



RUTGERS
THE STATE UNIVERSITY
OF NEW JERSEY

Municipal Snapshots & NJ FloodMapper

Presented by:

Lucas Marxen

Associate Director

NJAES Office of Research Analytics


Association of New Jersey Environmental Commissions

48th Annual Environmental Congress

October 21, 2021

Background

- NJAES Office of Research Analytics
 - Provides advanced statistical, spatial, economic, and technological tools to projects and programs throughout the NJAES and broader University.
 - Specialize in developing data informatics systems and data-driven online applications
 - Expertise in GIS, interactive web-mapping, and data visualization technology
 - Collaborate with experts and stakeholders to develop tools to meet research, extension and education mission of the Agricultural Experiment Station



RUTGERS
New Jersey Agricultural Experiment Station

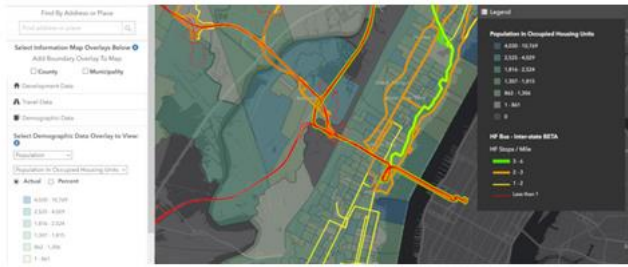
Universitywide New Brunswick New Jersey Agricultural Experiment Station

NJAES Office of Research Analytics

Home
About
News
Skills/Services
Selected Staff Publications
Contact Us

[NJAES OFFICE OF RESEARCH ANALYTICS](#) > [SKILLS/SERVICES](#) >

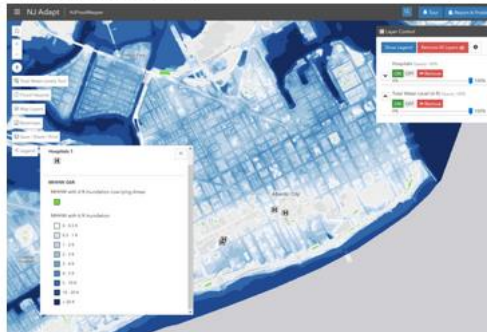
Data Informatics Systems & Data-Driven Online Applications



ORA staff have experience in developing data informatics systems and applying in-house data-driven website design to meet the needs of a broad range of research projects, extension programs, and policy initiatives. These tools allow for the more efficient and effective flow of data between stakeholders and provide new and innovative ways of conveying information in a dynamic manner. Some of the capabilities we provide include:

- SQL-based database design and development for data management
- Expertise in multiple scripting languages (PHP, Python, R, others) to provide custom data analysis, application functionality and APIs for access database back-ends.
- Expertise in interactive web mapping applications utilizing frameworks such as ArcGIS Server/Javascript, Leaflet, and OpenLayers.
- Custom GIS datasets, analyses, and visualizations using custom python scripting.
- Interactive visualizations, dashboards and custom reports using toolkits such as Dygraphs and Highcharts.
- Experience working with Big Data and providing responsive database designs for efficient queries and access to data.

Current/Past Projects:



NJFloodMapper

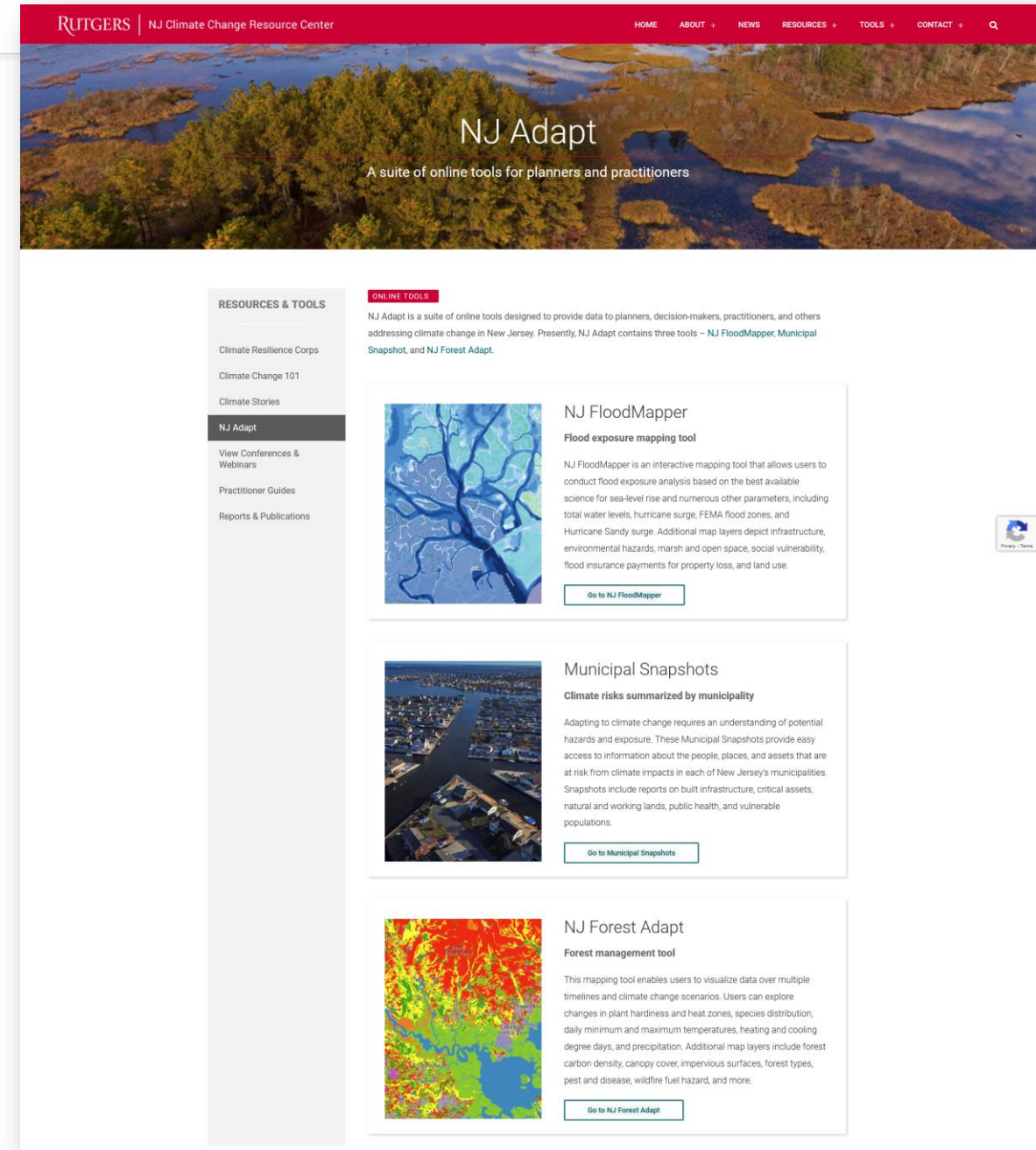
Project Investigators: Lisa Auermuller (NJAES/JCNERR), Jeanne Herb (EJB/EAC), Marjorie Kaplan (SEBS/RCI), Robert Kopp (SEBS/EOAS) Richard Lathrop (SEBS/CRSSA) & Lucas Marxen (NJAES/ORA)

This project developed an online mapping tool for visualizing the potential impact of future flooding events on New Jersey localities. The application developed by ORA provides users with interactive data layers and analytical tools for understanding the impact of sea-level rise and other flooding events on a variety of infrastructure and resources.

<https://www.njfloodmapper.org>

NJ Adapt

- NJ Adapt is a suite of online tools designed to provide data to planners, decision-makers, practitioners, and others addressing climate change in New Jersey.
- Presently, NJ Adapt contains three tools – NJ FloodMapper, Municipal Snapshot, and NJ Forest Adapt.
- New tools under development focused on climate change and public health, agriculture, and other sectors.



The screenshot shows the NJ Adapt website interface. At the top, there is a red navigation bar with the Rutgers logo and the text "RUTGERS | NJ Climate Change Resource Center". To the right of the navigation bar are links for HOME, ABOUT, NEWS, RESOURCES, TOOLS, CONTACT, and a search icon. Below the navigation bar is a large banner image of a wetland landscape with the text "NJ Adapt" and "A suite of online tools for planners and practitioners".

On the left side, there is a "RESOURCES & TOOLS" sidebar menu with the following items: Climate Resilience Corps, Climate Change 101, Climate Stories, **NJ Adapt** (highlighted), View Conferences & Webinars, Practitioner Guides, and Reports & Publications.

The main content area features a "ONLINE TOOLS" section with a red header. Below this header is a paragraph: "NJ Adapt is a suite of online tools designed to provide data to planners, decision-makers, practitioners, and others addressing climate change in New Jersey. Presently, NJ Adapt contains three tools – NJ FloodMapper, Municipal Snapshot, and NJ Forest Adapt."

There are three tool cards displayed:

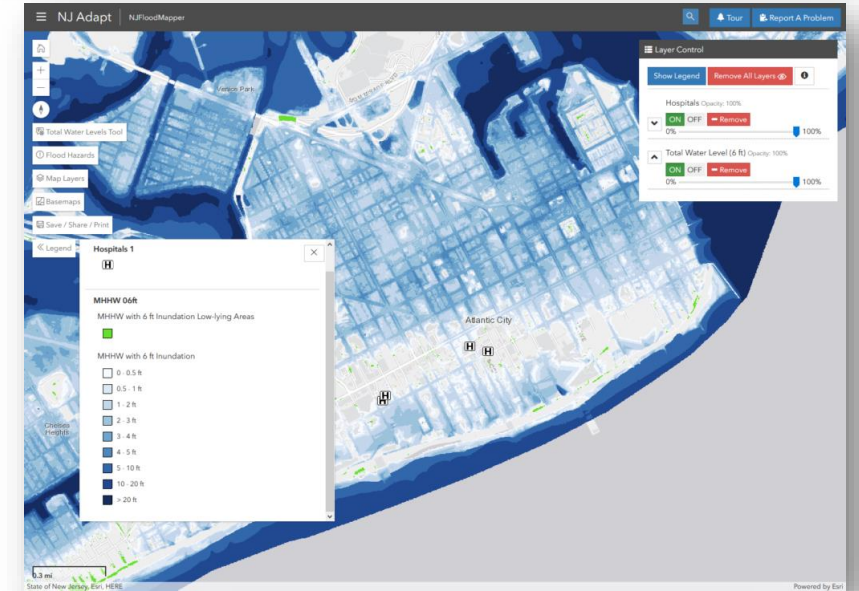
- NJ FloodMapper**: Flood exposure mapping tool. Description: "NJ FloodMapper is an interactive mapping tool that allows users to conduct flood exposure analysis based on the best available science for sea-level rise and numerous other parameters, including total water levels, hurricane surge, FEMA flood zones, and Hurricane Sandy surge. Additional map layers depict infrastructure, environmental hazards, marsh and open space, social vulnerability, flood insurance payments for property loss, and land use." Includes a "Go to NJ FloodMapper" button.
- Municipal Snapshots**: Climate risks summarized by municipality. Description: "Adapting to climate change requires an understanding of potential hazards and exposure. These Municipal Snapshots provide easy access to information about the people, places, and assets that are at risk from climate impacts in each of New Jersey's municipalities. Snapshots include reports on built infrastructure, critical assets, natural and working lands, public health, and vulnerable populations." Includes a "Go to Municipal Snapshots" button.
- NJ Forest Adapt**: Forest management tool. Description: "This mapping tool enables users to visualize data over multiple timelines and climate change scenarios. Users can explore changes in plant hardiness and heat zones, species distribution, daily minimum and maximum temperatures, heating and cooling degree days, and precipitation. Additional map layers include forest carbon density, canopy cover, impervious surfaces, forest types, pest and disease, wildfire fuel hazard, and more." Includes a "Go to NJ Forest Adapt" button.

Rutgers Team

- **Lisa Auermuller** – Jacques Cousteau National Estuarine Research Reserve
- **Anthony Broccoli** – Rutgers Climate Institute
- **Matt Campo** – Environmental Analysis and Communications Group
- **Daniel Farnsworth** – NJAES Office of Research Analytics
- **Jason Grabosky** – Department of Ecology, Evolution, and Natural Resources
- **Jeanne Herb** – Environmental Analysis and Communications Group
- **Marjorie Kaplan** – Rutgers Climate Institute
- **Robert Kopp** – Rutgers Institute of Earth, Ocean, and Atmospheric Sciences
- **Richard Lathrop** – Rutgers Center for Remote Sensing and Spatial Analysis
- **Lucas Marxen** – NJAES Office of Research Analytics
- **David Robinson** – Office of the State Climatologist
- **Michelle Stuart** – NJAES Office of Research Analytics
- **Sean Thatcher** – Rutgers Climate Change Resource Center
- **Jim Trimble** – Rutgers Center for Remote Sensing and Spatial Analysis
- **Pamela Zipse** – Rutgers Urban Forestry Program

NJ FloodMapper and Municipal Snapshots

- NJ FloodMapper (<https://njfloodmapper.org>)
 - Interactive mapping website to visualize exposure from coastal flooding hazards
 - Enhanced map overlay capabilities
 - Total Water Level approach for exposure from Sea Level Rise and storms
 - Funded by the National Estuarine Research Reserve System Science Collaborative – Catalyst Grant Program
- Municipal Snapshot Tool (<https://climatesnapshots.rutgers.edu>)
 - Provide easy to access reports on the coastal flooding risk to various municipal level resources
 - Integration into NJ FloodMapper



Vulnerable Populations Exposure Snapshot Atlantic City

Atlantic County

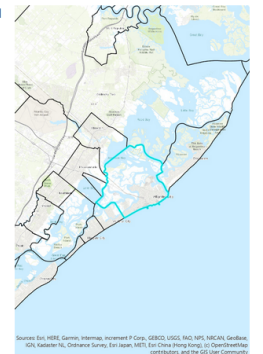
[Download PDF](#)

Introduction

While all people living in the United States are affected by climate change, some communities and some populations are more vulnerable. Some populations and communities are subject to multiple stressors, making them disproportionately affected by changing climate conditions.

Vulnerability may vary by several factors:

- **Location** - such as living close to flood prone areas.
- **Physical status** - such as age, pre-existing health conditions and/or physical disability.
- **Social, economic and underlying community conditions** - such as the extent to which individuals have access to the services and results of long-standing societal factors (i.e., community underinvestment, racism, and poor representation in decision-making).



The United States Centers for Disease Control (CDC) and Prevention uses information from the U.S. Census to create an index (the **Social Vulnerability Index**) that ranks the social vulnerability of communities in the United States to hazardous events and disasters. The ability to recover from these events and disasters is much more difficult for socially vulnerable populations. The CDC index, which helps identify these populations, is at a census tract level and is comprised of 15 social factors that are organized according to four themes. These four themes are: Socioeconomic Status, Household Composition and Disability; Minority Status and Language; and Housing and Transportation.

LIVE DEMOS

<https://njfloodmapper.org>

THANK YOU!

Lucas Marxen

Associate Director

NJAES Office of Research Analytics

Rutgers, The State University of New Jersey

ljmarxen@njaes.rutgers.edu

848-932-4543

<https://ora.rutgers.edu>

Municipal Snapshots

- Integration into NJFloodMapper
- Report Types:
 - Infrastructure Report
 - Critical Asset Report
 - Public Health Report
 - Vulnerable Populations Report
 - Natural and Working Lands Report

Public Health Exposure Snapshot Atlantic City

Atlantic County

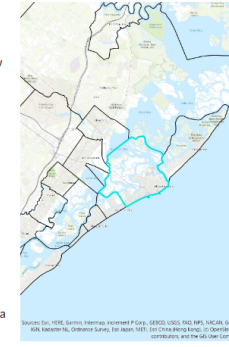
[Download PDF](#)

Introduction

Increasing temperatures, heavier rain events, and the increasing frequency and severity of flood events driven by sea-level rise present numerous impacts to public health that will continue to intensify, while new health threats are emerging.

Health impacts include:

- Increased respiratory disease,
- Increased cardiovascular disease,
- Injuries,
- Premature deaths related to extreme weather events (i.e., heat, breathing, and drowning - related fatalities),
- Food- and waterborne illnesses, and
- Mental health impacts (i.e., stress, anxiety and fear).



This public health municipal snapshot is a focused area of development for the Rutgers team. An initial set of data is presented while the Rutgers team is currently actively seeking additional sets of data that can support efforts to advance climate change and public health efforts at the state, regional and local levels.

Projected Climate Data

Year	Moderate Emissions (RCP 4.5)			High Emissions (RCP 8.5)		
	2030	2060	2090	2030	2060	2090
Change in Days Above 95 Deg F (Days) ¹	0 to +4	0 to +10	0 to +10	0 to +4	0 to +10	+11 to +20
Change in Cooling Degree Days (Degree Days) ²	+200 to +400	+400 to +600	+400 to +600	+200 to +400	+600 to +800	+1000 to +1400
Change in Max Temp. July (° F) ³	+1° F to +2° F	+3° F to +4° F	+3° F to +5° F	+1° F to +3° F	+4° F to +5° F	+6° F to +10° F
Average Max Temp In July (° F) ⁴	81° F to 90° F	81° F to 90° F	86° F to 90° F	81° F to 90° F	86° F to 90° F	86° F to 95° F

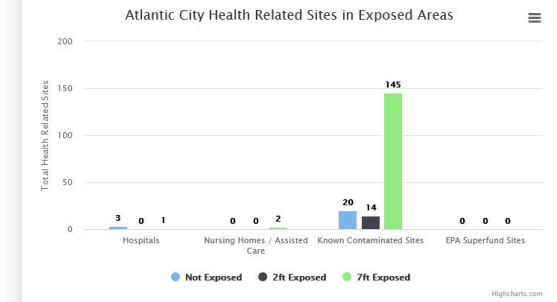
- ¹: The total number of days per year with maximum temperature above 95°F (35°C) is an indicator of how often very hot conditions occur. Depending upon humidity, wind, access to air-conditioning, humans may feel very uncomfortable or experience heat stress or illness on very hot days. Hot days also stress plants and animals as well as infrastructure. Increased demand for cooling can stress energy infrastructure.
- ²: The number of cooling degree days per year reflects the amount of energy people use to cool buildings during the warm season. For example, many people like to keep indoor temperatures at 65°F. On a day when the average outdoor temperature is 85°F, reducing the indoor temperature by 20 degrees over 1 day requires 20 degrees of cooling multiplied by 1 day, or 20 cooling degree days. Utility companies use cooling degree days to estimate the annual amount of energy people will use to cool buildings.
- ³ & ⁴: A day's highest (maximum) temperature usually occurs in the afternoon. Averaging the daily high temperatures over any period results in a mean maximum temperature for that period. Maximum temperature serves as one measure of comfort and safety for people and for the health of plants and animals. When maximum temperature exceeds particular thresholds, people can become ill and transportation and energy infrastructure may be stressed.

Climate observations and projection data provided by the Northeast Regional Climate Center at Cornell University through their Applied Climate Information System (ACIS, accis.org). The Localized Constructed Analog downscaling projections were obtained from the Scripps Institution of Oceanography (<http://ocea.ucsd.edu>).

Health Related Sites in Exposed Areas

Health Related Sites	Total Health Related Sites	# Exposed at 2ft TWL	# Exposed at 7ft TWL
Hospitals	4	0	1
Nursing Homes / Assisted Care	2	0	2
Known Contaminated Sites	165	14	145
EPA Superfund Sites	0	0	0

[Link to Locations In Flood Areas Map](#)



Vulnerable Population Report

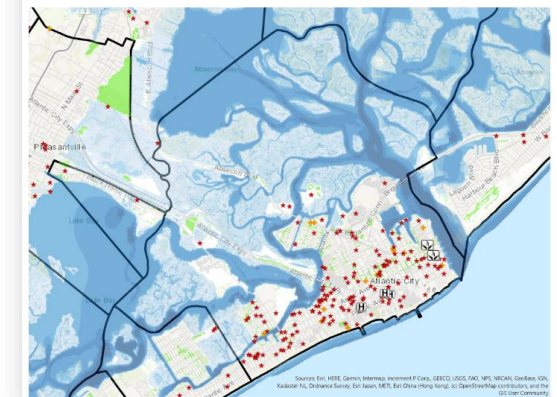
While all people living in the United States are affected by climate change, some communities and some populations are more vulnerable to changing climate conditions than others. Extensive research here in the United States and across the world points to populations of concern including those that are low-income, communities of color, immigrant populations, people with limited English proficiency, Indigenous people, older and younger adults, people with disabilities and compromised health and mental health conditions, and others.

[Link to Vulnerable Population Report](#)

Maps

2 ft. Exposed

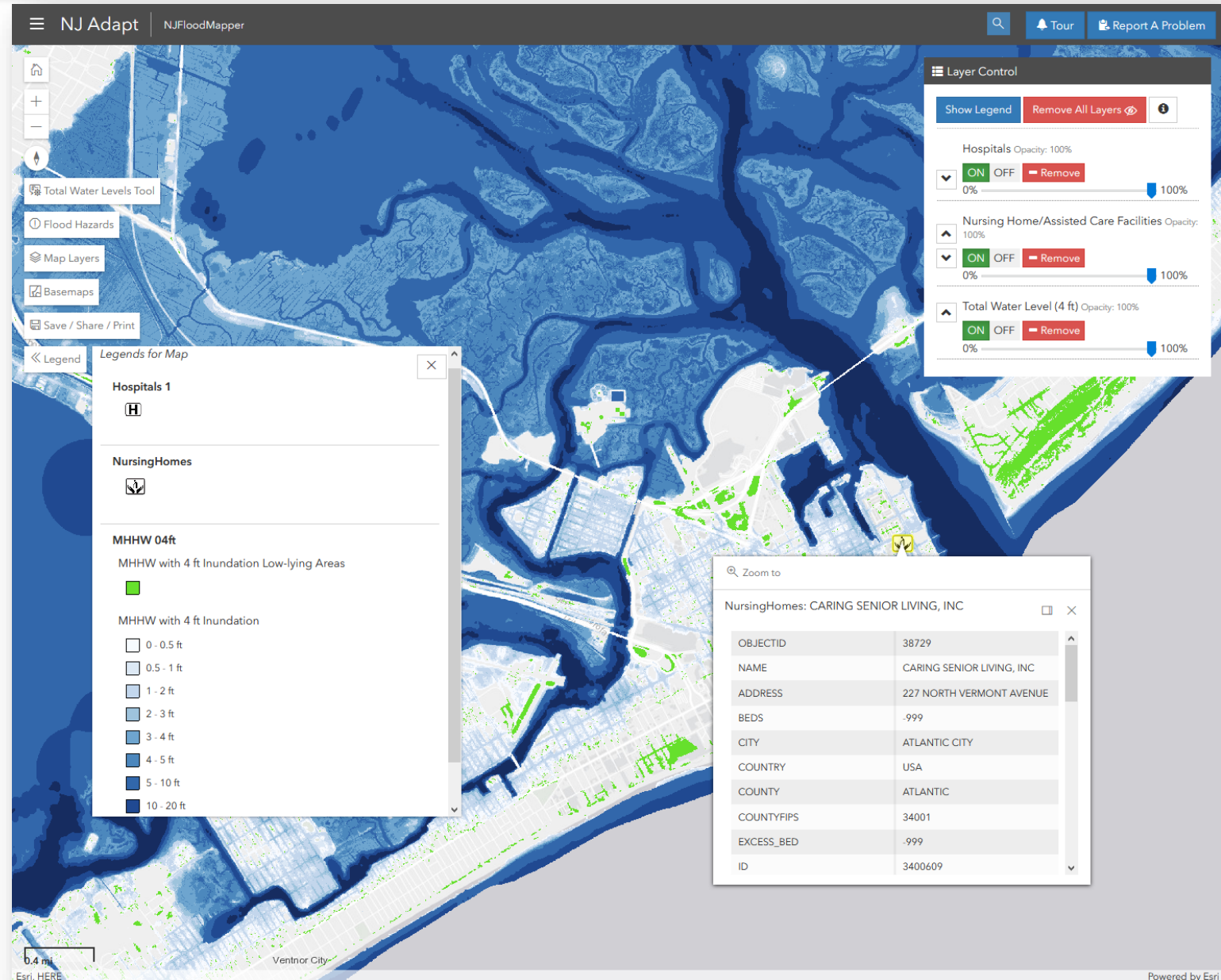
[Link to Live Map](#)



Source: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, NOAA, NCEM, GEBCO, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), Swisstopo, Mapbox Contributors, and the GIS User Community

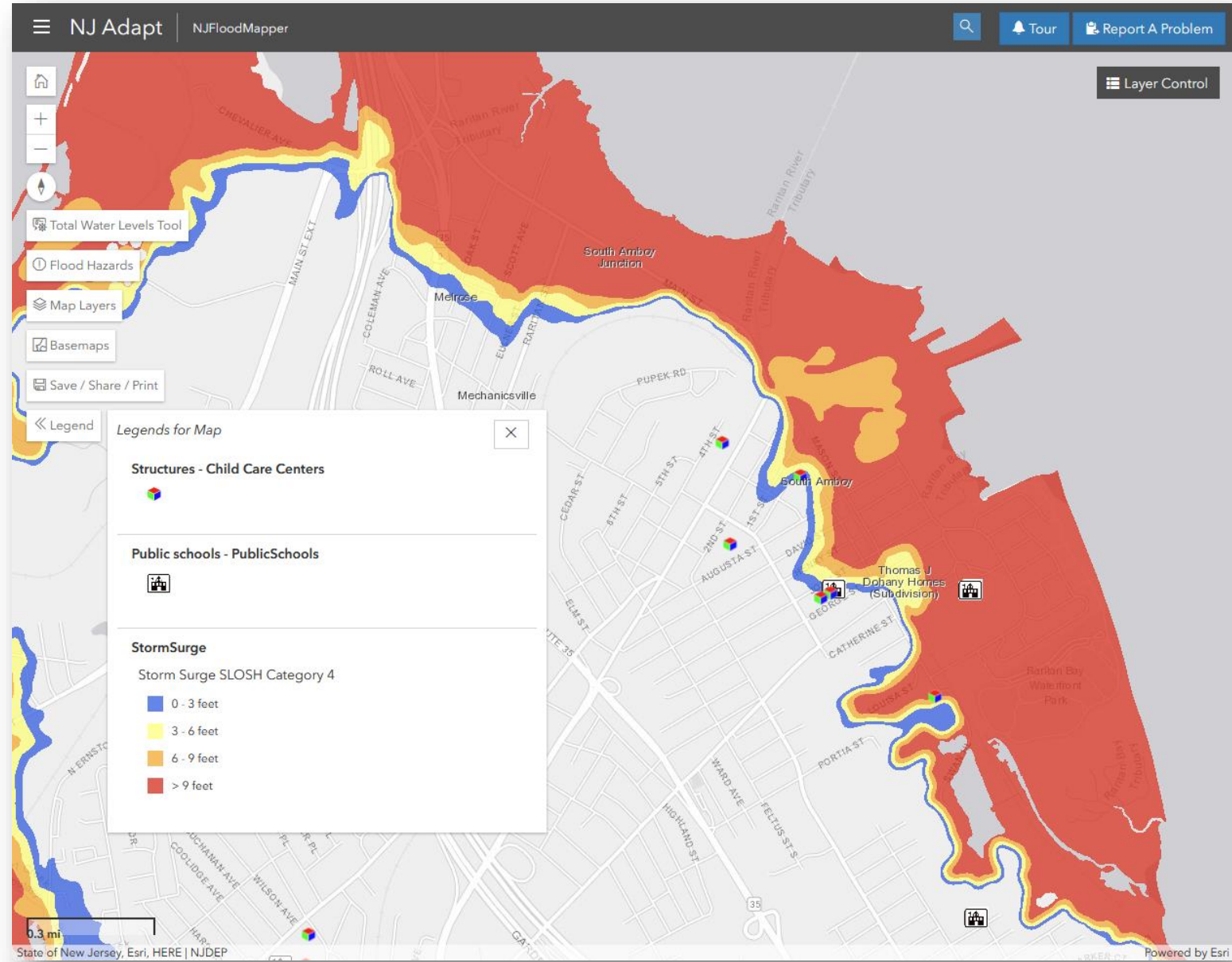
NJFloodMapper

- Flood Hazards
 - Total Water Level (0-20ft)
 - Sea Level Rise (0-10ft)
 - Sandy Surge Extent
 - SLOSH Cat 1-4
 - FEMA Flood Zones (Effective)
- Map Layers
 - Infrastructure
 - Facilities
 - Transportation
 - Environmental Hazards
 - Marsh and Open Space
 - Social Vulnerability
 - Property Loss
 - Land Use/Land Cover



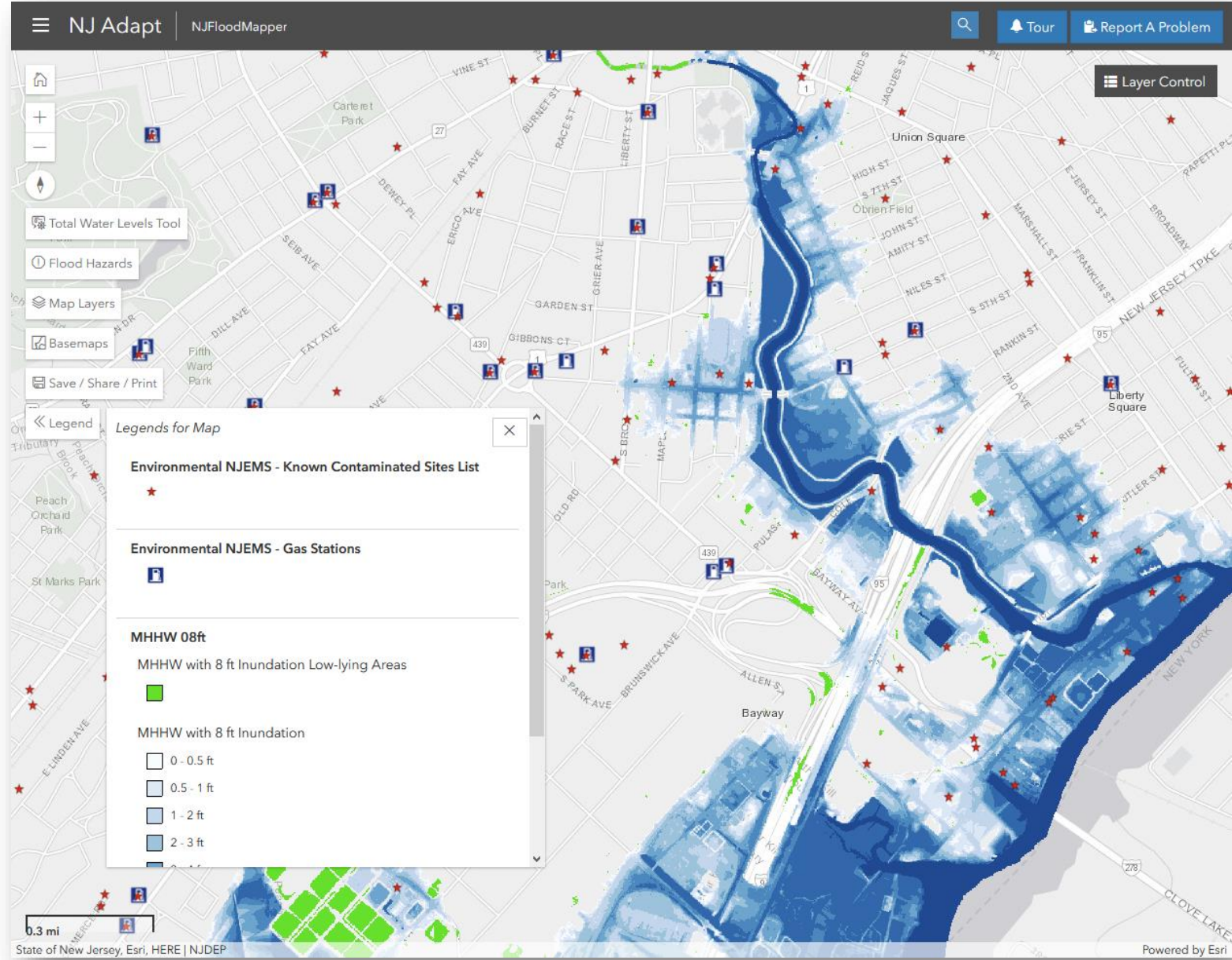
NJFloodMapper

- Infrastructure
 - Wastewater Treatment Plants
 - Energy Generation Facilities
 - Mobile Home Parks
 - Child Care Centers
 - Tidal Water Public Access
 - Power Plants (NJ)
- Facilities
 - Schools
 - Fire Stations
 - Hospitals
 - Law Enforcement
 - Nursing Home/Assisted Care
 - Evacuation Shelters
 - Historic Preservation



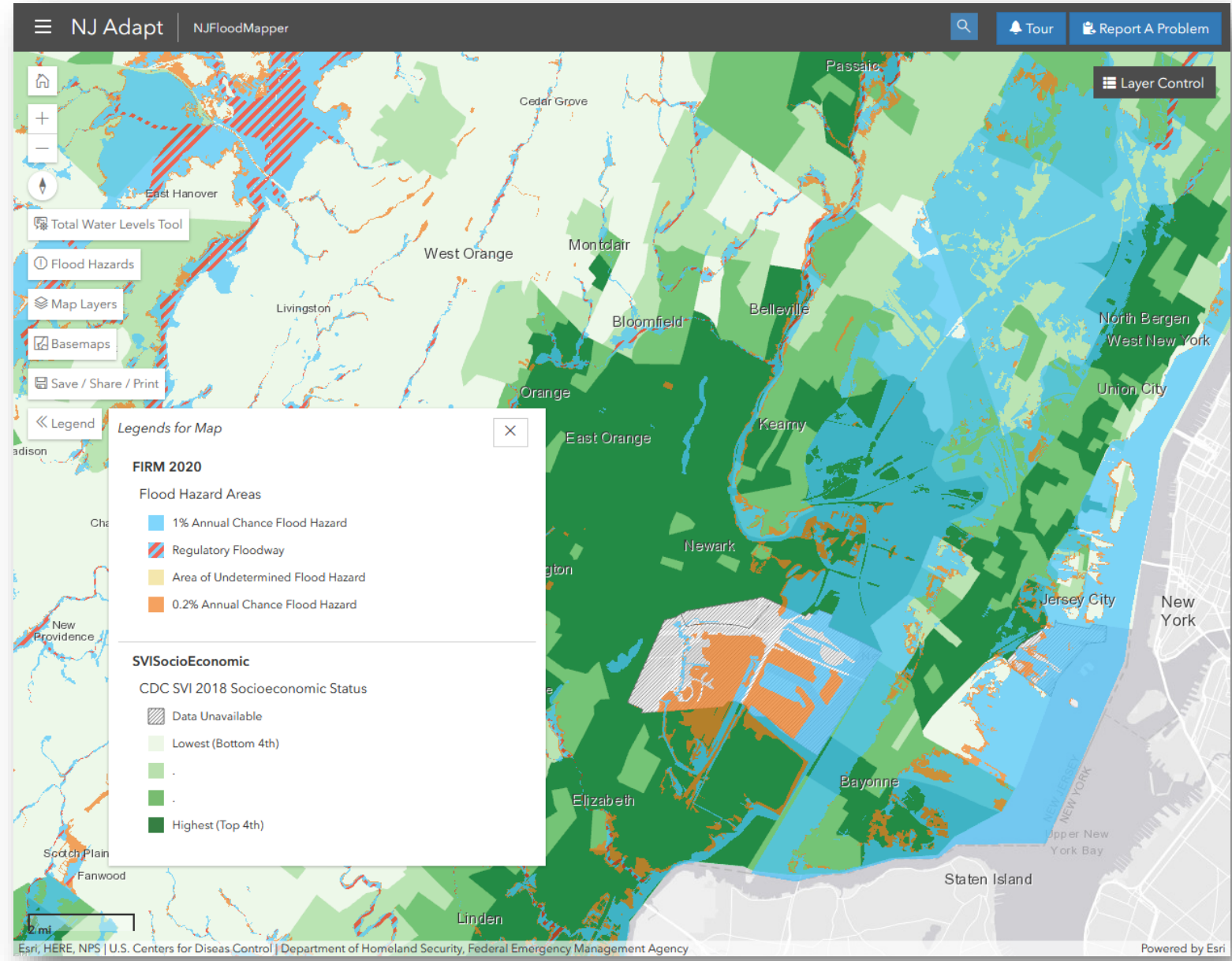
NJFloodMapper

- Transportation
 - Hurricane Evacuation Routes
 - NJ Bridges
 - Rail Lines
 - Gas Stations
- Environmental Hazards
 - Known Contaminated Sites
 - EPA Cleanup Sites



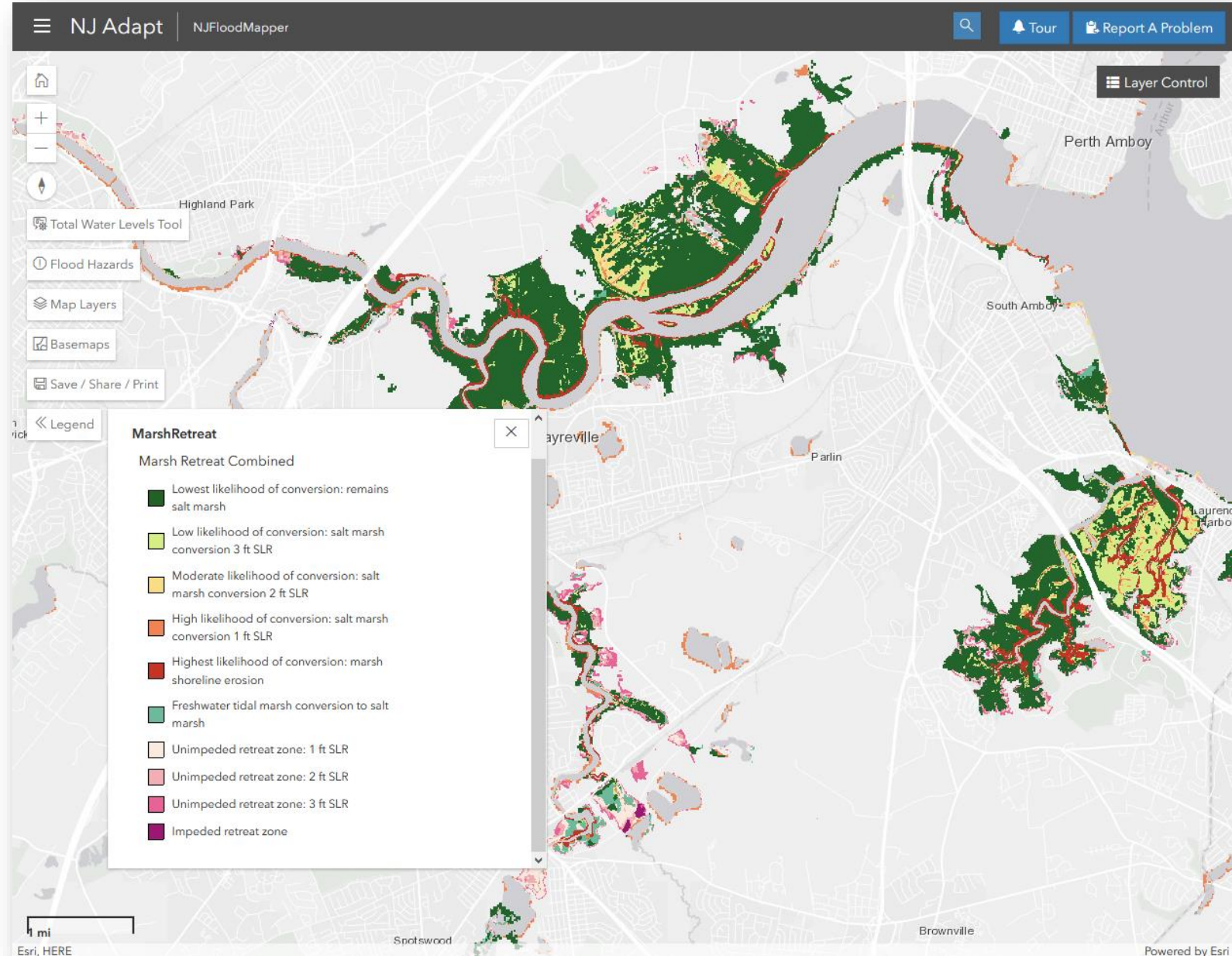
NJFloodMapper

- Social Vulnerability
 - CDC Social Vulnerability Indexes
 - United Way ALICE Households
 - Veteran Population
 - DCA MRI Distress Score
 - Housing Built Pre-1970
 - Homeless Count



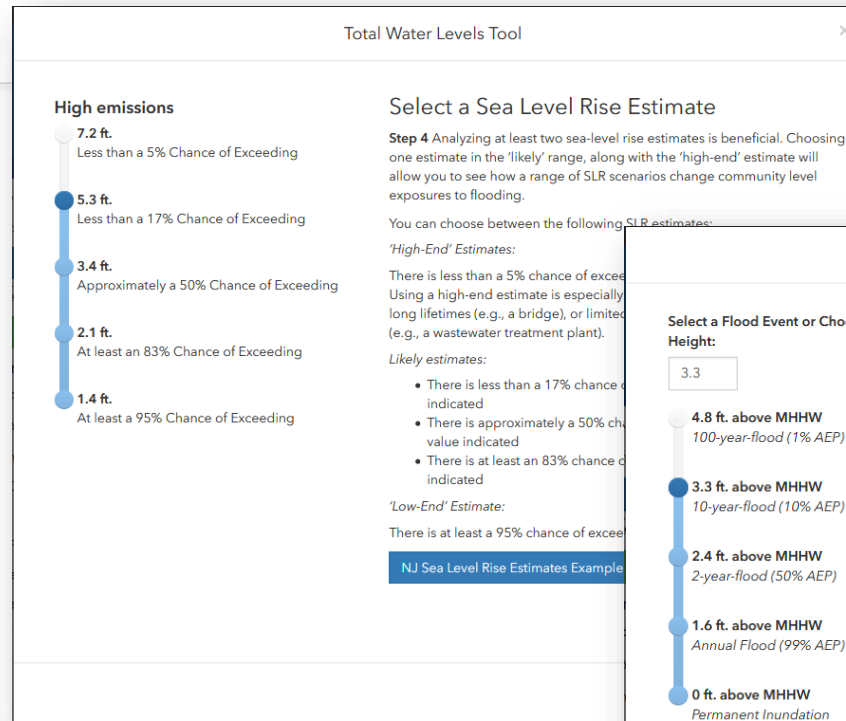
NJFloodMapper

- Marsh and Open Space
 - Tidal Marsh
 - Open Space
 - Marsh Retreat (Combined)
 - Marsh Retreat 1-3ft
 - Marsh Edge Erosion
- Property Loss
 - Repetitive Loss (Building/Contents/Total)
 - Severe Repetitive Loss (Building/Contents/Total)
 - National Flood Insurance Program claims
- Land Use/Land Cover 2015



NJFloodMapper

- Total Water Levels Tool
 - Interactive tool to allow users to consider the impact of Sea Level Rise combined with future flood events for planning purposes
 - User can select:
 - Tide Gauge Location
 - Emissions Scenario
 - Timeframe
 - SLR Estimate
 - Flood Event
 - Resulting TWL can be easily added to the map and adjusted by user



Total Water Levels Tool

High emissions

- 7.2 ft. Less than a 5% Chance of Exceeding
- 5.3 ft. Less than a 17% Chance of Exceeding
- 3.4 ft. Approximately a 50% Chance of Exceeding
- 2.1 ft. At least an 83% Chance of Exceeding
- 1.4 ft. At least a 95% Chance of Exceeding

Select a Sea Level Rise Estimate

Step 4 Analyzing at least two sea-level rise estimates is beneficial. Choosing one estimate in the 'likely' range, along with the 'high-end' estimate will allow you to see how a range of SLR scenarios change community level exposures to flooding.

You can choose between the following SLR estimates:

'High-End' Estimates:

There is less than a 5% chance of exceeding the value indicated. Using a high-end estimate is especially beneficial for long lifetimes (e.g., a bridge), or limited lifetimes (e.g., a wastewater treatment plant).

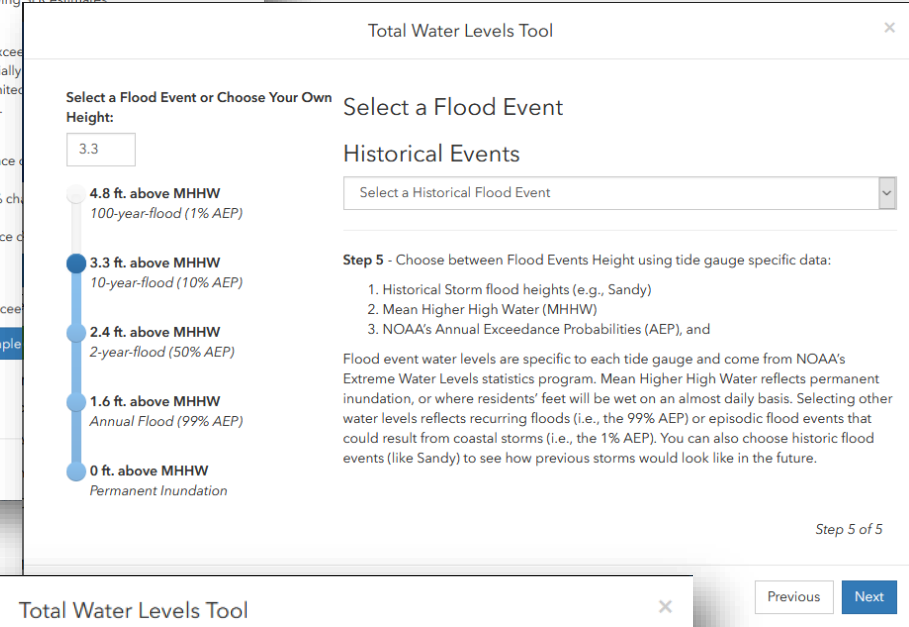
Likely estimates:

- There is less than a 17% chance of exceeding the value indicated
- There is approximately a 50% chance of exceeding the value indicated
- There is at least an 83% chance of exceeding the value indicated

'Low-End' Estimate:

There is at least a 95% chance of exceeding the value indicated.

[NJ Sea Level Rise Estimates Example](#)



Total Water Levels Tool

Select a Flood Event

Historical Events

Select a Historical Flood Event

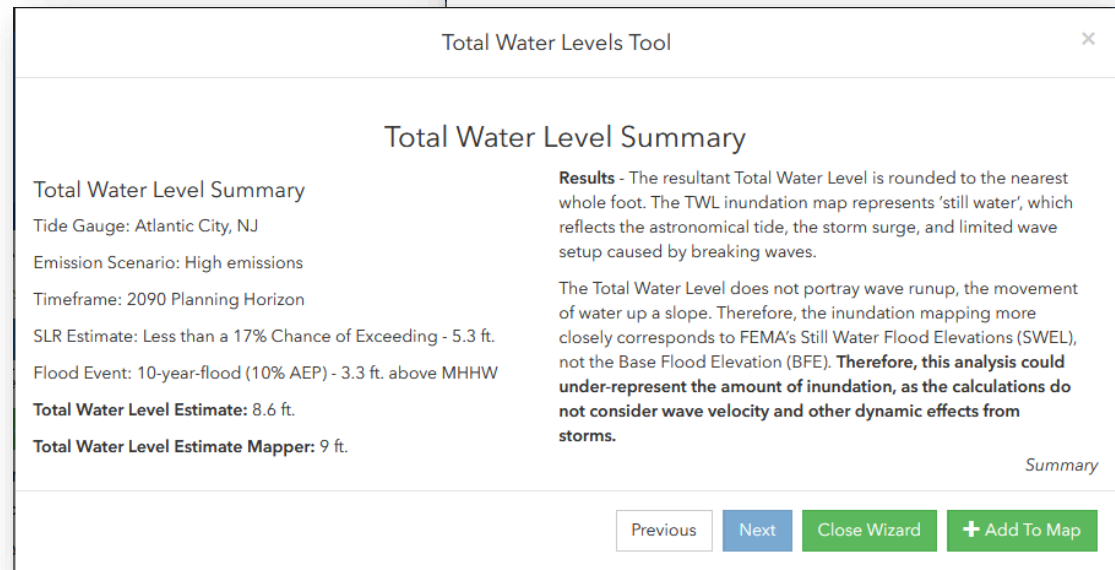
Step 5 - Choose between Flood Events Height using tide gauge specific data:

1. Historical Storm flood heights (e.g., Sandy)
2. Mean Higher High Water (MHHW)
3. NOAA's Annual Exceedance Probabilities (AEP), and

Flood event water levels are specific to each tide gauge and come from NOAA's Extreme Water Levels statistics program. Mean Higher High Water reflects permanent inundation, or where residents' feet will be wet on an almost daily basis. Selecting other water levels reflects recurring floods (i.e., the 99% AEP) or episodic flood events that could result from coastal storms (i.e., the 1% AEP). You can also choose historic flood events (like Sandy) to see how previous storms would look like in the future.

Step 5 of 5

[Previous](#) [Next](#)



Total Water Levels Tool

Total Water Level Summary

Total Water Level Summary

Tide Gauge: Atlantic City, NJ

Emission Scenario: High emissions

Timeframe: 2090 Planning Horizon

SLR Estimate: Less than a 17% Chance of Exceeding - 5.3 ft.

Flood Event: 10-year-flood (10% AEP) - 3.3 ft. above MHHW

Total Water Level Estimate: 8.6 ft.

Total Water Level Estimate Mapper: 9 ft.

Results - The resultant Total Water Level is rounded to the nearest whole foot. The TWL inundation map represents 'still water', which reflects the astronomical tide, the storm surge, and limited wave setup caused by breaking waves.

The Total Water Level does not portray wave runup, the movement of water up a slope. Therefore, the inundation mapping more closely corresponds to FEMA's Still Water Flood Elevations (SWEL), not the Base Flood Elevation (BFE). **Therefore, this analysis could under-represent the amount of inundation, as the calculations do not consider wave velocity and other dynamic effects from storms.**

[Summary](#)

[Previous](#) [Next](#) [Close Wizard](#) [+ Add To Map](#)

NJFloodMapper

- Other Features
 - Custom Layer Tool
 - Save/Share/Print Maps
 - Create shareable URL that recreates mapping application state
 - Print maps with legends
 - Export map as image file
 - Large selection of Base maps
 - Layer control
 - ArcGIS Map Services

Save / Share / Print

Save / Share

Save / Share Current Map Print Current Map Map Image

Permalink

<https://www.njfloodmapper.org/map/CCreSb7e0UB44sV>

Create a permanent link of your current map for sharing

Temporary Map Url

[https://www.njfloodmapper.org/?options={\"center\":{\"lat\":39.373752663366986,\"lng\":-74.44605021524525},\"zoom\":14,\"basemap\": \"gray\", \"layers\":](https://www.njfloodmapper.org/?options={\)

Use this link if you're not ready to make your options a permanent link.

Show Legend Remove All Layers

Hospitals Opacity: 100%

ON OFF Remove

0% 100%

Nursing Home/Assisted Care Facilities Opacity: 100%

ON OFF Remove

0% 100%

Total Water Level (4 ft) Opacity: 100%

ON OFF Remove

0% 100%

ArcGIS REST Services Directory

Home > services

JSON | SOAP

Folder: /

Current Version: 10.61

View Footprints In: [ArcGIS Online Map Viewer](#)

Folders:

- [Agriculture](#)
- [Climate](#)
- [CoastalFlooding](#)
- [Demographics](#)
- [Environment](#)
- [Forestry](#)
- [LandUseLandCover](#)
- [Municipal_Flood_Data](#)
- [Political](#)
- [Snapshot](#)
- [Utilities](#)

Services:

None

Supported Interfaces: [REST](#) [SOAP](#) [Sitemap](#) [Geo Sitemap](#)