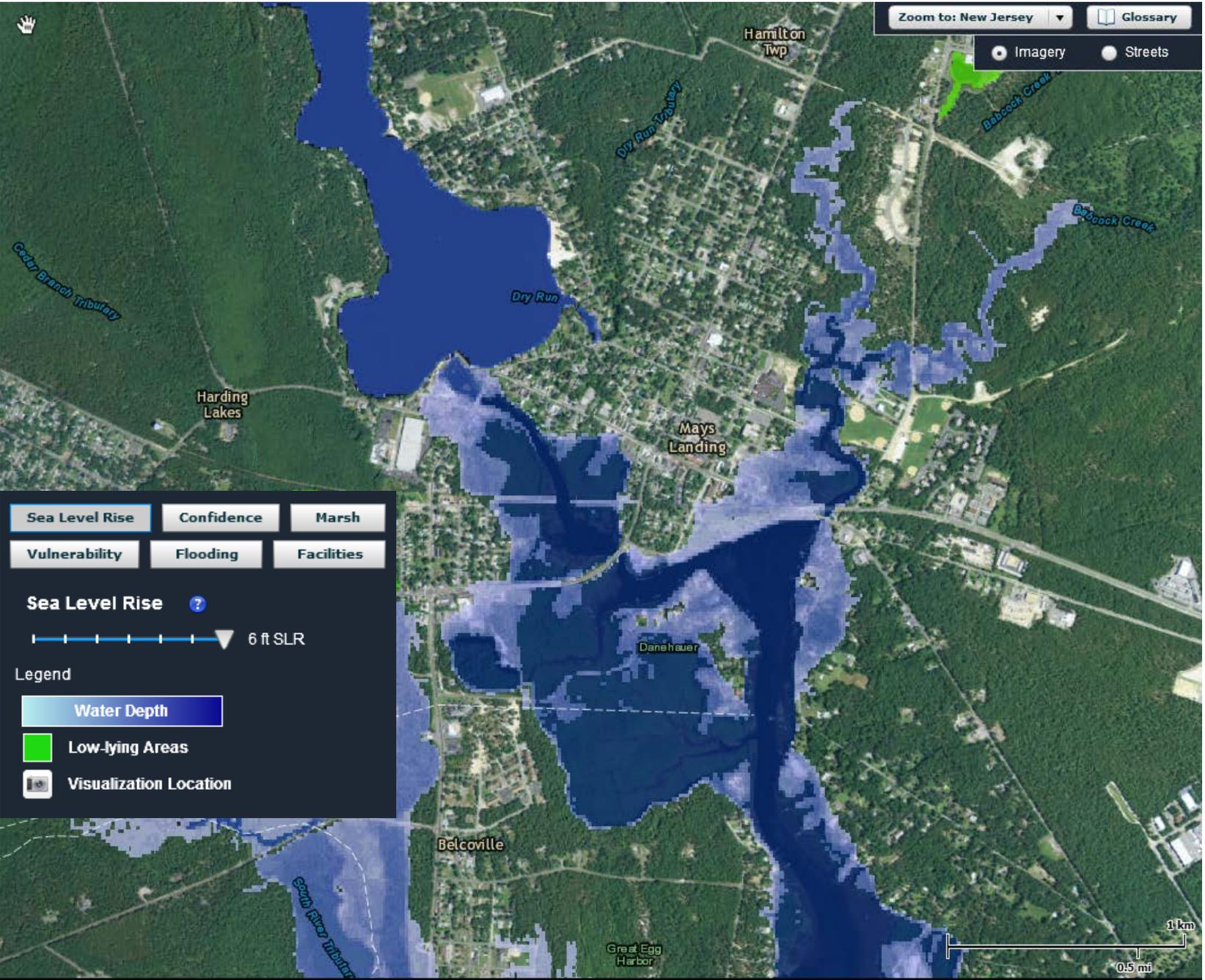


Zoom to: New Jersey

Glossary

Imagery

Streets



Sea Level Rise Confidence Marsh

Vulnerability Flooding Facilities

Sea Level Rise ?

6 ft SLR

Legend

- Water Depth
- Low-lying Areas
- Visualization Location



Sea Level Rise Confidence Marsh
 Vulnerability **Flooding** Facilities

Flood Hazard Areas/Storm Surge ?

Tide Gauges

PFIRMs **Storm Surge** 2050 SFHA

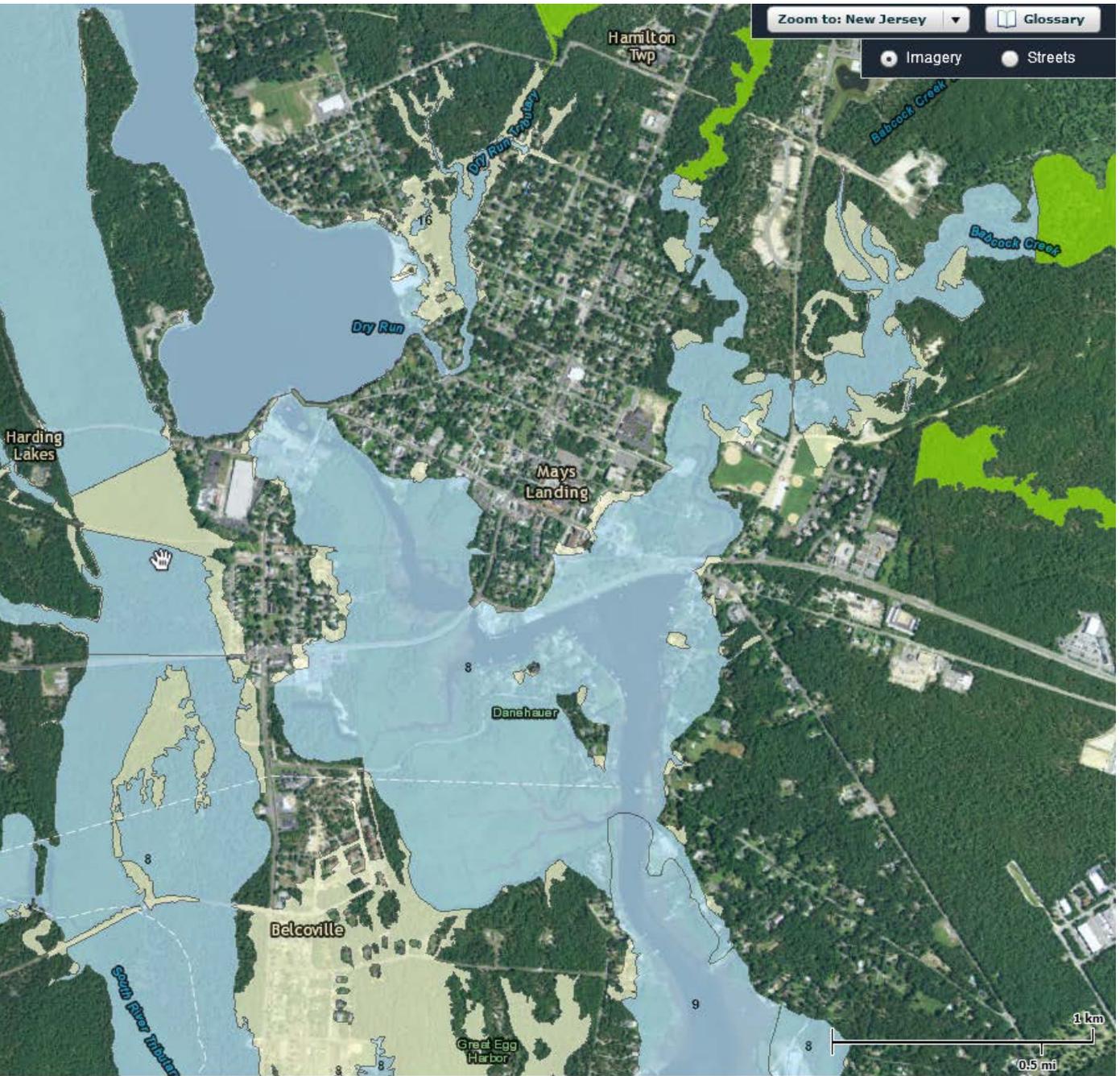
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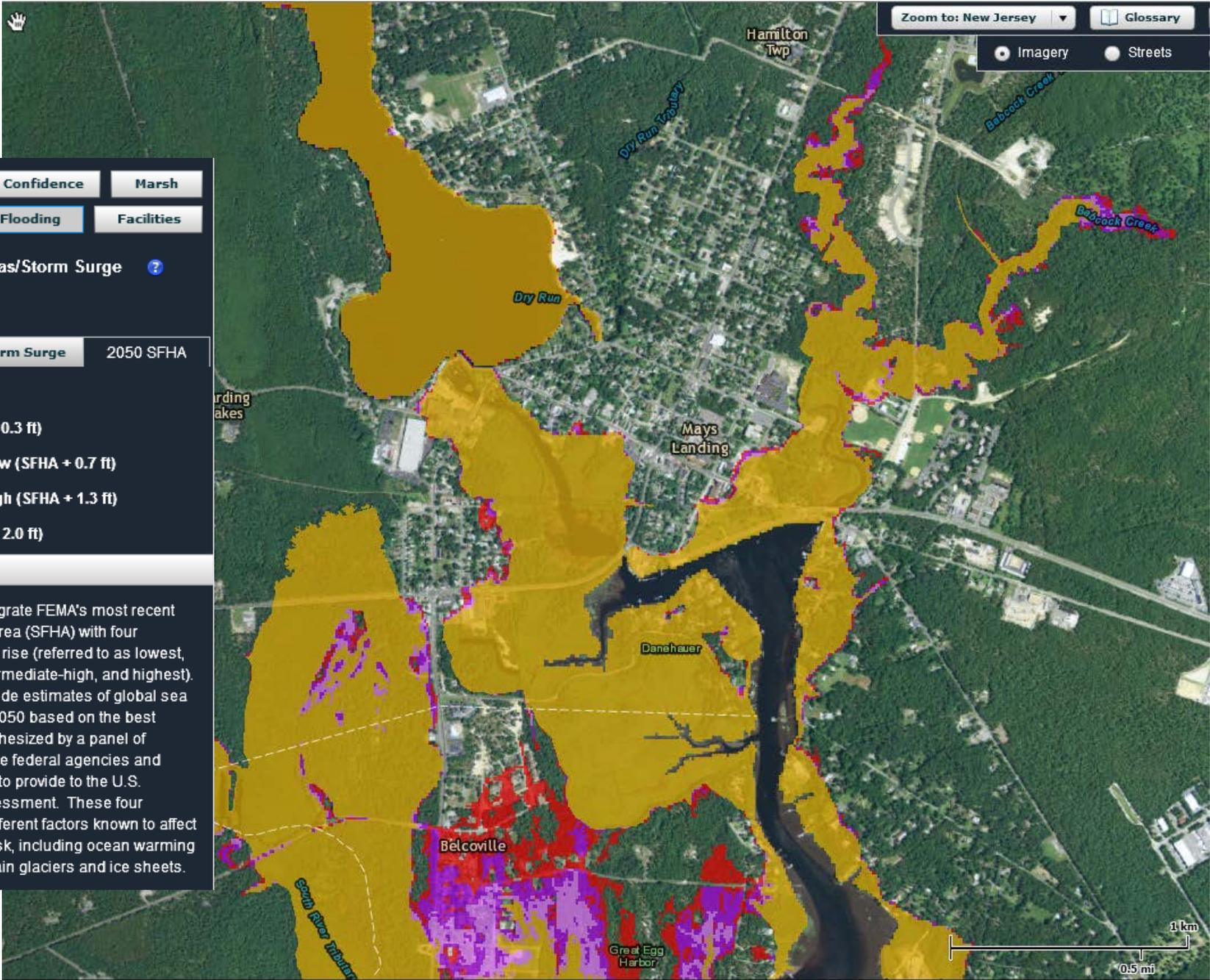
- A: 100-year flooding, no BFE
- AE: 100-year flooding, BFE
- AO: 100-year flooding, 1-3 feet
- VE: 100-year flooding w/ velocity hazard
- X: 500-year flooding
- BFE in feet (zoom in to display)

Overview

This map shows high-risk (1% annual chance, or 100-year floodplain) and moderate-risk (0.2% annual chance, or 500-year floodplain) flood zones designated by the Federal Emergency Management Agency (FEMA).

Some parts of the flood zone may experience frequent flooding while other areas are only affected by severe storms. Areas outside of mapped zones may also be at risk since land use changes could have occurred after the maps were created, changing the flooding potential.





Sea Level Rise Confidence Marsh
Vulnerability **Flooding** Facilities

Flood Hazard Areas/Storm Surge ?

Tide Gauges

PFIRMs Storm Surge 2050 SFHA

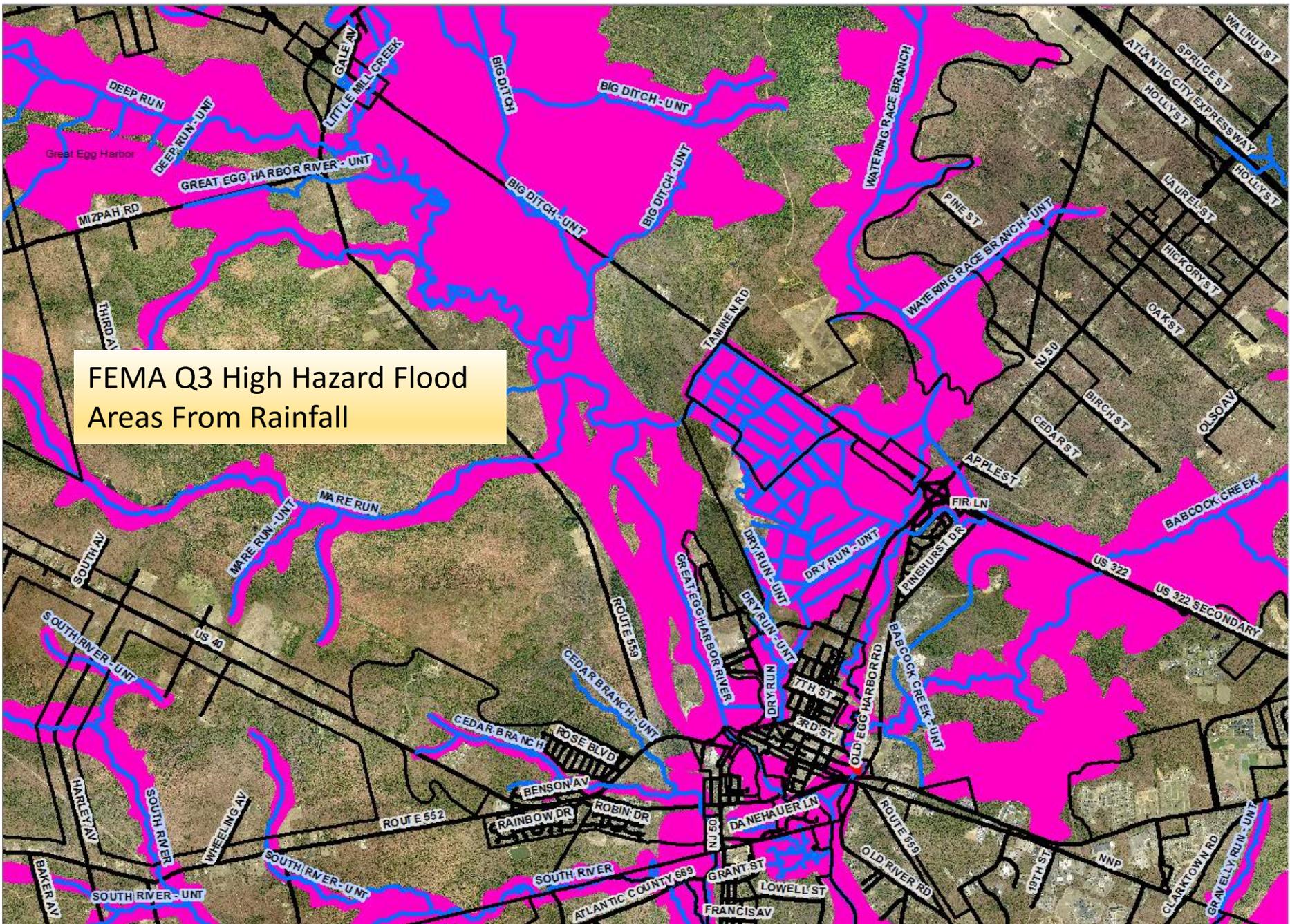
Legend

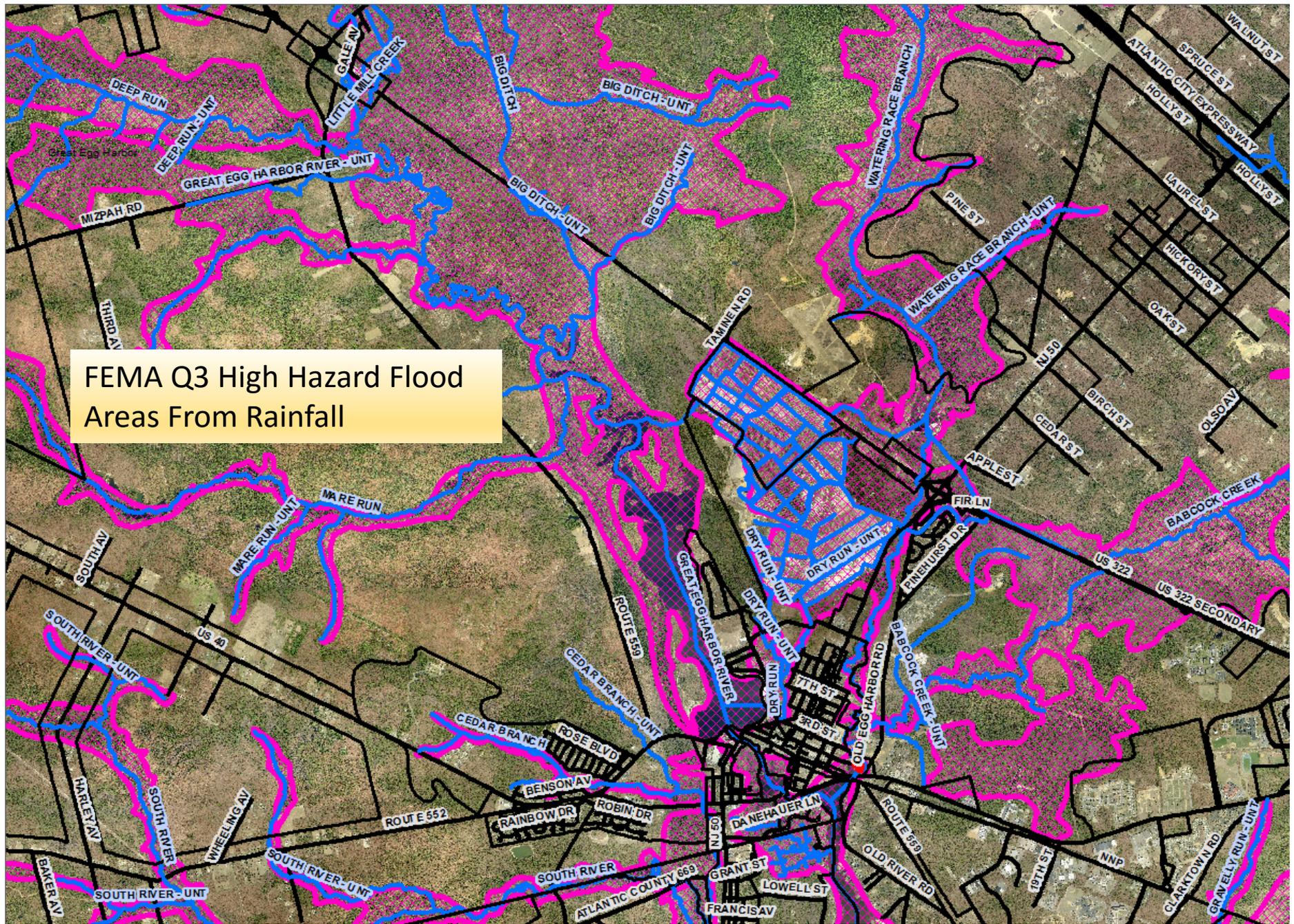
- Lowest (SFHA + 0.3 ft)
- Intermediate-Low (SFHA + 0.7 ft)
- Intermediate-High (SFHA + 1.3 ft)
- Highest (SFHA + 2.0 ft)

Overview

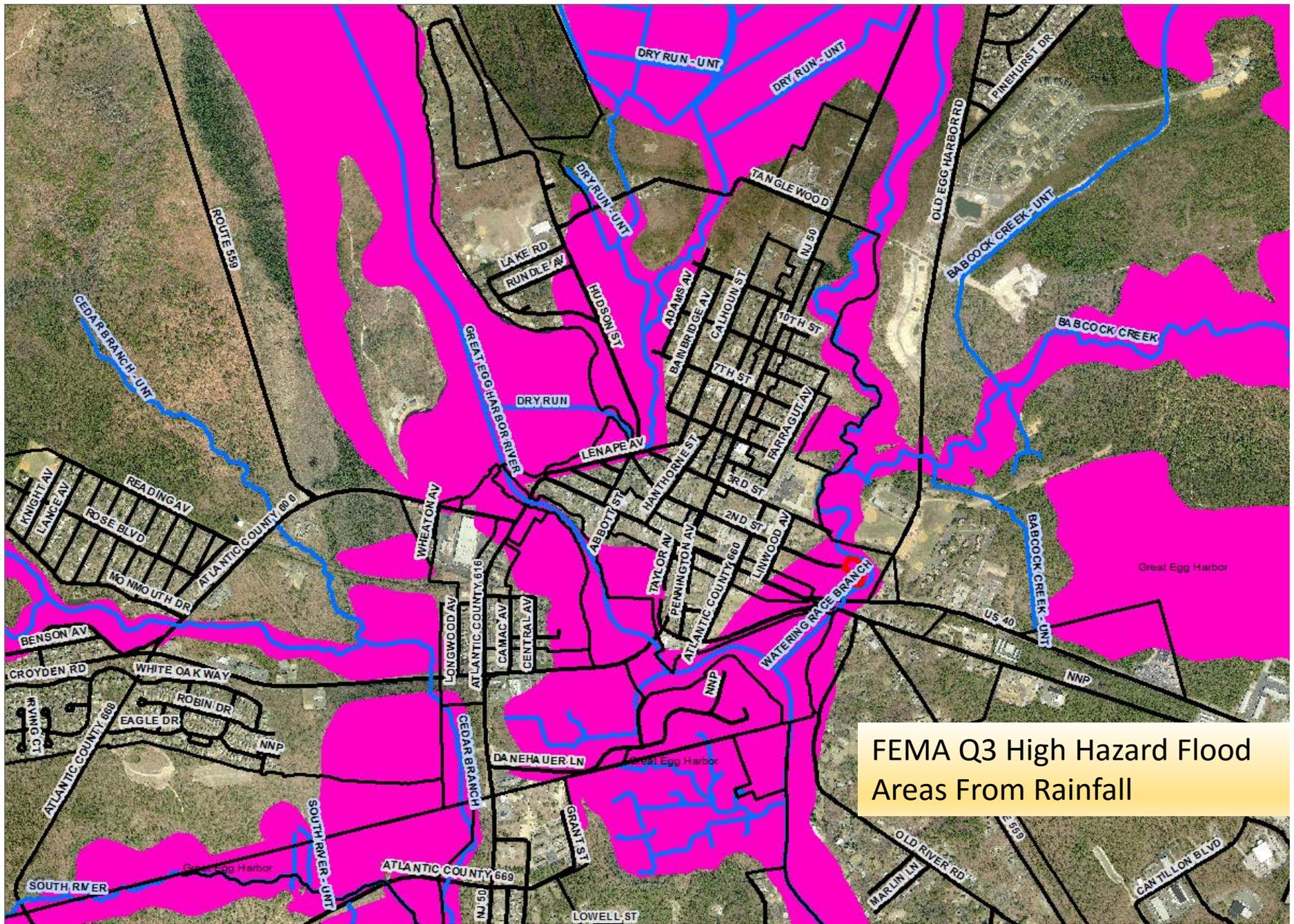
The maps shown integrate FEMA's most recent special flood hazard area (SFHA) with four scenarios of sea level rise (referred to as lowest, intermediate-low, intermediate-high, and highest). These scenarios provide estimates of global sea level rise by the year 2050 based on the best available science synthesized by a panel of scientists from multiple federal agencies and academic institutions to provide to the U.S. National Climate Assessment. These four scenarios address different factors known to affect future sea level rise risk, including ocean warming and melting of mountain glaciers and ice sheets.

FEMA Q3 High Hazard Flood Areas From Rainfall

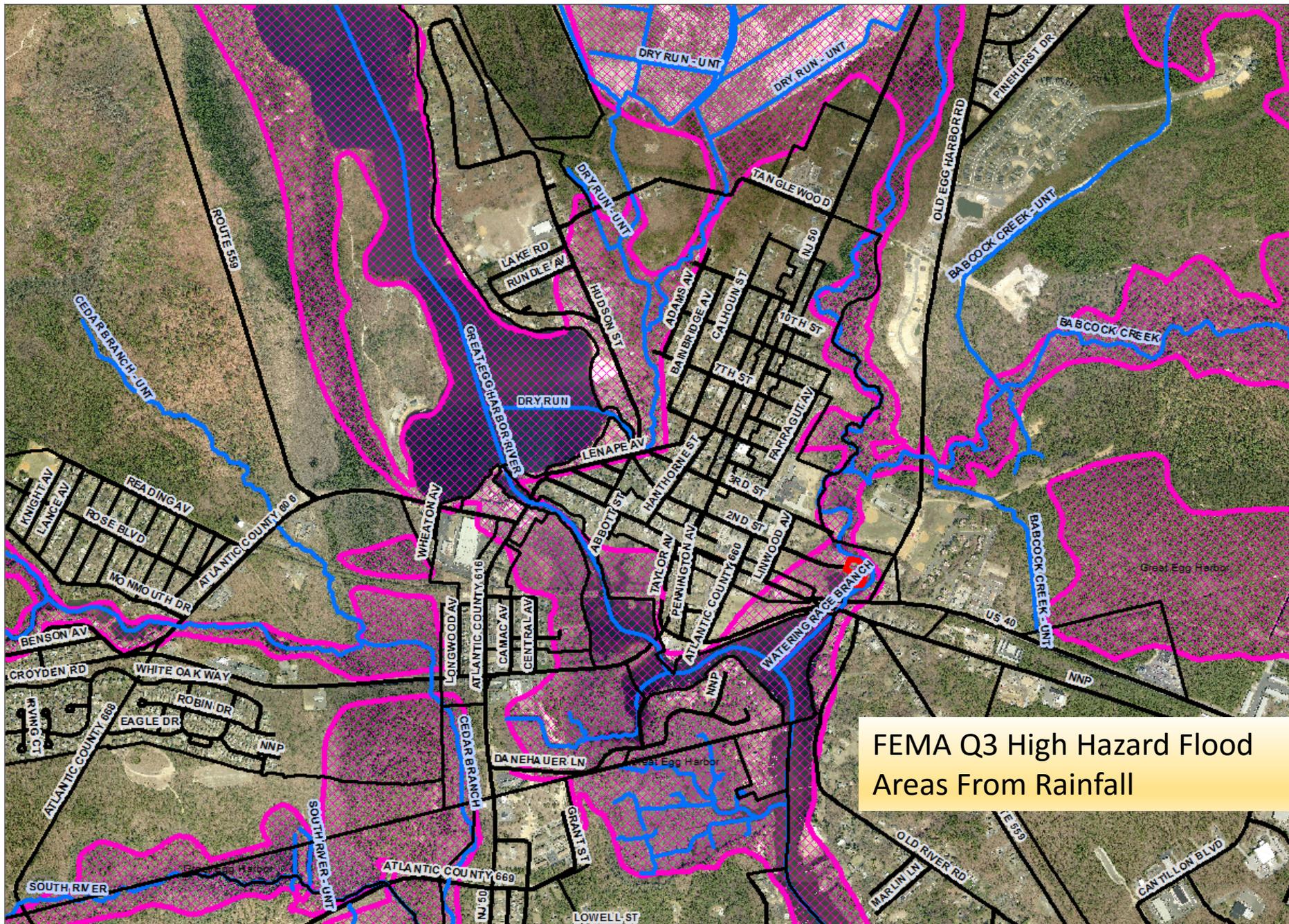




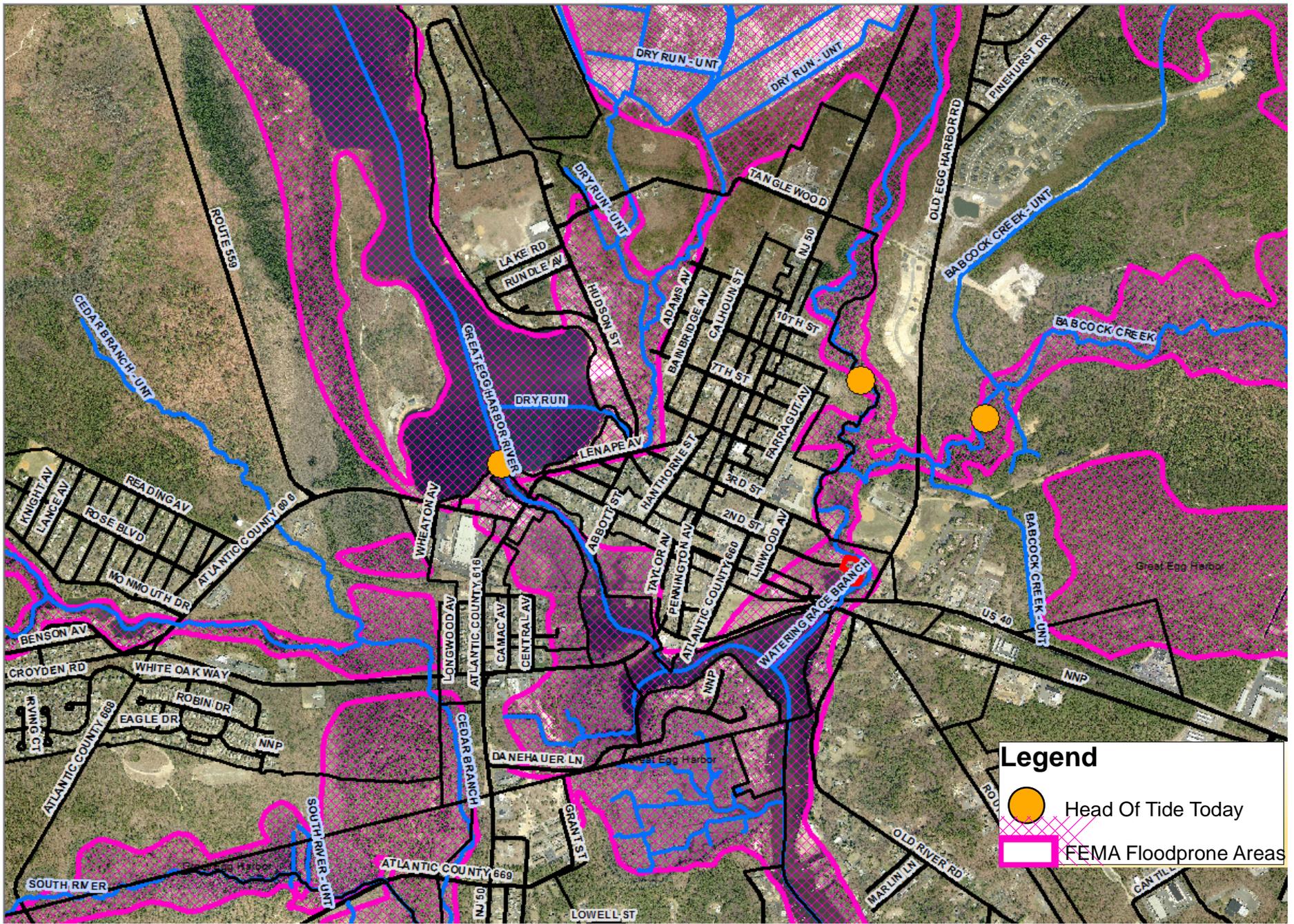
FEMA Q3 High Hazard Flood Areas From Rainfall



FEMA Q3 High Hazard Flood Areas From Rainfall



FEMA Q3 High Hazard Flood Areas From Rainfall



Legend

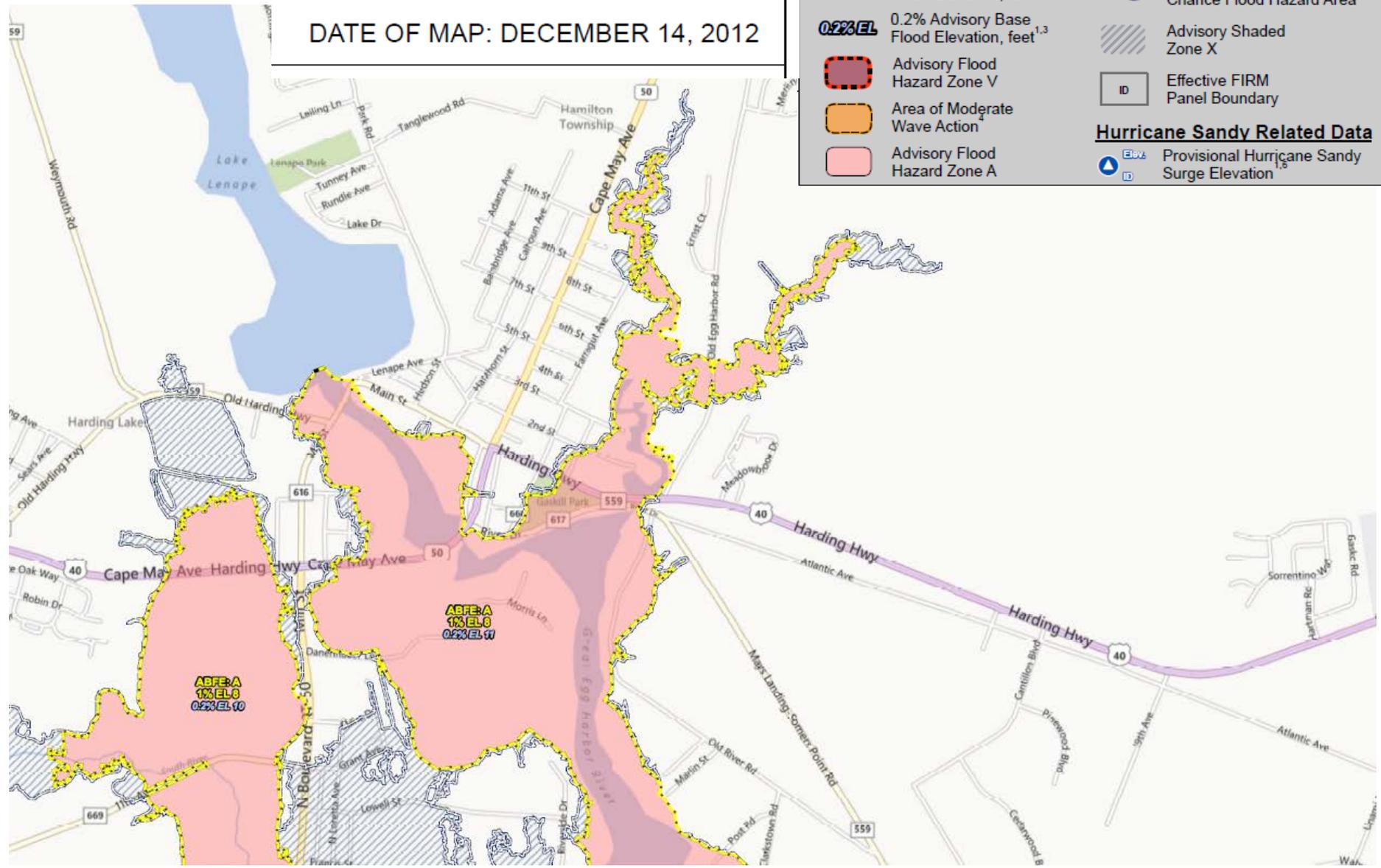
-  Head Of Tide Today
-  FEMA Floodprone Areas

MAP ID: MAYS LANDING NW
DATE OF MAP: DECEMBER 14, 2012
Flood Advisory Related Data

-  Advisory Base Flood Elevation Zone (ABFE)²
-  Advisory Limit of the 1% Annual Chance Flood Hazard Area²
- 1% EL** 1% Advisory Base Flood Elevation, feet^{1,2}
-  Advisory Limit of the 0.2% Annual Chance Flood Hazard Area³
- 0.2% EL** 0.2% Advisory Base Flood Elevation, feet^{1,3}
-  Advisory Flood Hazard Zone V
-  Advisory Shaded Zone X
-  Area of Moderate Wave Action
-  Advisory Flood Hazard Zone A
-  Effective FIRM Panel Boundary

Hurricane Sandy Related Data

-  Provisional Hurricane Sandy Surge Elevation^{1,6}



WHO WE ARE

An independent organization of leading scientists and journalists researching and reporting the facts about our changing climate and its impact on the American public.

WHAT WE DO

Climate Central surveys and conducts scientific research on climate change and informs the public of key findings. Our scientists publish and our journalists report on climate science, energy, sea level rise [Read More](#)

ABOUT OUR EXPERTISE

Members of the Climate Central staff and board are among the most respected leaders in climate science. Staff members are authorities in communicating climate and weather links, sea level rise, climate [Read More](#)

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 EMAIL UPDATES

CAN YOU BEAT THE 2°C TARGET? TAKE THE QUIZ

THE 2° CHALLENGE

Take the quiz to see if you can beat the 2°C target. Then, at the end, decide whether to share your results with diplomats meeting in Paris ...

[CONTINUE ▶](#)



OUR PROGRAMS Collapse x



WXshift

A comprehensive weather site, delivering everything you'd ever want to know about your weather, including the climate context.



Climate Science

Data-driven research and reporting that makes climate science local and advances understanding of climate change impacts.



Meteorology

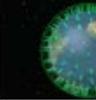
Climate Matters provides meteorologists with data & graphics on local weather events and their link to climate change.

NEWS



Where Cows and Coal Rule, So Does CO2

Per capita carbon emissions are falling, but Wyoming's are still seven times the national average.



These Tiny Satellites Could Keep an Eye on Wildfires

Soon, satellites smaller than a shoebox could offer real-time monitoring for wildfires.

<http://ss2.climatecentral.org/>

Introduction

Climate Central's Surging Seas: Risk Zone map shows areas vulnerable to near-term flooding from different combinations of sea level rise, storm surge, tides, and tsunamis, or to permanent submersion by long-term sea level rise. Within the U.S., it incorporates the latest, high-resolution, high-accuracy lidar elevation data supplied by NOAA, displays points of interest, and contains layers displaying social vulnerability, population density, and property value. Outside the U.S., it utilizes satellite-based elevation data from NASA. It provides the ability to search by location name or postal code.

The accompanying [Risk Finder](#) is an interactive data toolkit for the U.S. that provides local projections and assessments of exposure to sea level rise and coastal flooding tabulated for every zip code and municipality along with planning, legislative and other districts. Exposure assessments cover over 100 demographic, economic, infrastructure and environmental variables using data drawn mainly from federal sources, including NOAA, USGS, FEMA, DOT, DOE, DOI, EPA, FCC and the Census. The three components of the Risk Finder can be accessed via links in the upper right hand corner of this map.

This web tool was highlighted at the launch of The White House's Climate Data Initiative in March 2014. Climate Central's original [Surging Seas](#) was featured on [NBC](#), [CBS](#), and [PBS](#) national news, the cover of [The New York Times](#), in [hundreds](#) of other stories, and in testimony for the [U.S. Senate](#). The Atlantic Cities named it the [most important map of 2012](#). Both the Risk Zone map and the Risk Finder are grounded in peer-reviewed [science](#).

Methods and Qualifiers

This map is based on analysis of digital elevation models mosaicked together for near-total coverage of the global coast. Details and sources for U.S. and international data are below. Elevations are transformed so they are expressed relative to local high tide lines (Mean Higher High Water, or MHHW). A simple elevation threshold-based “bathtub method” is then applied to determine areas below different water levels, relative to MHHW. Within the U.S., areas below the selected water level but apparently not connected to the ocean at that level are shown as a stippled (as opposed to solid) blue on the map. Outside the U.S., due to data quality issues and data limitations, all areas below the selected level are shown as solid blue, unless separated from the ocean by a ridge at least 10 meters (33 feet) above MHHW, in which case they are shown as not affected (no blue).

Flood control structures

Levees, walls, dams or other features may protect some areas, especially at lower elevations. Levees and other flood control structures are included in this map within the U.S., but data limitations, such as an incomplete inventory of levees, and a lack of levee height data, make assessing protection difficult. For this map, levees are assumed high and strong enough for flood protection. However, it is important to note that only 8% of monitored levees in the U.S. are [rated](#) in “Acceptable” condition ([ASCE](#)). Also note that the map implicitly includes unmapped levees and their heights, if broad enough to be effectively captured directly by the elevation data.

Error

Errors or omissions in elevation or levee data may lead to areas being misclassified. Furthermore, this analysis does not account for future erosion, marsh migration, or construction. As is general best practice, local detail should be verified with a site visit. Sites located in zones below a given water level may or may not be subject to flooding at that level, and sites shown as isolated may or may not be so. Areas may be connected to water via porous bedrock geology, and also may also be connected via channels, holes, or passages for drainage that the elevation data fails to or cannot pick up. In addition, sea level rise may cause problems even in isolated low zones during rainstorms by inhibiting drainage.

Surging Seas RISK ZONE MAP

Enter a global coastal place



water level

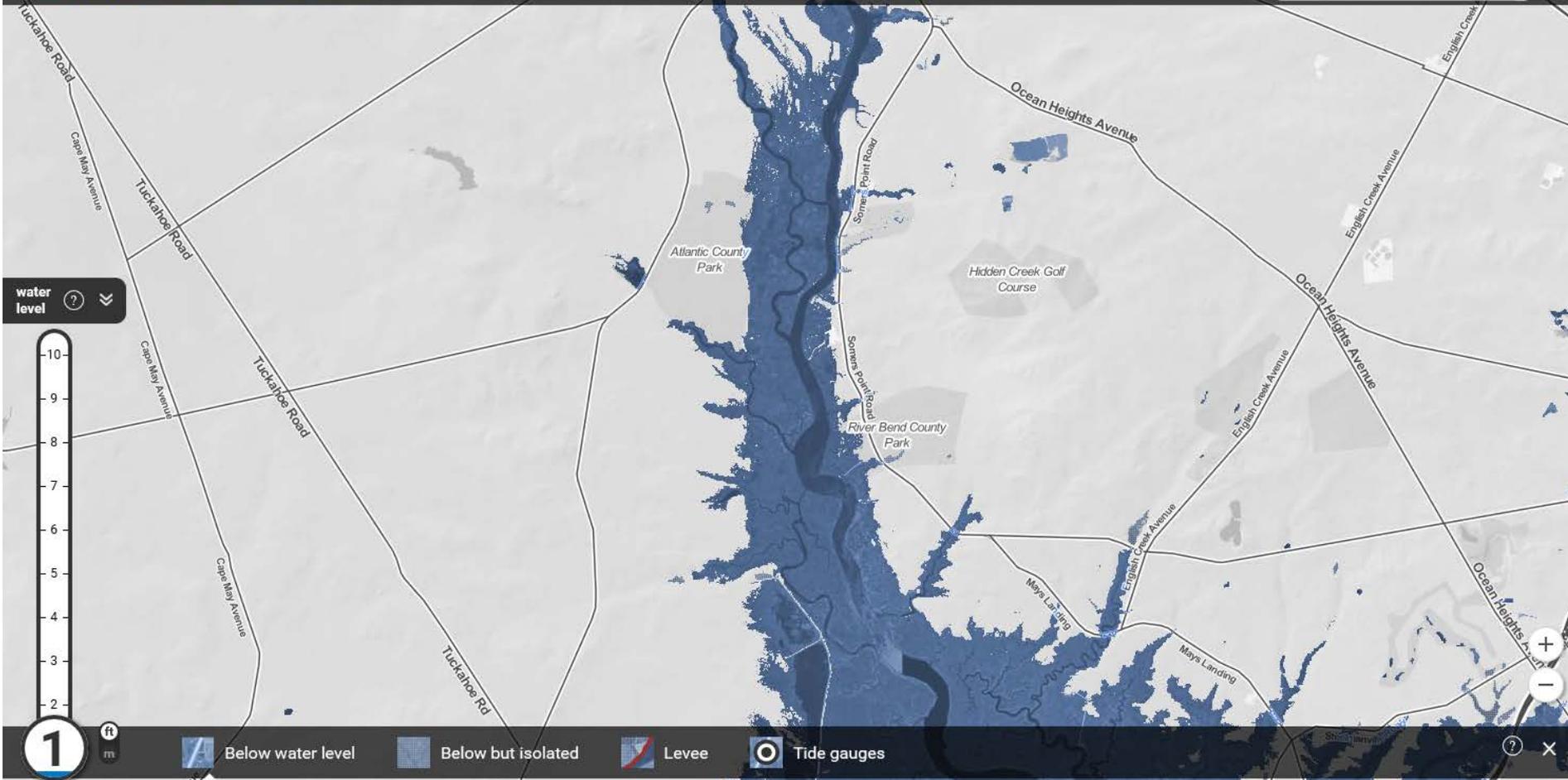


- Below water level
- Below but isolated
- Levee
- Tide gauges

Navigation controls: zoom in (+), zoom out (-), search (?), and close (x).

Surging Seas RISK ZONE MAP

📍 ⏪ ⏩ + ❤️ 📷 ⬇️ Enter a global coastal place 🔍



water level ? >>



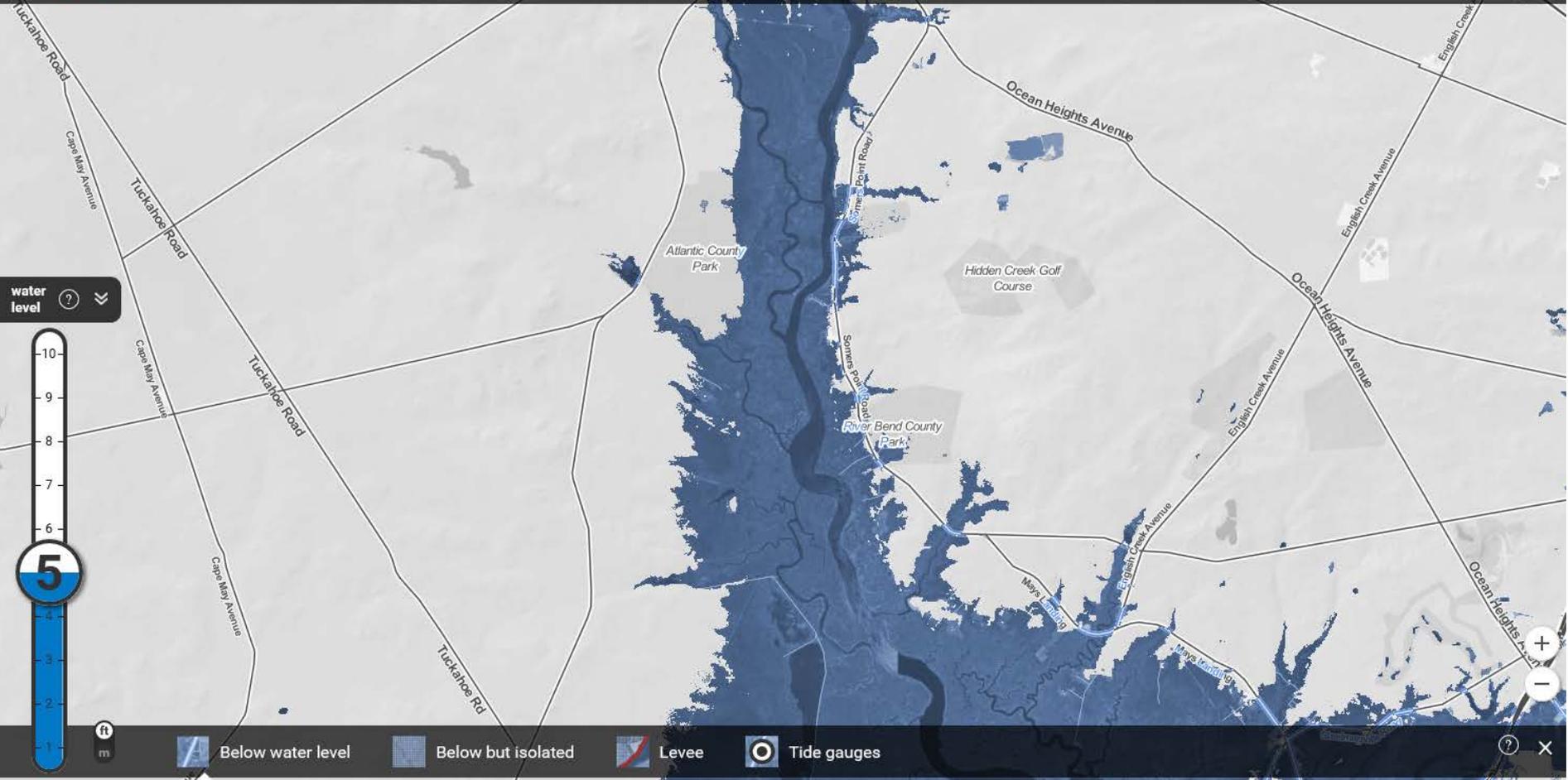
1 ft

- Below water level
- Below but isolated
- Levee
- Tide gauges

Surging Seas RISK ZONE MAP



Enter a global coastal place



water level ?

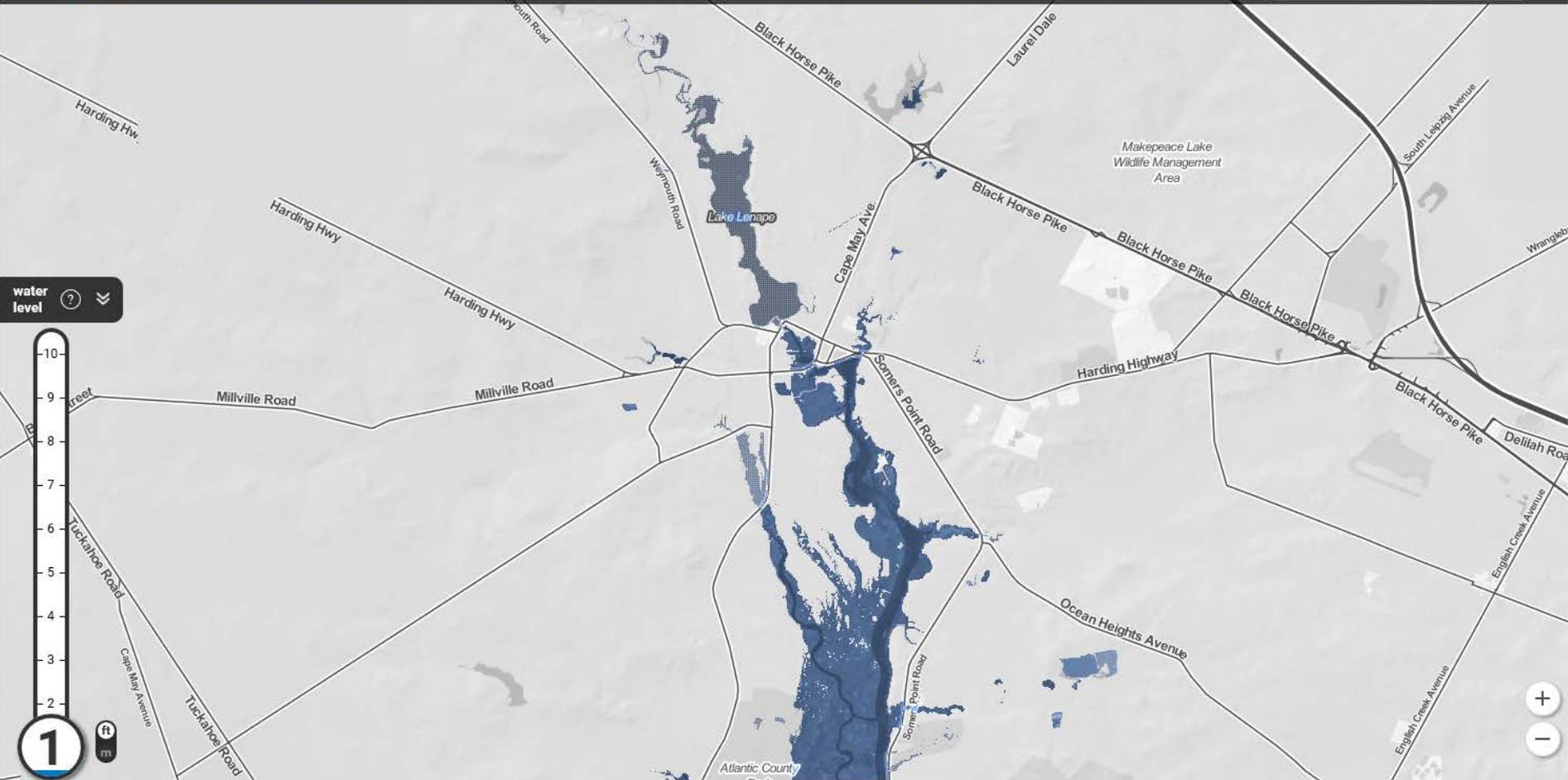


- Below water level
- Below but isolated
- Levee
- Tide gauges

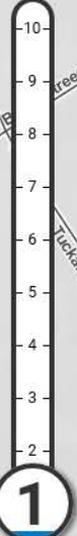
Surging Seas RISK ZONE MAP



Enter a global coastal place



water level ?



1

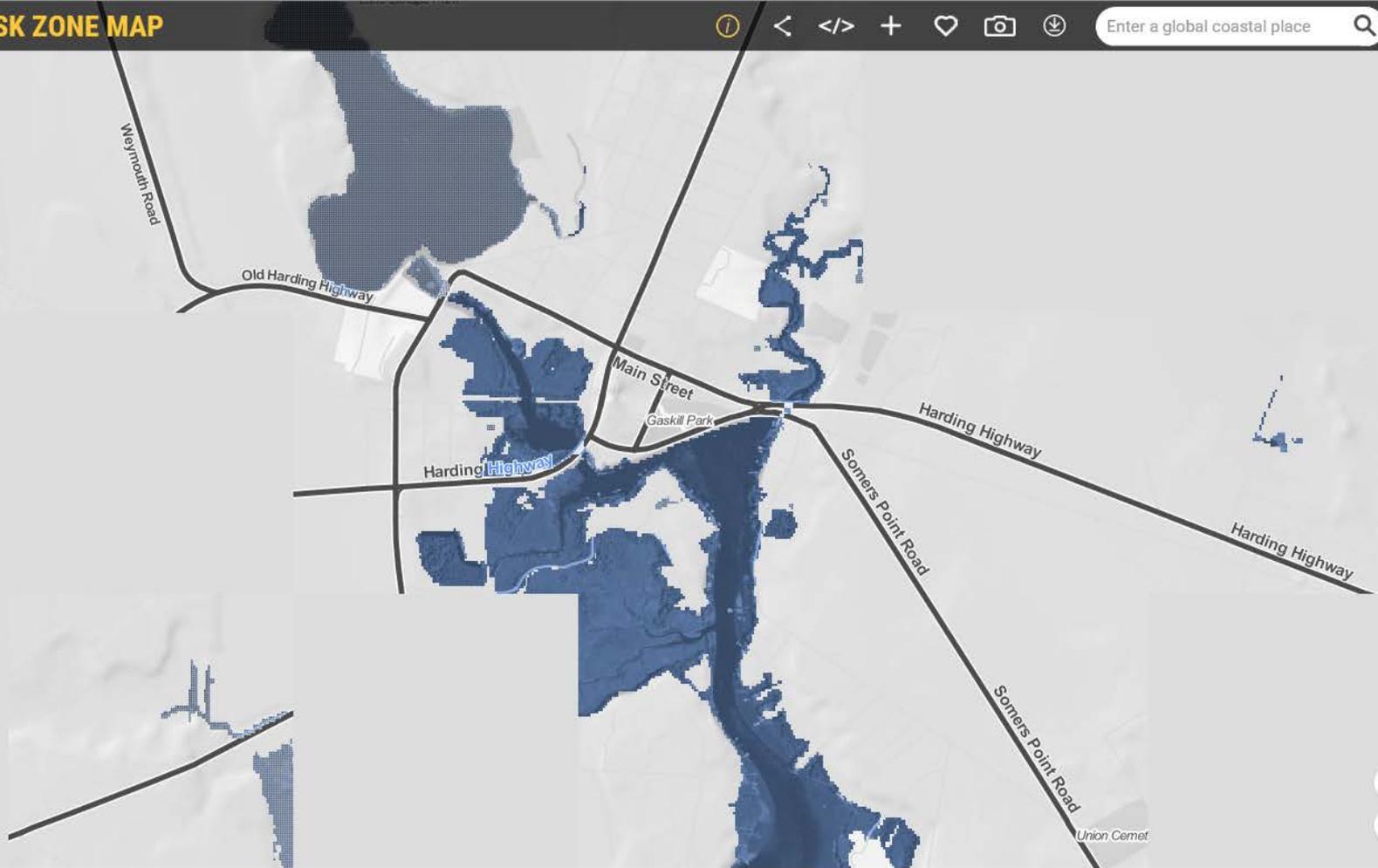
Surging Seas RISK ZONE MAP

ⓘ < </> + ❤️ 📷 ⬇️ Enter a global coastal place 🔍

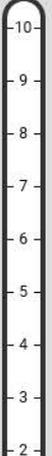


Surging Seas RISK ZONE MAP

ⓘ < </> + ♥ 📷 ⬇️ Enter a global coastal place 🔍



water level ?



1

ft m

+
-

Surging Seas RISK ZONE MAP

Enter a global coastal place

water level



Mapping Choices: Which sea level will we lock in?

<http://choices.climatecentral.org/>

[Lock-In](#) | [Timing](#) | [Choices](#) | [Impacts](#) | [Sources](#) | [Help](#) | [Team](#) | [Funding](#) | [Legal](#)

Introduction

These maps are based on [peer-reviewed scientific research](#) led by [Benjamin Strauss](#) and [Scott Kulp](#) of [Climate Central](#) in collaboration with [Anders Levermann](#) of the [Potsdam Institute of Climate Impact Research](#), and published in [Proceedings of the National Academy of Sciences of the United States of America](#). Application of this research to areas outside the U.S. is detailed in the [Mapping Choices report](#).

These notes are intended to help explain the research, the maps, and how to use them.

Sea level lock-in

Carbon pollution casts a long shadow. It is expected to persist in the atmosphere long enough to prolong temperature increases for hundreds and thousands of years, long after we stop burning fossil fuels or clearing forest. And the seas will continue to rise.

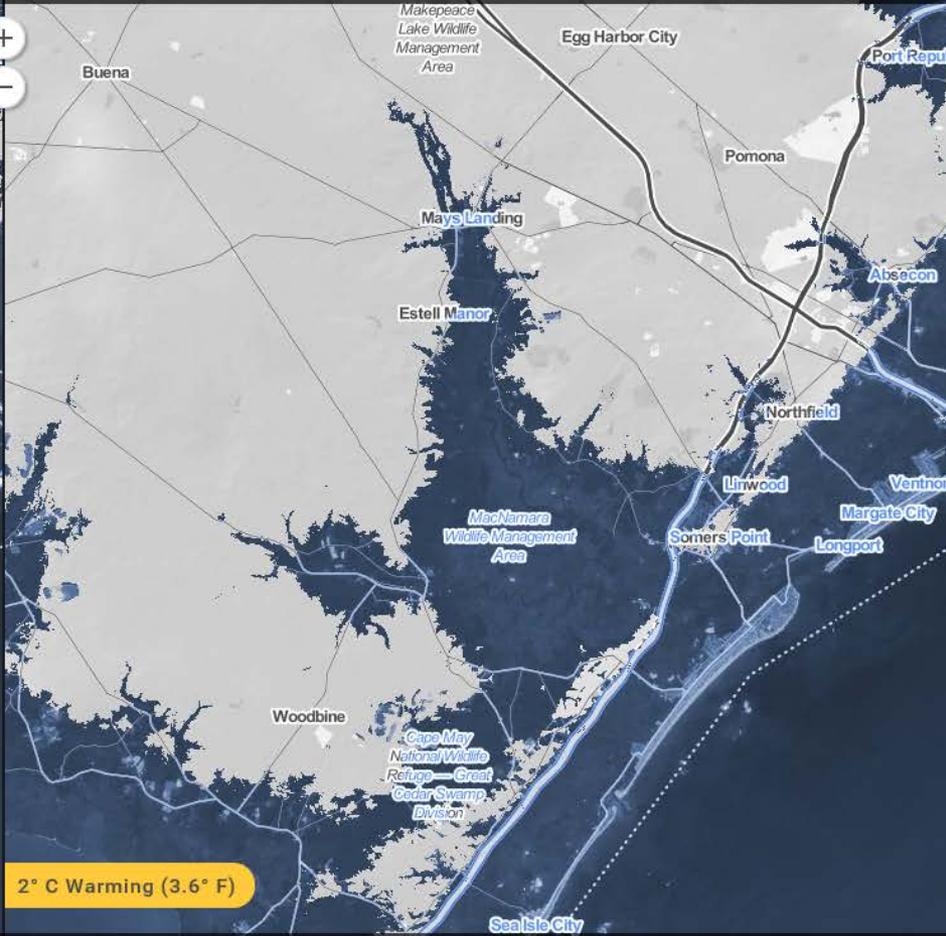
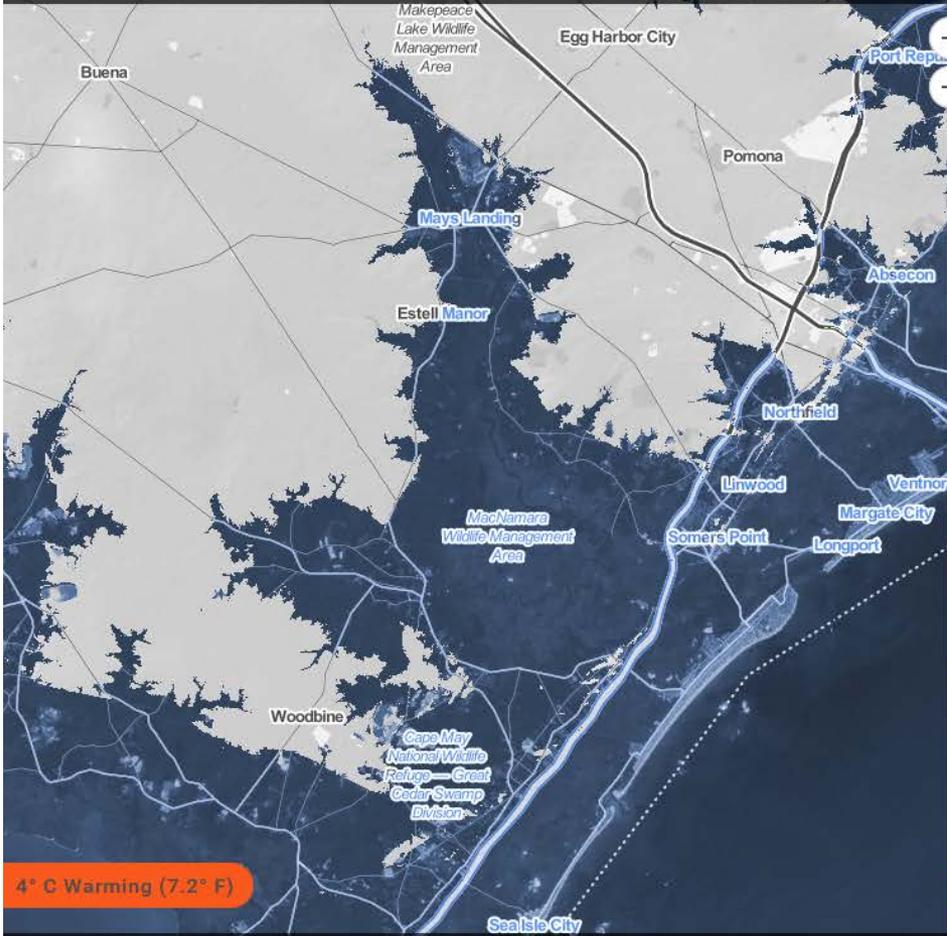
That's what these maps are about. They do *not* show what sea levels will be in *this* century (see [this map](#) for near-term analysis). What they do show are scientific projections, taken from [this paper](#), of the different post-2100 sea levels that could *lock in* this century, depending upon the carbon pathway we select. The areas colored blue are the areas below those levels – areas which will eventually be permanently underwater. These maps pose this question: which legacy will we choose?

Some research has suggested that the West Antarctic Ice Sheet has begun an unstoppable collapse, but the evidence is far from conclusive. The maps here do *not* assume inevitable West Antarctic collapse. If collapse has in fact begun, all locked-in sea levels would be higher than shown. Carbon emissions levels would still influence all outcomes.

Enter a global coastal place

Which sea level will we lock in?

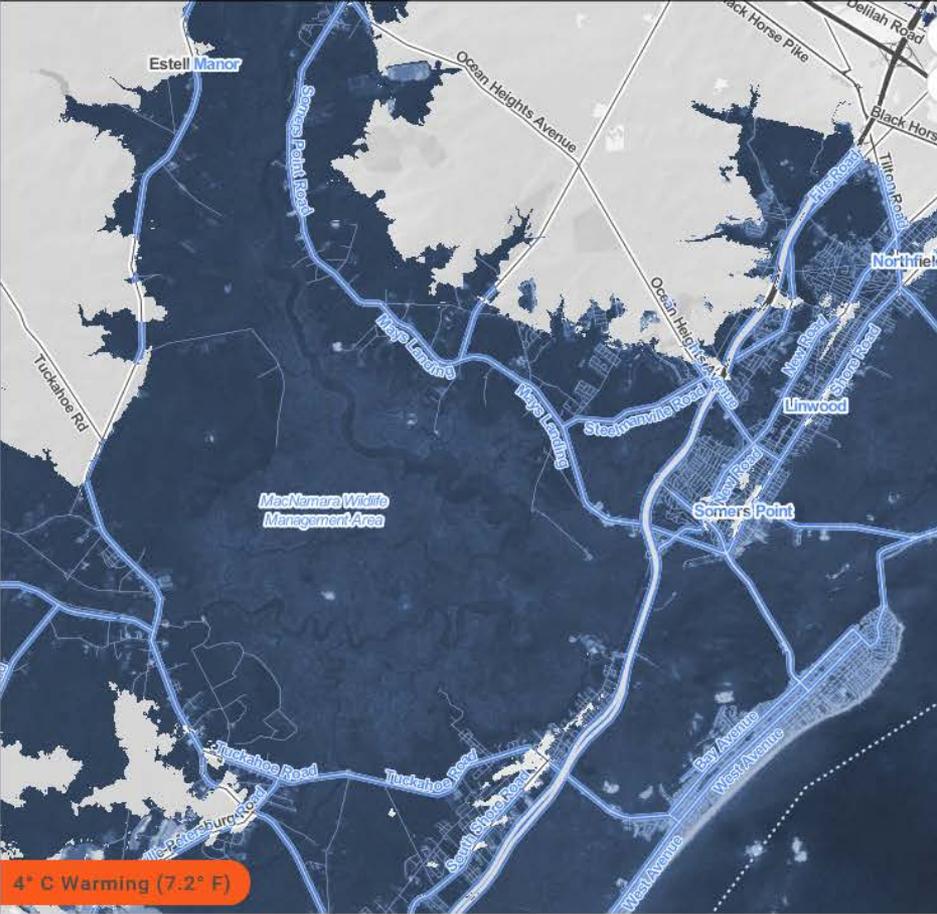
When will this happen?



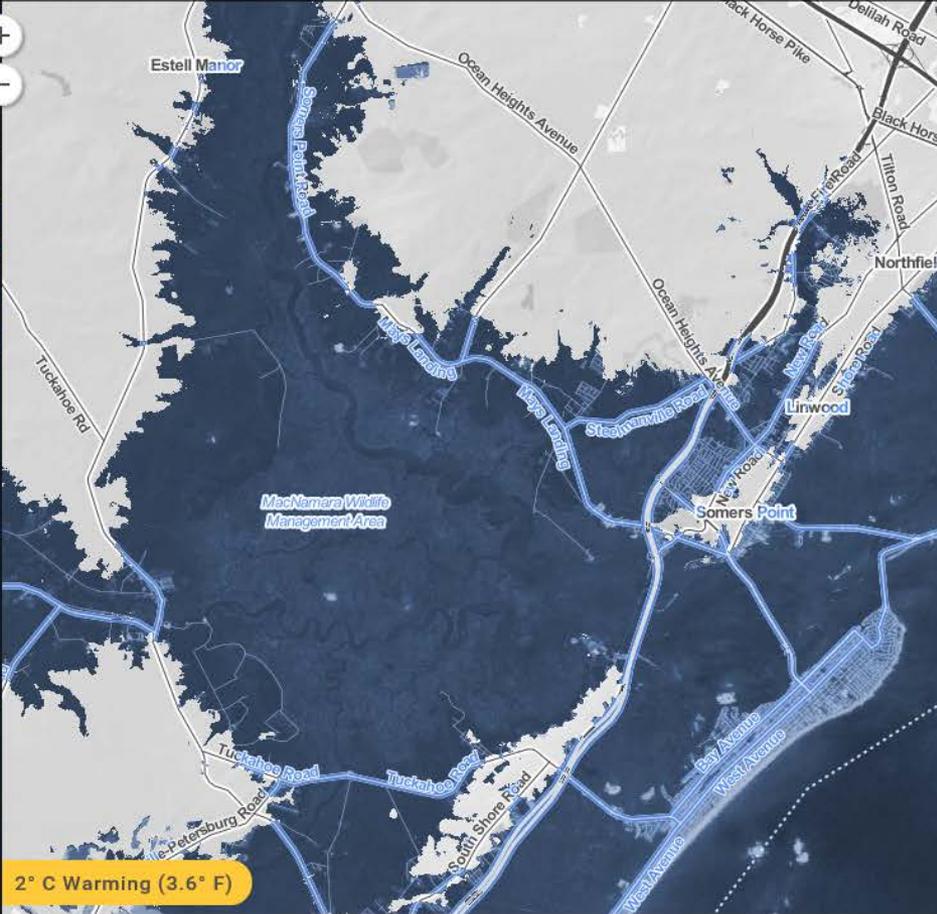
Enter a global coastal place

Which sea level will we lock in?

When will this happen?



4° C Warming (7.2° F)

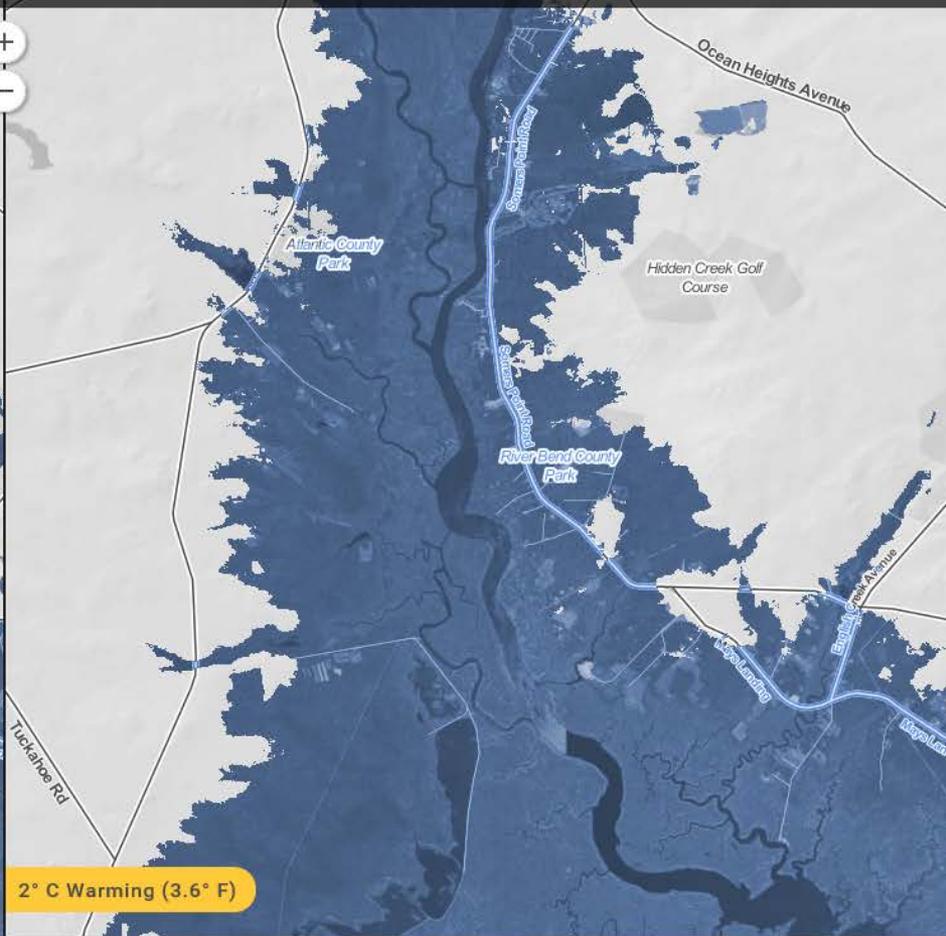
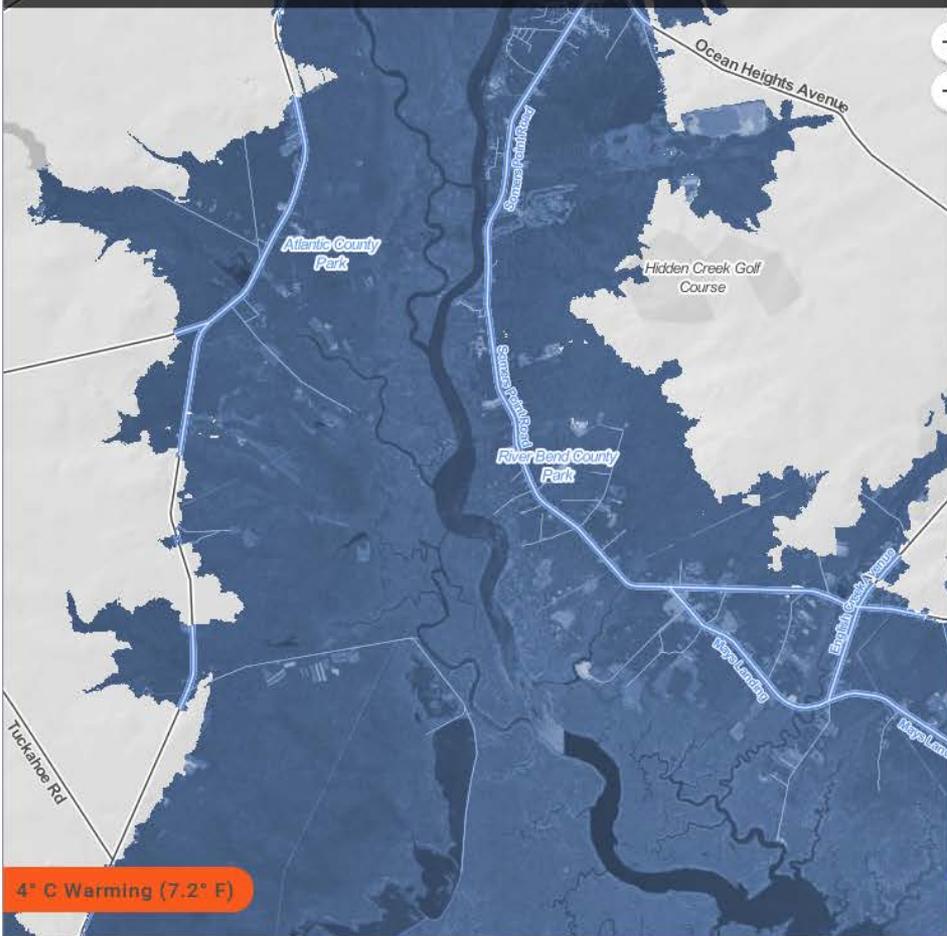


2° C Warming (3.6° F)

Enter a global coastal place 

Which sea level will we lock in?

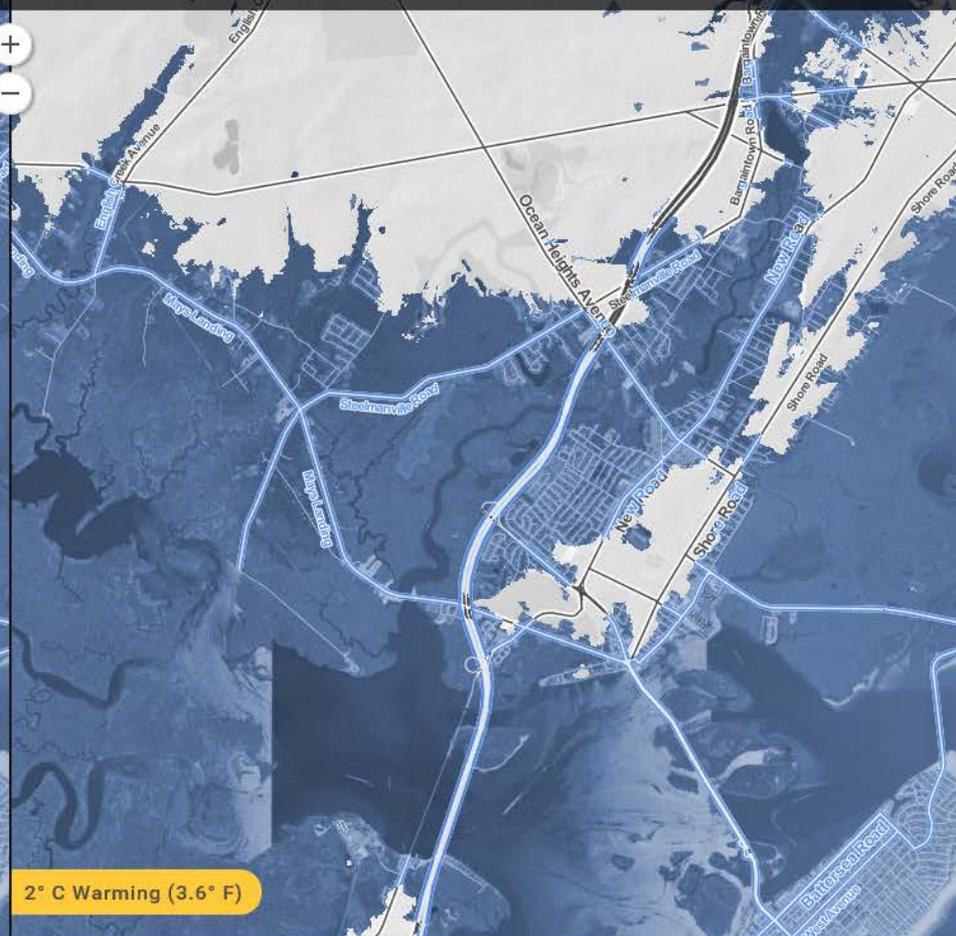
When will this happen?



Enter a global coastal place

Which sea level will we lock in?

When will this happen?

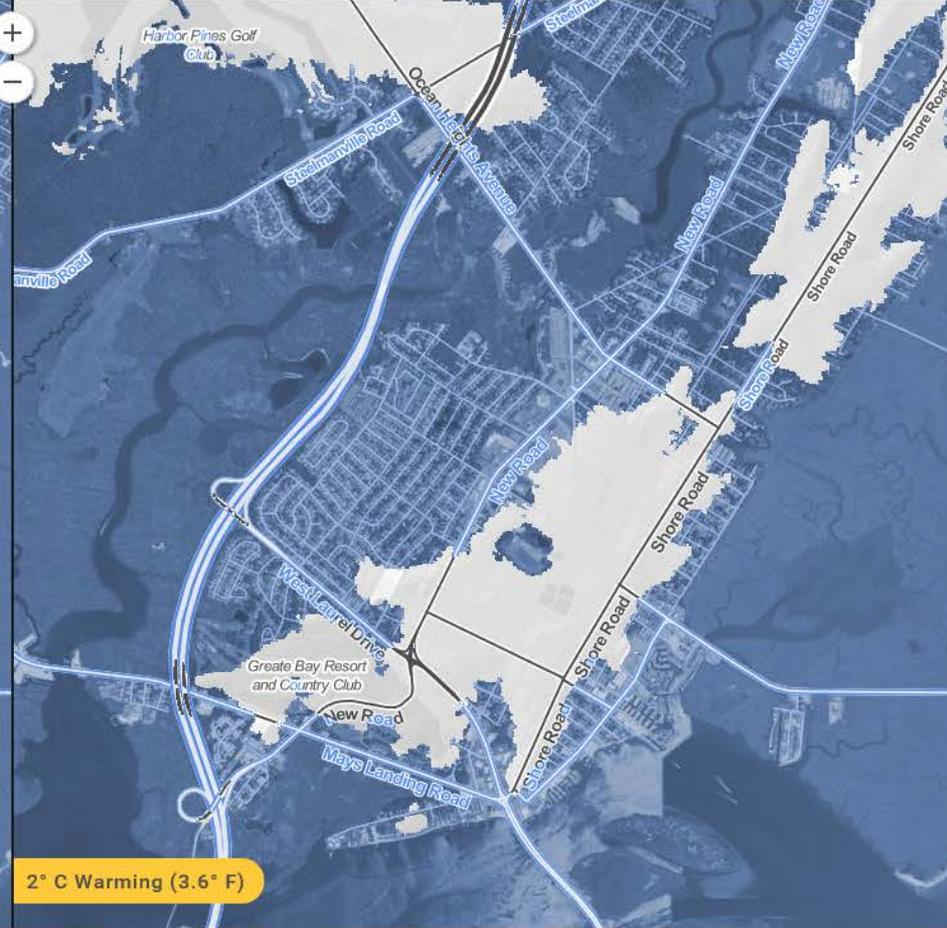
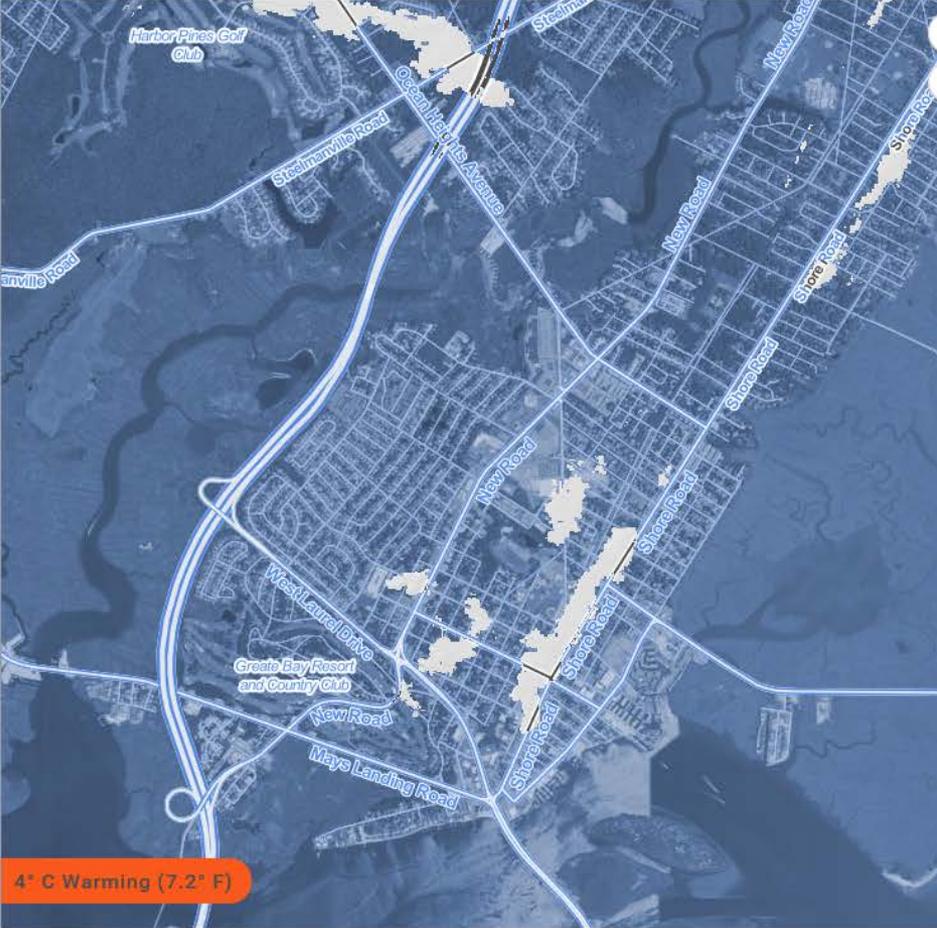


Enter a global coastal place



Which sea level will we lock in?

When will this happen?



Enter a global coastal place

Which sea level will we lock in?

When will this happen?

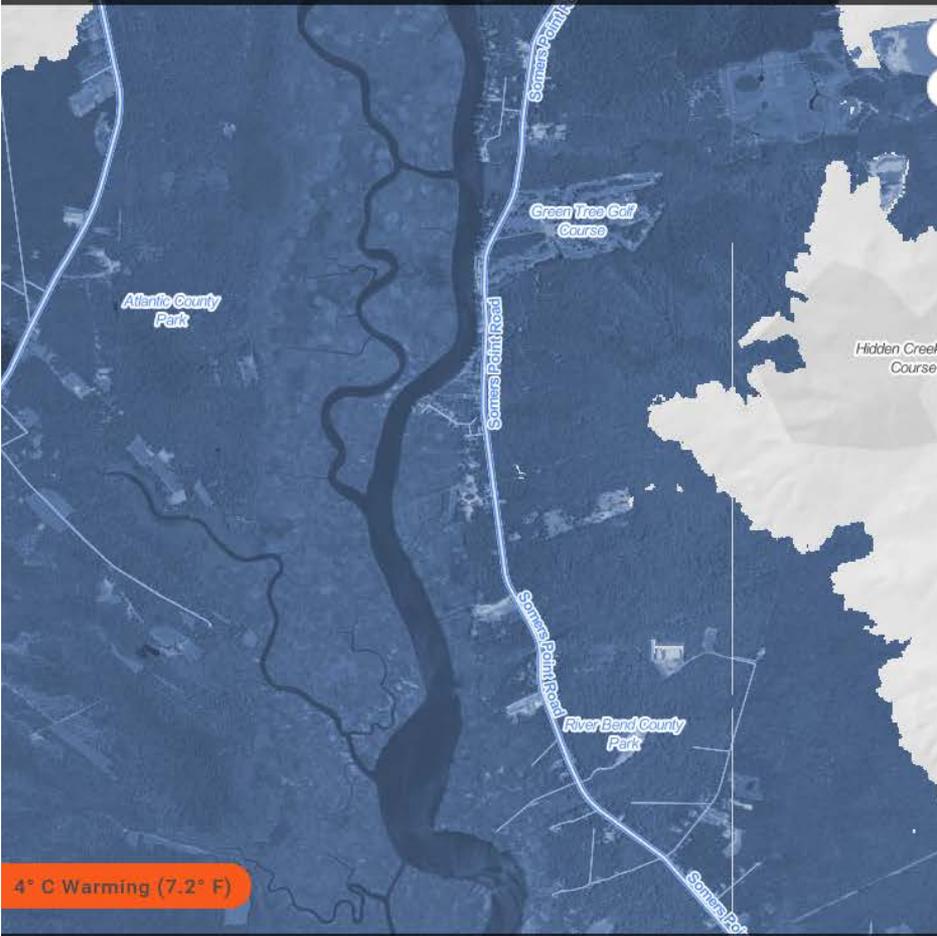


Enter a global coastal place

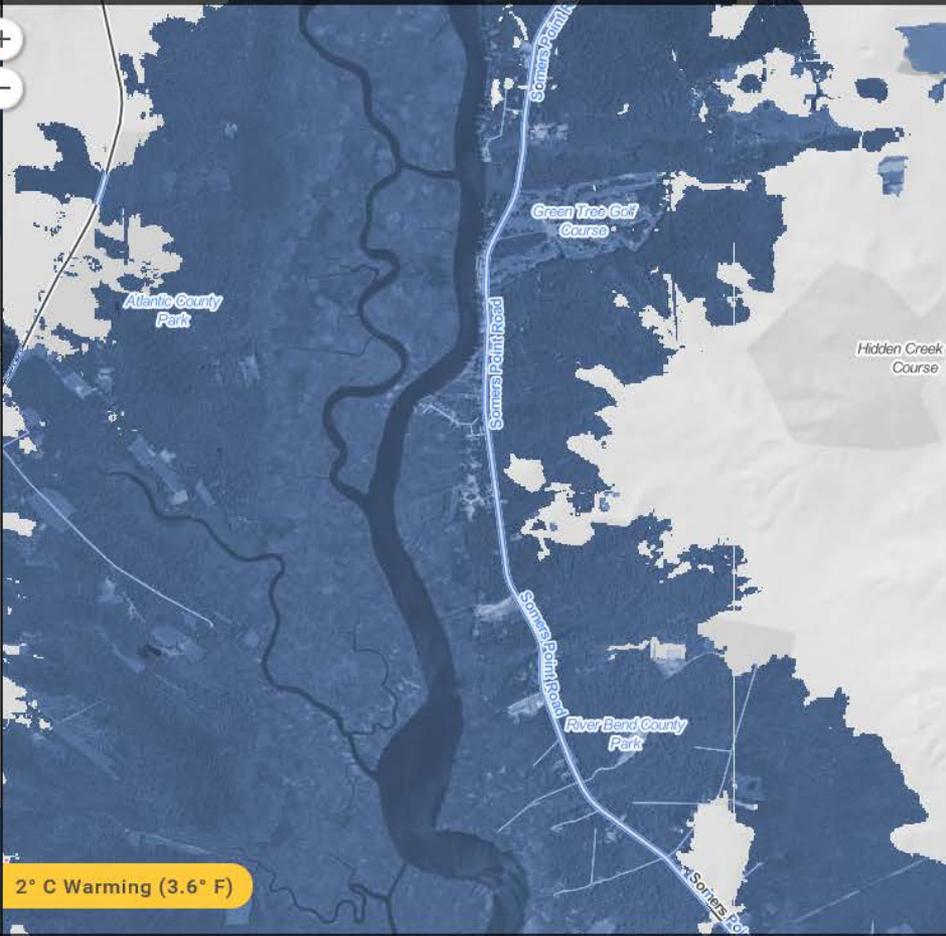


Which sea level will we lock in?

When will this happen?



4° C Warming (7.2° F)

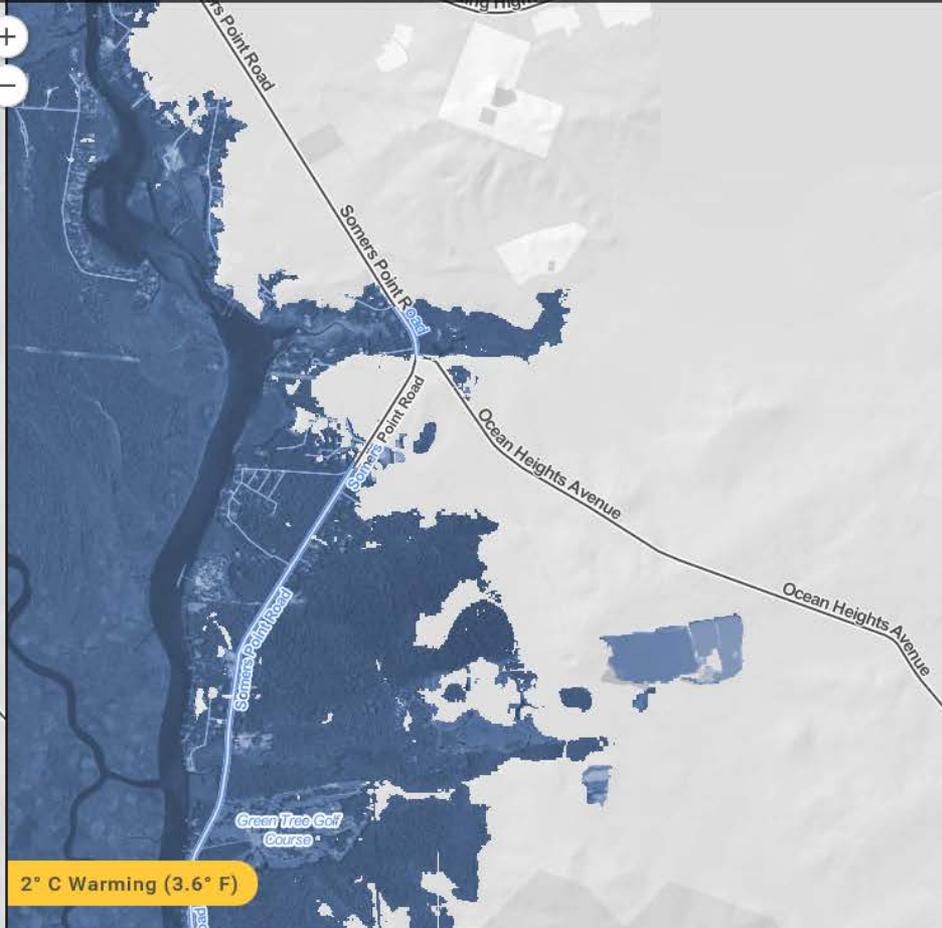


2° C Warming (3.6° F)

Enter a global coastal place

Which sea level will we lock in?

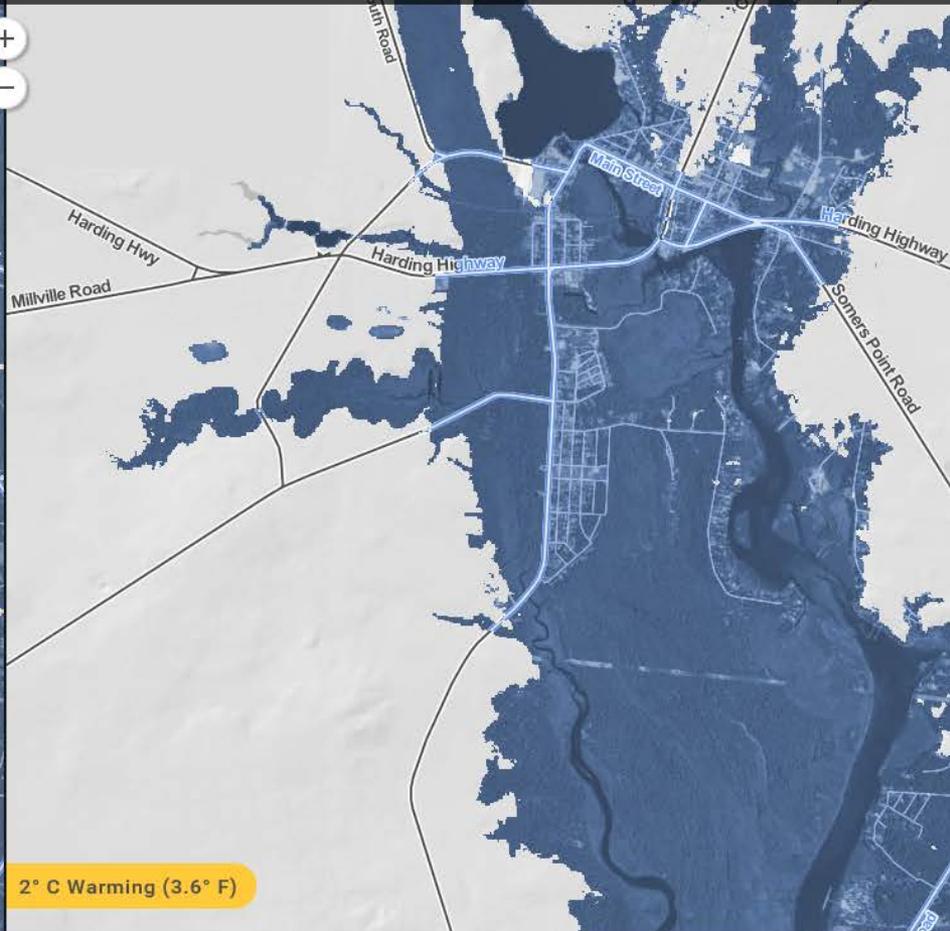
When will this happen?



Enter a global coastal place

Which sea level will we lock in?

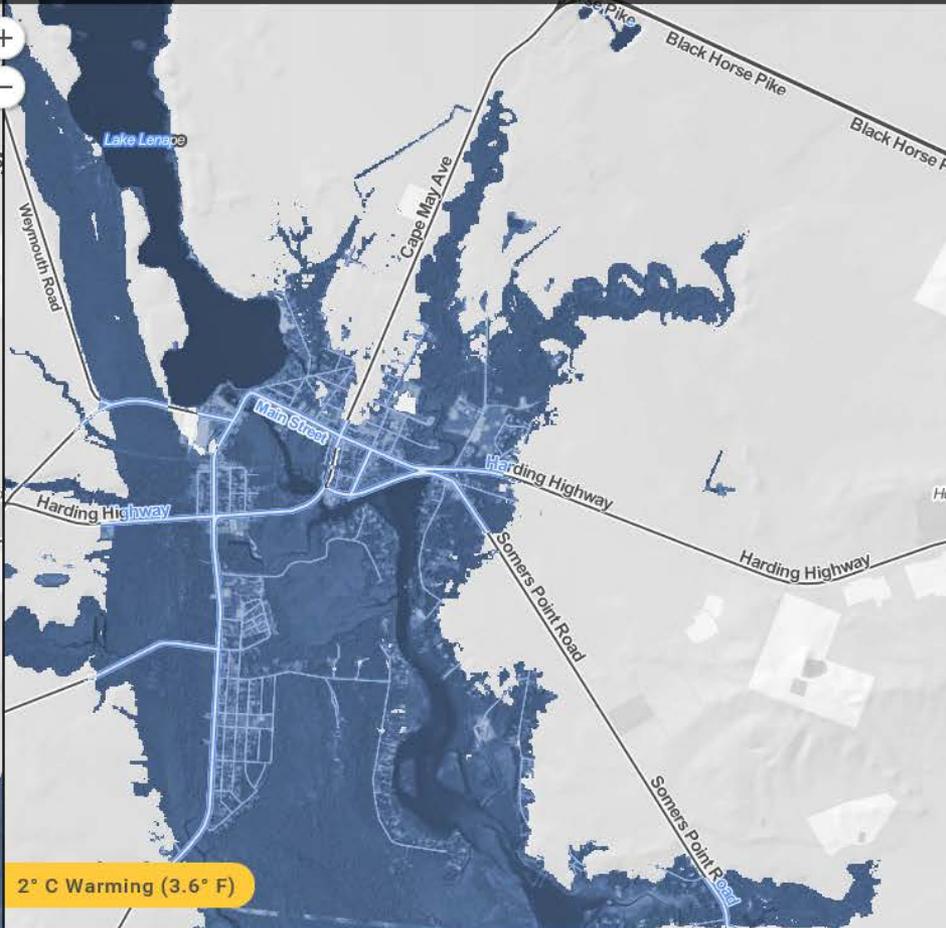
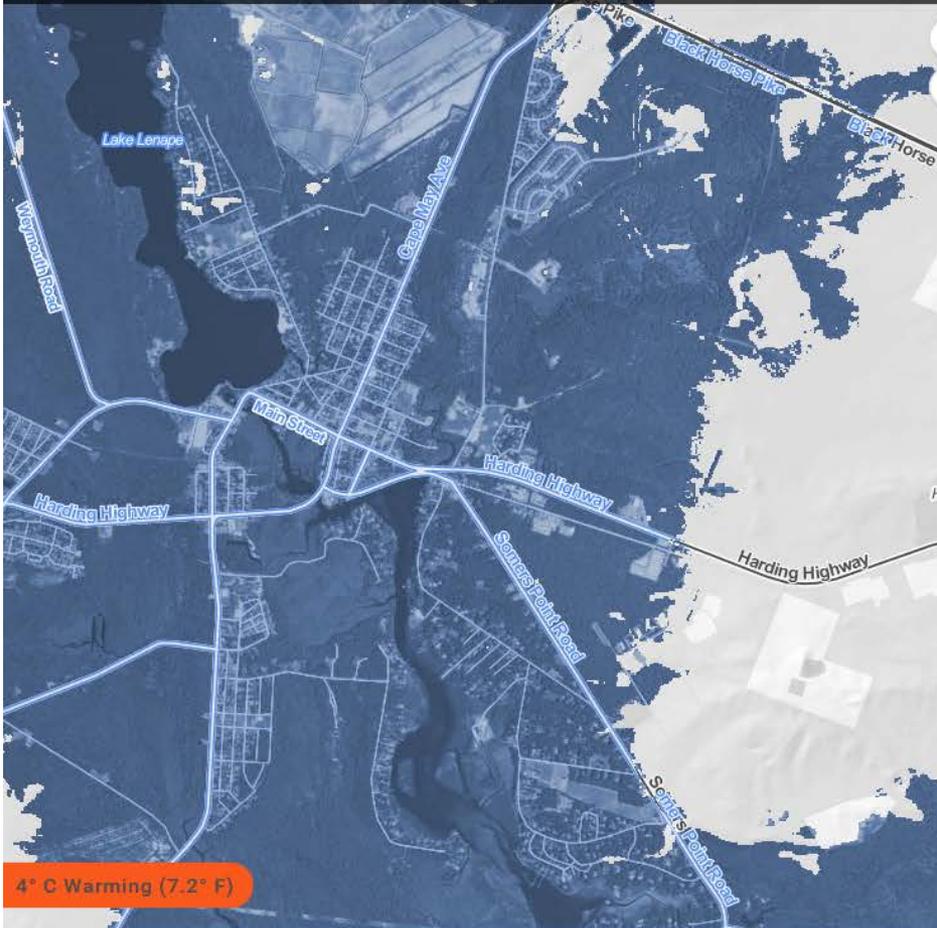
When will this happen?



Enter a global coastal place

Which sea level will we lock in?

When will this happen?



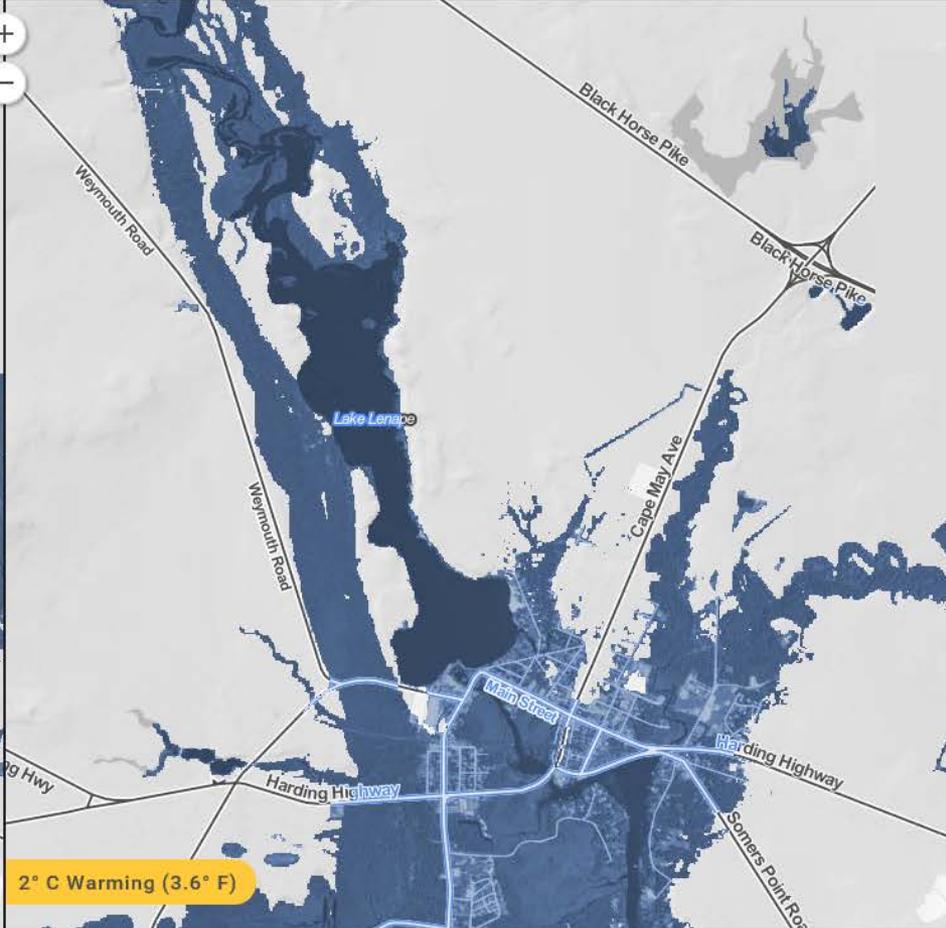
Enter a global coastal place

Which sea level will we lock in?

When will this happen?



4° C Warming (7.2° F)

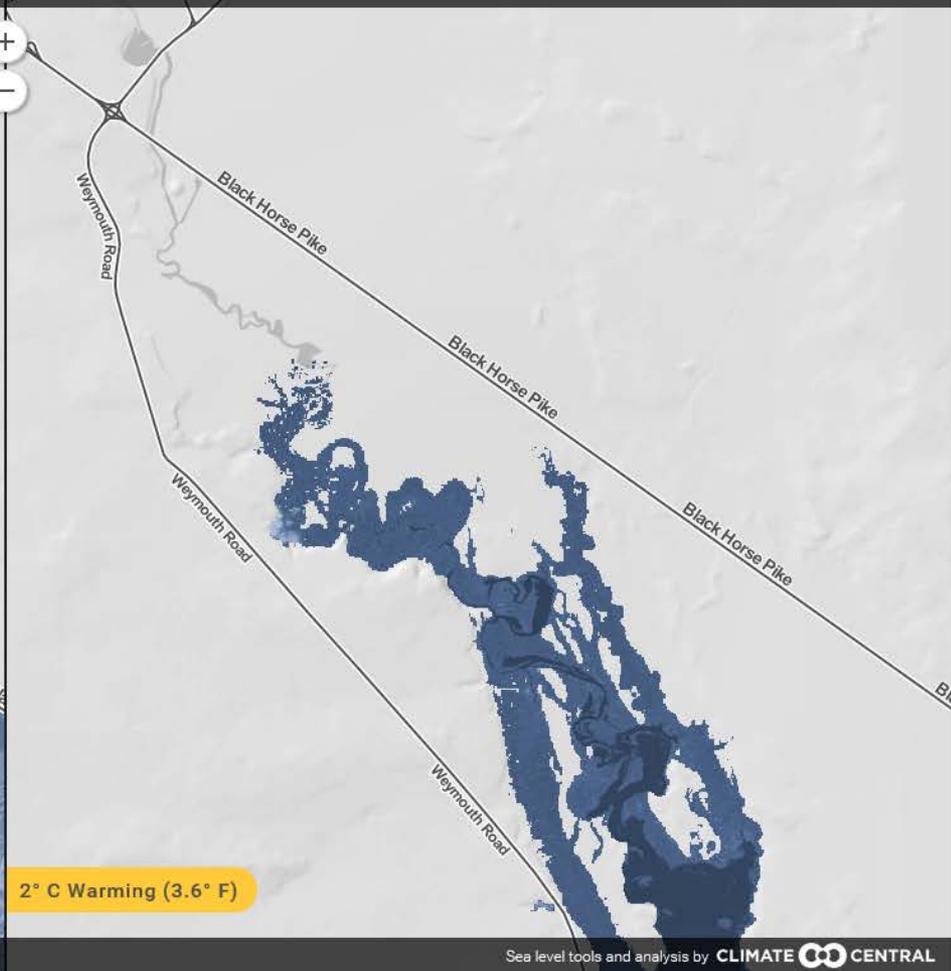
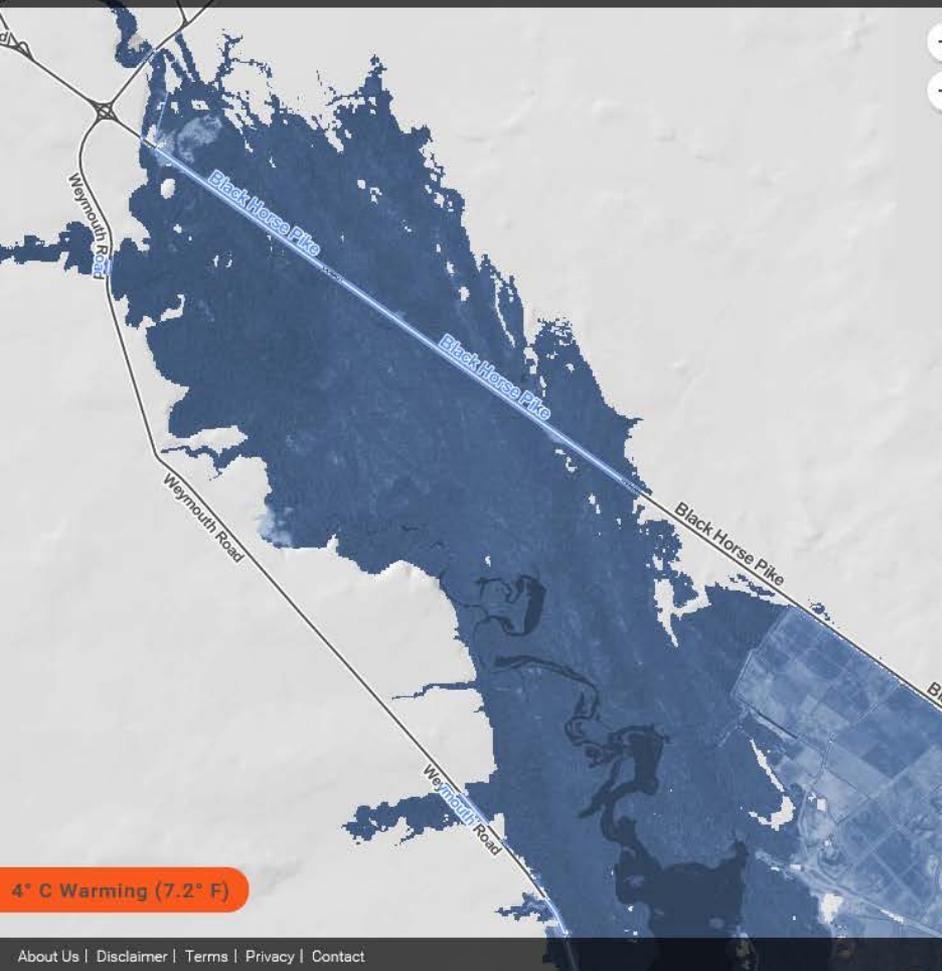


2° C Warming (3.6° F)

Enter a global coastal place

Which sea level will we lock in?

When will this happen?



Enter a global coastal place

Which sea level will we lock in?

When will this happen?



HURRICANE SANDY Category 1 storm

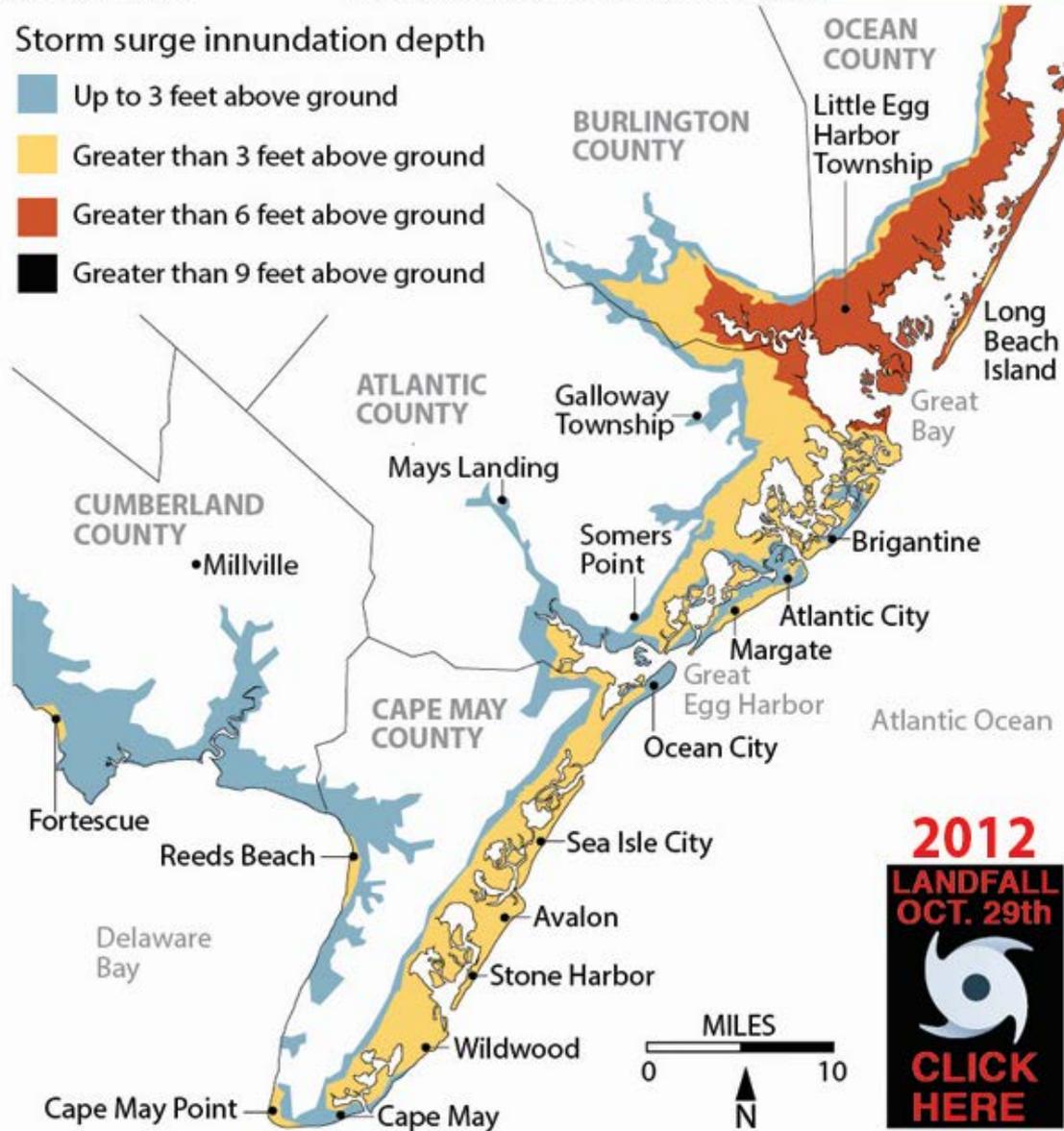
SOURCE: NOAA

WEB DEVELOPER KRISHNA MATHIAS

[Click here to see 1821 storm](#)

Storm surge inundation depth

-  Up to 3 feet above ground
-  Greater than 3 feet above ground
-  Greater than 6 feet above ground
-  Greater than 9 feet above ground



2012
LANDFALL
OCT. 29th

CLICK
HERE

1821 HURRICANE Category 3 storm

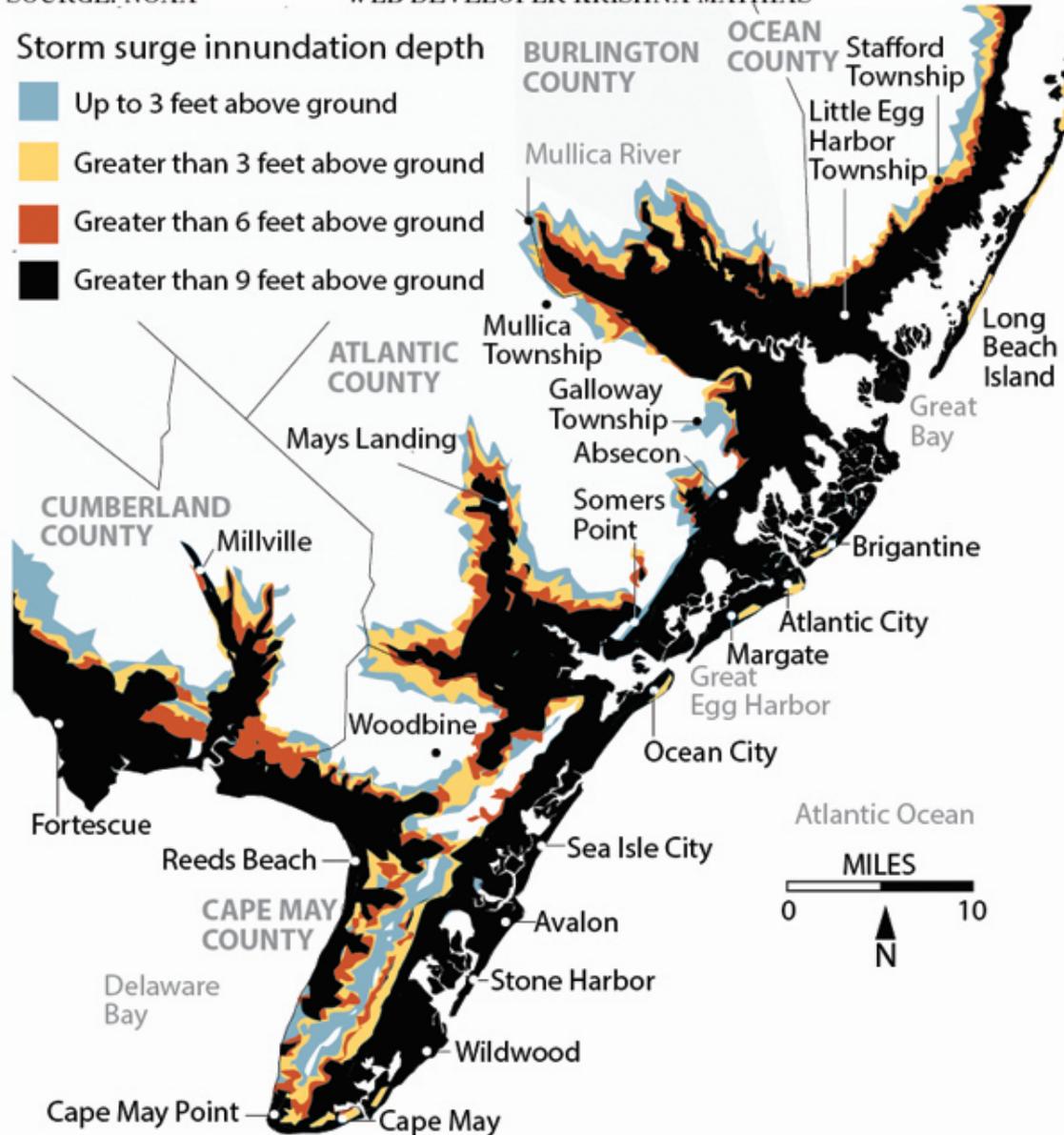
[Click here to see Sandy](#)

SOURCE: NOAA

WEB DEVELOPER KRISHNA MATHIAS

Storm surge inundation depth

-  Up to 3 feet above ground
-  Greater than 3 feet above ground
-  Greater than 6 feet above ground
-  Greater than 9 feet above ground



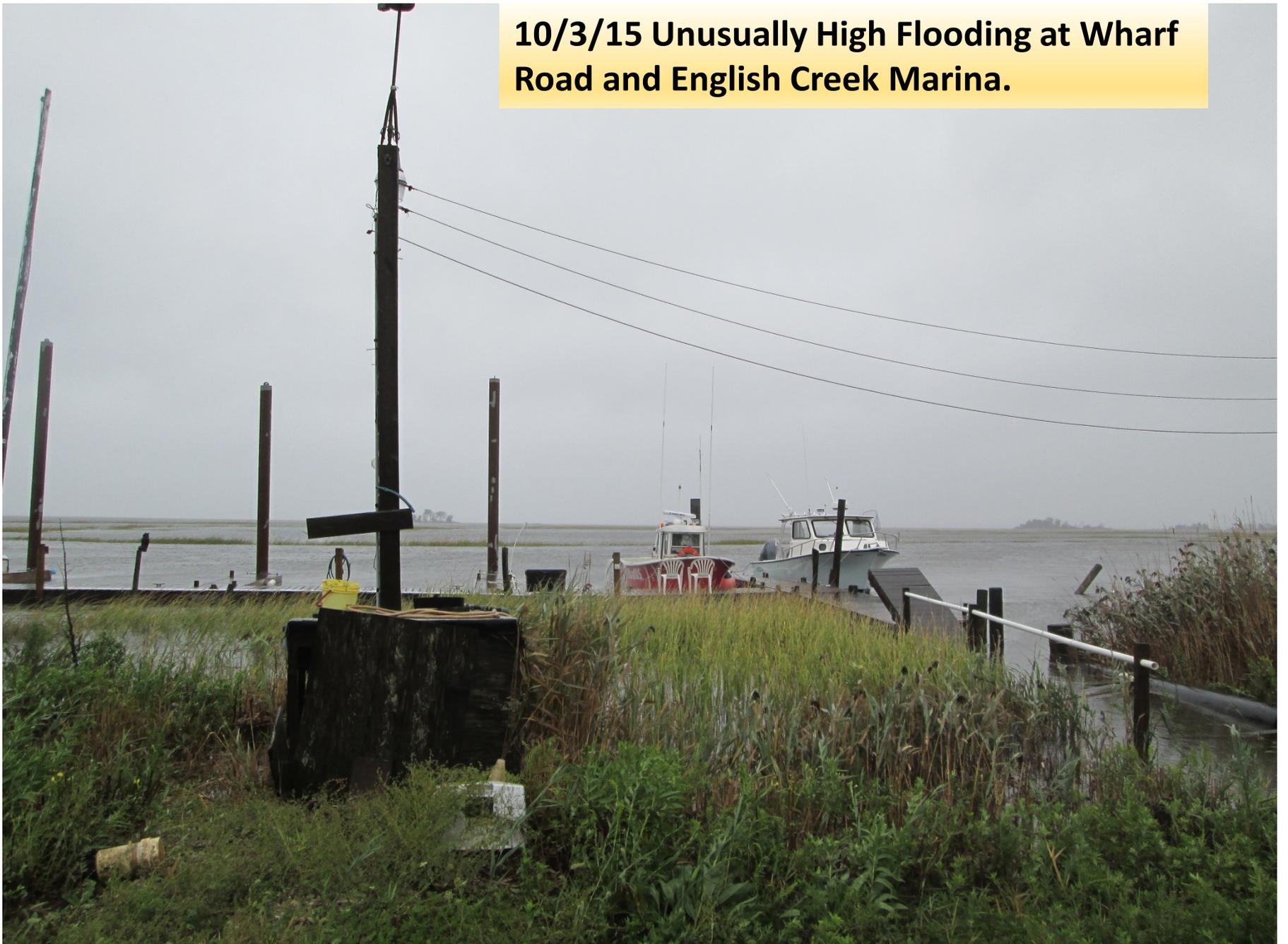


10/3/15 Unusually High Flooding at Wharf Road and English Creek Marina.

10/3/15 Unusually High Flooding at Wharf Road and English Creek Marina.



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Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases.

Mitigation can mean using new technologies and renewable energies, making older equipment more energy efficient, or changing management practices or consumer behavior.

It can be as complex as a plan for a new city, or as simple as improvements to a cook stove design.

Efforts underway around the world range from high-tech subway systems to bicycling paths and walkways.

Protecting natural carbon sinks like forests and oceans, or creating new sinks through silviculture or green agriculture are also elements of mitigation.

UNEP takes a multifaceted approach towards climate change mitigation in its efforts to help countries move towards a low-carbon society

Agriculture

Feeding the planet's ever-expanding population while dealing with climate change will require a new way of thinking about agriculture.

[Read More](#)



Forests

Forests sustain over 50 percent of the Earth's species, regulate our climate through carbon storage, and protect watersheds. Yet this priceless resource is being threatened by deforestation and forest degradation.

[Read More](#)



Energy

As populations and incomes grow, so does the demand for energy. Our thirst for energy services is one of the biggest challenges to mitigating climate change and building a greener future.

[Read More](#)



Buildings and Cities

Approximately one third of the world's energy use takes place inside buildings, and the sector is the Earth's biggest contributor to greenhouse gas emissions. Meanwhile, cities are growing quickly, especially in developing countries.

[Read More](#)



Transport

Transport gobbles up over half of the planet's liquid fossil fuels and is responsible for almost a quarter of energy-related greenhouse gas emissions.

[Read More](#)



Waste

As countries' economies grow, so does the volume of their garbage. According to estimates, some 11.2 billion metric tonnes of solid waste are currently being collected around the world every year.

[Read More](#)



Manufacturing

Responsible for some 35 percent of global electricity use, 20 percent of CO2 emissions, and a quarter of primary resource extraction, manufacturing has a major impact on the environment and must be factored into the climate change equation.

[Read More](#)



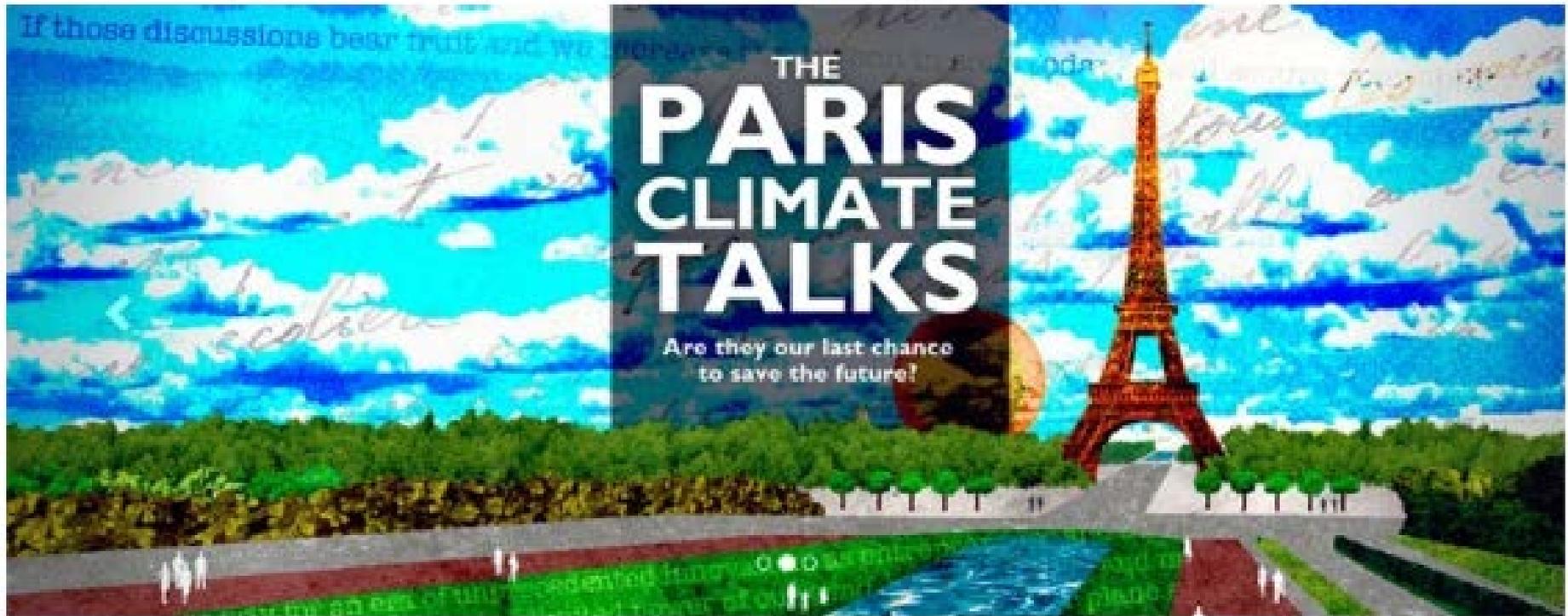
Tourism

Nothing seems to be able to quell the human urge to visit foreign places. The tourism sector currently accounts for 5 percent of global GDP and continues to grow, particularly in developing countries.

[Read More](#)



Strong Leadership for Climate Mitigation is Desperately Needed

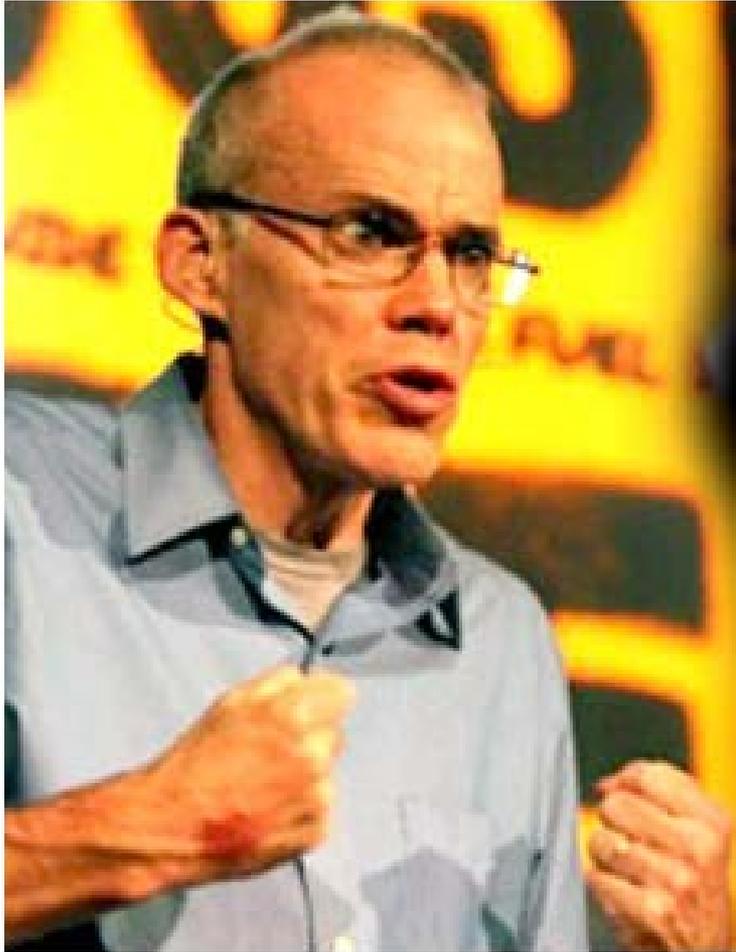


Strong Leadership for Climate Mitigation is Desperately Needed



Paris Climate Change Conference (COP21): overview by Al Gore

Strong Leadership for Climate Mitigation is Desperately Needed



“By the time the great Paris climate conference of 2015 rolled around, many of us were inclined to cynicism.”

— Bill McKibben, *Letters to the Future*

Strong Leadership for Climate Mitigation is Desperately Needed

"The Paris UN Climate Conference represents an historic opportunity to put the world on course to meet the climate change challenge.

The world needs a new model of growth that is safe, durable and beneficial to all.

COP21 seeks to deliver a clear pathway with short and long term milestones, and a system to help us measure and increase progress over time until we get the job done.

The Paris Agreement is not only possible, it is necessary and urgent. We are counting on everyone's contribution."



Christiana Figueres, Executive Secretary
UNFCCC

[Read biography](#)

Follow [@CFigueres](#) on Twitter

Strong Leadership for Climate Mitigation is Desperately Needed

Everything must be done to make the Paris conference a success.

If we don't reach an agreement in December, the global public, who are looking at us, wouldn't understand. Our fellow citizens know that later will be too late.

So we, ministers and negotiators, must show ourselves equal to the challenges and to our responsibilities. Collectively, we must find the path to an ambitious compromise. Together, we can build hope.

It will be my role to get across this message with a single aim: to achieve in Paris on 11 December the success the whole planet is expecting.”



H.E. Mr. Laurent Fabius, Minister of Foreign Affairs and International Development of France and President-Designate of COP 21 and CMP 11

[Read biography](#) (268 kB)

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Obama: COP21 will show world 'not afraid' of extremists

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© AFP / Fred Dufour | US President Barack Obama attends a press conference in Kuala Lumpur on November 22, 2015

Text by [FRANCE 24](#) [Follow](#)

Latest update : 2015-11-22

US President Barack Obama said Sunday he would go ahead with a visit to Paris for a pivotal UN summit on climate change despite the recent attacks in the French capital, urging other leaders to do the same to show "we are not afraid" of extremists.

COP21 IS A RARE OPPORTUNITY TO SEIZE JOHN KERRY SAID ABOUT CRUCIAL MARKER

ROAD TO PARIS DISCUSSION

Responsible Author: [Rahma Sophia RACHDI](#) | Paris, Washington DC, 11/03/2015, 13:53 Time

4398x read



Us Secretary Kerry Luncheon Xi Píng

USPA NEWS - "We need to seize every opportunity – before, during and after Paris – to make progress." Secretary Kerry discusses important markers on the #RoadtoParis towards a successful #COP21 in a new Op-ed "Paris Climate Conference. Here is an excerpt from the John Kerry's remarks on October 29.

Hydrofluorocarbons (HFCs)

DEFINITION

PHASE DOWN

PHASE OUT

"We need to seize every opportunity – before, during and after Paris – to make progress." Secretary Kerry discusses important markers on the #RoadtoParis towards a successful #COP21 in a new Op-ed: "Paris

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

COP21 logo
Source: COP21



SPUTNIK



**Kerry: COP21 Not to Result
in Legally Binding Measures
to Cut Emissions**

© AP Photo/ Martin Meissner, File

Kerry told The Financial Times on Wednesday that he expected summit participants to agree on measures aimed at reducing carbon emissions but there were "not going to be legally binding reduction targets like Kyoto."

According to Kerry, there is a problem with "attitudes about climate change" in Congress and an "ideological barrier" that is making it difficult for the United States to move ahead with its climate improvement measures, such as allocating \$3 billion to help developing countries combat global warming.